Scientific Knowledge and Cultural Diversity

Proceedings

Scientific Knowledge and Cultural Diversity

PCST-8

www.pcst2004.org

Forum of Cultures, Barcelona 2004

Proceedings

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www.pcstnetwork.org

Scientific committee
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Local Committee
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Local organizing committee:
Science Communication Observatory
Pompeu Fabra University
Head: Gemma Revuelta
General coordinator: Isabel Bassedas
Coordinator: Sílvia Coll
Support committee: Karla Islas Pieck, Núria Pérez, Raimundo Roberts, María José González, Miguel Tapia

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"We have to give a voice to those parts
of the world that are silenced"

FEDERICO MAYOR ZARAGOZA

"It is not about achieving a major public comprehension of
science, but to get to a better public comprehension
of the world, with the help of Science"

MARIANO GAGO

This book is a first contribution to the newly born Academy of Society and Science.

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PCST-8 Sessions

Presentation

Scientific knowledge and cultural diversity

Public Communication of Science & Technology Network

8th Conference - Barcelona, June 2004
Forum of Cultures 2004

Under the theme "Scientific Knowledge and Cultural Diversity", 700 participants from more than 50 countries from five continents got together for four days in Barcelona to debate on the 341 communications from 36 countries who had before chosen the scientific committee of the PCST Network. Fifteen years separates the founding meeting of the Public Communication of Science & Technology Network en Poitiers (France) from the eighth conference held in Barcelona (Spain) within the framework of the first Forum of Cultures 2004.[1] In two years the location will be Seoul (South Korea) under the organization of the Korean Science Foundation, and in four years in Los Angeles (United States of America), under the auspices of the American Association for Advancement of Sciences.

Academy of Society and Science

In the closing act, it was announced that Barcelona would host the first headquarters of the Academy of Society and Science (provisional name). This newly created entity will be responsible for the creation of the documental base of the PCST Network. The principal mission is: to analyse and draft reports on the concrete problems in the ambit of the communication and social perception of science, and in general- all those areas that are related to the activities of the PCST Network. The Institute for Culture in Barcelona, the Catalan Foundation for Research and Innovation, the Department of Culture in Catalonia and the University of Pompeu Fabra in Barcelona had committed themselves to launch this project during the spring of 2005, with the idea that a first local nucleus of the Academy of Society and Science be created in Barcelona (Spain), planting a further proposal at the same time –open and pending discussion– that other cities hosting PCST Network conferences or symposia could create future local nodes, so that one day, there would be a network of centres of the Academy of Society and Science on all continents.

Olympia-Barcelona Letter

The PCST conference assembly decided to give its support to the content of the named Olympia Letter on Culture. The document was signed in September 2001 at the opening of the Cultural Olimpiada in Athens by seventy personalities from the total orb at the iniciative of the Greek Minister of Culture. The formal compromise, amongst others, was specified to 'incite the communication media, public or private, to assume, totally aware of their moral responsibility and working as vectors for peace and dialogue and to guarantee the plurality of information, as with its independence facing all pressures executed by the powers of politics, ideology and economics'. It was agreed that this document, as from this time, would be known as *Olympia-Barcelona Letter*[2] and the delegates present at the Forum of Cultures 2004 compromised themselves to help and broadcast its content all over the world.

Beijing 2005 PCST Symposium

The scientific commitee of the PCST had agreed in Barcelona that, apart from the biannual conference in even numbered years, they would convene mid-term events in the form of regional and sectoral simposia of the PCST Network in odd numbered years, cycle which will be inaugurated on 22-23 of June 2005 in China. Participants at the Beijing 2005 PCST Symposium[3] will learn, share and discuss practical success stories about science communication. Over the past decades, researchers around the world have kept on studies in science and technology communication. How to make effective communication of science and technology, i.e. the strategy in action, however, remains almost untouched and now looms up as a nut waiting cracking. At PCST conferences held every two years as well as other similar meetings, strategic issues were usually cast into shade by fervent argument on overall S&T communication issues. They nearly slipped under our nose. For this reason, the Public Communication of Science and Technology Network (PCST), China Association of Science and Technology (CAST) and Science and Development Network (SciDev. Net) decided to join hands in holding this coming international symposium under the theme: *Strategic Issues in Science and Technology Communication.* The discussion will focus on how to make effective communication of science and technology. About 50 case studies will be selected from around the world for presentation in plenary or poster sessions. After each presentation session, small groups will discuss the strategic communication issues emerging from the case studies. The symposium presentations and discussions will form the basis of a book to be developed and published by the PCST Network.

Barcelona PCST 2004 Conference

The Barcelona conference was developed in three large blocks of activities:

1) On the 2 of June, the workshop *New Models of Science Health and Life Museums*, coordinated by the Hospital de la Santa Creu i Sant Pau de Barcelona and the Science Communication Observatory (Pompeu Fabra University), was held.
2) From the 3 to the 6 of June took place the dialogue: *Scientific Knowledge and Cultural Diversity* at the Forum of Cultures 2004, which corresponds to the eighth International Conference of the Public Communication of Science and Technology

Network (PCST-8). Local organizers were the Science Communication Observatory (Pompeu Fabra University) and the Commissioner of Scientific Culture of the Barcelona City Council. The conference was structured into three plenary sessions *–native knowledge and current science; scientific communication; historical perspectives and new tendencies and science communication and social inclusion–* plus 30 parallel session on related themes.
These proceedings include the content of the Barcelona Conference PCST 2004.

3) Finally, on the 7 and 8 of June, the seminar on *Scientific Journalism in a Diverse World* was held; co-organized by the Spanish Foundation for Science and Technology and the Science Communication Observatory (Pompeu Fabra University), in collaboration with the Spanish Association of Scientific Journalism and the Catalan Association of Scientific Communication.[4]

Cultural Agenda 21

The coming years supposes an important expansion in its global influence for the PCST Network with the announced conferences in Seoul and Los Angeles, but we have to work to guarantee the incorporation into the net the activities of those countries with currently greater difficulties of economic nature. It is not only about the net continuing growing, but that it is represented by even more different cultures in the world. Scientific communication has to –in this sense– respect different cultural contexts and integrate knowledge from all the continents. This is one of the subjects planted and pending. This enormous, present and future cultural diversity of the PCST Network is its greatest patrimony!
This is another relevant inheritance left by the Forum of Cultures Barcelona 2004 and we want all persons working with our PCST Network to know:
The Local Authorities Forum of Porto Alegre –mayors and local government representatives- committed to social inclusion– from all over the world met in Barcelona and proclaimed the base document named Cultural[5] Agenda 21. The idea arose to contribute in formulating answers to the cultural development challenges man is now facing in the 21st century, given that the tendency of exclusive, uniform globalisation threatens cultural.
The initiative has a clear president in the process toward the end of the last century as regards the environment, when it was evident that, current development models, excessively predatory on resources and natural ecosystems, first mobilised, world public opinion which later irreversibly influenced government and international institutions. There are undisputable political analogies between cultural and ecological problem areas given that so much so culture as the environment are common wealth of humanity, inherited and accumulated through time. Today a similar sensitivity is emerging in the cultural camp, in that this plays a central role in globalisation but lacking instruments for authentic political debate. For this reason it is especially important to develop agreements that define the cultural diversity and preserve the values of creativity, participation and inherent freedom of the cultural generation. At the same time influencing in the necessary balancing between knowing and power. In this sense a new sustainable development is already spoken about: that of the binomial knowing and power. These are the fundamentals carried by the Local Authorities Forum that lead Barcelona and Porto Alegre to suggest the Cultural Agenda 21.

Local governments are currently working on a key paper to propose the necessity to give impetus to open and diverse cultures in a world characterised by globalisation and adopt the compromise for culture to have an essential dimension in urban politics and in really participatory democracies that favours social cohesion. A relevant aspect of the Cultural Agenda 21 includes the compromise to "encourage programs directed at divulging scientific and technological cultures among all citizens", in that they consider the application of new scientific knowledge generates ethical, social, economical and political questions that are of clear public interest.

What is this all really about? We wish for scientific knowledge to act as a bridge of understanding between different cultures in the world and that diverse societies can understand and participate in the evolution of this essential knowledge related to the survival of humanity. Relating and bettering the use of the global resources, as well as the development of new technologies that alows us living longer and better with the will to diminish the great educational, social, economical differences and in general the opportunities that seperates one from the other.

It is evident that without adequate educational and cultural levels –including the scientific– it is impossible that we can reach a citizenry with a sufficiently critical capacity that allows it to participate democratically and achieve authentic social inclusion. This is the real challenge that encompasses all others!

Vladimir de Semir
Chair of the PCST Network
Director of the Science Communication Observatory (UPF)
Commissioner for Scientific Culture –Barcelona City Council

Notes

[1] See: www.pcst2004.org and http://www.barcelona2004.org/eng/banco_del_conocimiento/dialogos/ficha.cfm?IdEvento=153

[2] See page 15.

[3] See: http://pcst2005.cast.org.cn

[4] See: http://www.imim.es/quark/num34/default.htm

[5] See: www.agenda21delacultura.net

Olympia–Barcelona Letter

The participants in the opening of the ***Cultural Olympiad of Athens*** and the participants in the dialogue ***Scientific knowledge and cultural diversity*** **of the Universal Forum of Cultures of Barcelona** solemnly reject any idea of the fatality of conflicts between civilisations. We consider culture and cultural creation bearers of values that overcome all differences. We firmly believe that cultural plurality and polyphony, guarantors of the acknowledgement and respect of the right of people, participate in the development of each person and allow open dialogue, excluding all sectarian and totalitarian ideologies. We are convinced that the parity of cultures constitutes the condition *sine qua non* of peaceful coexistence and world development and we desire that Culture, representing one of the creative forces of human action, would be considered more broadly both as an essential process for the future construction of humanity and the advent of a culture of peace.

To this effect, we declare that it is essential:

- To provide the culture of the 21st century with the necessary means in all areas of intellectual and artistic activity, and also to provide the supplementary means for scientific research with no commercial or economic goals and to favour the development of a scientific and technical culture which integrates critical and ethical interrogation;

- To take into consideration the history and traditions of each people and to take care of the conservation or restoration of monuments and the safeguarding of non-material heritage, a component of different cultures which, all together, constitute the common heritage of the all humankind;

- To embrace the fight for peace and against plagues, such as violence, fanaticism, exclusion (in the form of sexism and apartheid) and terrorism, but also to ensure the conditions essential for the development of cultural life, fighting against underdevelopment, malnutrition, the lack of medical care, economic precariousness, pollution and attacks on the environment and, finally, to sustain the scientific effort and the fine-tuning of principles of precaution in order to ensure the conditions of life, respecting biological integrity and the specificity of each human being, considered as a bearer of all that is humanity;

- To further promote, especially among the school-going public, the equality of opportunities for the equality of access to all knowledge, for the fight against illiteracy and ignorance, for the preparation of integrated actions, particularly aimed at the most disadvantaged peoples linking cultural or pedagogic programmes to economic development and for the widest possible diffusion of the new communications technologies;

- To encourage the media, private or public, to assume, with full awareness, their moral responsibility, their role as vectors for peace and dialogue and to guarantee the plurality of information and its independence from all pressures exerted by political, ideological or economic powers;

- To foresee for the future, at national and international level, the ways and means for dialogue and intercultural exchange, founded on respect for oneself and for others, both in terms of acknowledgement of individual and collective identities and legacies of the past and in terms of mutual aid and solidarity between generations and peoples.

All the people that support this declaration wish to start a debate and to widely spread all the proposals included in the **Olympia–Barcelona Letter** in all our local fields. We ask both national and international competent organizations to support and update their contribution in order to promote an universal coverage of a true cultural humanism.

Athens-Olympia, 21-23 September 2001
Barcelona-Forum of Cultures, 3-6 June 2004

Introduction

An imperfect chronicle of four passionate days

3-6 June 2004

Science Communication Observatory (Pompeu Fabra University, UPF) and Forum of Cultures 2004

Towards the Knowledge Society

We are living a historical moment in the transition from an Industrial Society and the development of what has come to known as a Knowledge Society characterized by the speedy incorporation of scientific advances into our daily lives. This transformation entails not only economic but also, and particularly, cultural and social changes. Consequently, it becomes increasingly necessary to set forth strategies aimed at popularising new knowledge and its possible applications and uses, plus the resulting ethic, social, economic and political issues.

The underlying idea is, thus, abolish the dichotomy that was established and has increasingly developed throughout the 20th century, and which has lead us to talk about and differentiate between *culture* with no epithets (Arts, Humanistic Studies, and Social Sciences) and *scientific culture* as if they were two different things. It was C.P. Snow, the British scientist and high public officer who defined this partition as early as 1959 in *Two cultures*. To this day, this document undoubtedly has had the most significant impact in describing the relationship of science in society, and the debate is still alive despite almost half a century has elapsed since it was written.

Only one culture exists, this meaning "culture" comprises the whole array of knowledge and ideas that we use to try to understand the world we live in. Thus, *scientific culture* integration is a prerequisite if we wish to have competent citizens in this emerging Knowledge Society and if it is our desire to re-establish a balance between power and knowledge. This is the context of the 8th conference of PCST.

Knowledge useful for citizens

Nowadays, scientific information plays an important role as a raw material, transforming agent and also as a result. It must not be forgotten that the weight of cultural specificities is increasingly important and involves opening up to other cultures. The challenge for our times, according to Pierre Fayard (Professor of the Public Communication of Science at the Université de Poitiers and executive member of the PCST network) is "knowing how to make possible a creative dialogue between knowledge and the sciences, to produce knowledge that is useful to citizens". Social participation and the *multi-directionality* of the dialogue between citizens, scientists and suppliers of scientific information are key factors in making scientific knowledge a real driving force for progress which influences political decisions, and for making citizens into a key agent for setting the scientific agenda. Pierre Fayard spoke of the need to transmit scientific knowledge in every country, taking into account their cultural differences. For Fayard it is important to distinguish between scientific activity and communicating this activity. In this sense, scientific activity is universal and international and communicating it is social and cultural. Fayard provided an historical vision of how sciences have been communicated has emphasized three stages: the first in the 18th century in which scientific encyclopedias became widely accessible; the second, towards the end of the century when these became popular through the media and, finally, the present-day version based on the creation of knowledge and specialized scientific emancipation. In this sense, Fayard explained "we need to achieve a creative dialogue between local knowledge and international scientific knowledge in order for it to be useful". "The most important thing to be done is to instill curiosity in people", concluded Fayard.

Being able to make own decisions

Federico Mayor Zaragoza (chairman of the Foundation Culture for Peace and general director of UNESCO from 1987 to 1999) declared that "we must be actors and actresses in our lives" and that the best legacy we can leave to our future generations is: creating the future. The president of the Foundation Culture for Peace has pointed out the importance of two-way communication: "Communication does not only mean communicating but making oneself understood through communication. A better transmission of knowledge to citizens results in them being able to make their own decisions. Our aim is to avoid human suffering, if we don't know about something, we can't predict it and if we can't do that, we won't be able to prevent it from happening". The former general director of Unesco explained "we have to give a voice to those parts of the world that are silenced and we should participate in order to avoid standardization which will lead us further towards globalization. It is important for us to take on the role of communicator and not just act as receivers of information in front of a TV screen", concluded Mayor Zaragoza.

Knowledge as a bridge between civilizations

At the moment there is no harmonious coexistence between indigenous and scientific knowledge. On the contrary, the wisdom of experience –local, traditional, indigenous– is increasing subordinated to scientific-technical western knowledge. Humanity is progressively losing its traditional knowledge and each individual experiences the *tragedy* of forgetting the wisdom of his or her own ancestors.

Although this is a difficult situation, the various speakers in the dialogue showed that they were committed and hopeful of turning obstacles into opportunities in order to integrate traditional and scientific knowledge on a horizontal level. So, Christine Müller (Institute Image. Ecole National Superieure des Arts et Metiers-France), declared that nowadays it could no longer be said that there is a dichotomy between traditional and scientific knowledge, but instead "there has to be a mutual exchange involving reciprocal interaction; integration of the knowledge of neighbours based on respect". Examples of good practices along these lines are those carried out in Thailand, where there are experiments in co-operation between knowledgeable people from indigenous communities and doctors; in Portugal, where the "Congress of Popular Wisdom" has been created; or in Australia, where programs are being developed to recover local wisdom. It was unanimously concluded that if all the knowledge in the world was added together, humanity would enjoy greater wisdom and opportunities for development.
The director-general of the Catalan Research Foundation, Enric Banda, explained the current status of scientific research in comparison with the United States. In this sense, Banda explained that "in Europe we are very concerned by the difference that exists between US and European investment in scientific research". Furthermore, Banda pointed out that this investment pattern also changes between European states: "the same investment is not made in Sweden as in Greece and this leads to an imbalance in progress and makes European policy weaker in this field". According to Banda, as well as lower investment and a fragmented system, Europe lacks competencies, flexibility and diversity in decision-making processes, which are very slow. With a view to alleviating this situation, Banda explained that "there is an intention to create a European Research Council, which would facilitate a more international approach to research and seek new talents in this field". Banda added that, without taking into account investments in research projects on defense matters, public investment is very small, and therefore there has instead been an increase in private investment. In his view this investment leads to "control over the results and makes scientists look for shortcuts that can lead to bad research practices".

Indigenous knowledge as a silent treasure of our age

Yuwanuch Tinnaluck, from the Association for the promotion and development of Asian products, explained the joint venture that is being conducted between the traditional Thai healers and conventional medicine. The aim of the project is to "apply unwritten knowledge and implicit knowledge" to achieve both local and international benefits. "From the dialogue and communication between communities we are introducing traditional medicine practices in hospitals and health centers, so there is a richer knowledge base".
The president of the Network of African Climate Reporters, Patrick Luganda, focused his speech on the co-operation between traditional knowledge and related agricultural practices in Uganda, where nearly 90% of the population works in agriculture. Luganda explained that through the knowledge of the experts in the villages, and the transmission of that knowledge to future generations, farmers have been able to create a sustainable agriculture and collective management of pests. "Thanks to plant extracts and blends farmers have managed to protect plantations from pest infestations". Luganda also spoke about hunger in Africa, and in this regard he pointed out that the farmers "have reacted by developing a subsistence agriculture which is not affected by deaths and migrations". In

relation to climate change, Luganda explained that "African farmers and meteorologists base their forecasts on probabilities and modify their practices in response to climate change. On the other hand, the information we publish on medical matters in the newspaper where I work, that of the greatest spread in Uganda can mark the difference between life and death. For example, in the case of sanitary problems that affects pregnant women and children, problems that are still very common in my country. I call to take action by considering indigenous knowledge as a silent treasure of our age", he concluded.

Germano Bruno, professor of the Physics department at the Paranà Federal University in Brazil, explained his experience with the Guaranan Indians of Brazil and their scientific knowledge. Bruno spoke of the similarities that exist between the Peahiru route and the Milky Way, and how the native people seek paradise along this route. Native knowledge of the constellations is comparable to that of the pilgrims of the Middle Ages who followed the route to go to Santiago de Compostela.

The "Science Train" project was presented by Cheng Donghong, executive secretary of the Chinese Association of Science and Technology, whose aim is to promote development in rural China. According to Donghong, the content of this program, and of any program of any kind that wants to be effective, "must be designed and led based on an analysis of the actual needs of the local population". Therefore, the center of both the flow of communication and the process of producing scientific knowledge must be *located* in the needs of citizens.

To take part in the process of social construction

There was a consensus among speakers and those attending that to make this possible it is necessary to create a space for communication between scientists and citizens characterized by mutual credibility and trust. This space for communication is where scientific communication professionals must act.

According to Bernard Schiele, professor at the University of Quebec in Montreal, "people know that they are exposed to considerable risks and, because of this, they increasingly need to take part in the process of social construction". Schiele noted that in order to control the distortion between what scientists say and its interpretation by citizens, the role of the intermediaries in the communications media, is fundamental. He said this imperatively requires "the creation of a specific code for dealing with scientific issues". Bernard Schiele thinks scientists should "learn" to communicate with people. He has the theory that people know they are exposed to "important risks" and for this reason we need "to participate more and more in the process of social development". Professor Schiele pointed out that there is a need to control "the distortion between what the scientists say and what the people know", and to this end the media has fundamental power as mediators.

At the conference "Scientific Knowledge and Cultural Diversity" a series of important surveys were distributed which partly justify the complexity of providing information on scientific topics. According to these surveys some scientists only use the media when it is in their interests to do so, while others think that science does not have to be published in the media because it is a way of trivializing it. This is the feeling the research community expressed today during one of the parallel sessions entitled "Scientists and scientific institutions as agents of the PCST: responsibilities".

Another revealing piece of information shows that only 30% of the researchers are

interested in publicizing their work. Luís Antonio Martínez Sáez, of the Canary Islands Institute of Astrophysics, circulated these surveys. Also he wanted to point a finger both at the scientists and at the community as a whole. According to him, "the scientists are obliged to inform the public because it pays them to do so", but at the same time he considers that the people, including the media, "would have to wake up a bit more to be ready for the information". However, the conclusion is that most scientists do not know, nor do they care, what people think about the research they are doing. Martínez Sáez justified them in a way by arguing that "the task of the scientist is research and science" and not the reporting of it. There are always exceptions, such as in the field of biotechnologists, who do show they are conscious of when it is the time to communicate about what they are doing.

In the same session it was demonstrated, by way of contrast, that there are specific social groups that at certain times are interested in scientific issues. During this session the problems of the sea oil pollution from tanker "Prestige" were discussed, specifically the difficulties of giving the media an adequate general explanation for the event at the time, because of political issues. The fact is that the people with an interest in the effects of the sinking of the "Prestige" were going direct to the scientific sources to ask questions, and the websites, specifically that of the Vigo Maritime Institute, were essential sources that the Galician fishermen consulted.

Answer the questions of the people

In the plenary session on "Science communication: historical perspectives and new trends", the academic world has agreed that now is the time to produce a "social" or "popular" aspect to science, according to Young Hwan Choi, president of the Korean Science Foundation, in such a way that it reaches everyone, because there is a vital need for information.

Bernadette Bensaude-Vincent, professor of Science at the University of Paris X, pointed out that the most important issue in science communication is to manage to "answer the questions of the people instead of circulating the items of interest to the scientists themselves". In this sense, she thinks the scientific world must make a complete turnaround in their way of thinking. Scientists believe that "science is the center of the universe, and it is not", but this mentality is gradually changing.

Jon Turney, scientific journalist from the United Kingdom and now staff member of Penguin Books, was more conservative in defending the notion that books are "the only means" through which science can be expressed accurately. "Books permit the assimilation of knowledge, which is more difficult through the audiovisual media", he pointed out. In any case, he explained that "there is little information about how science books influence people's lives. People buy science books, but we do not know if they really read them", he said. There have been very popular science books, best-sellers like the *Brief History of Everything* by Ken Wilber and *The Egoist Gen* by Richard Dawkins, but the effect of these on their readers is unknown.

Other parallel sessions dealt with science reporting in specific media. The session "Science on radio and television: quality, quantity and new trends" concluded that, even when there is a belief that the people are more interested in history and social programs, science in fact occupies a very important place in the interests of viewers. The audience for science programs on the BBC is evidence of this theory. It has also been claimed that science topics almost never appear in news programs, and that the European television

channels in particular only give 2.3% of the total news and information programs to science news.

The media has a "very commercial orientation"

The session entitled "Are the expectations of the Internet being met?" received the general answer of "yes". Two expectations have been met: one is having facilitated communication between scientists and the other is having facilitated communication with geographically isolated scientific communities. One expectation of the Internet which so far has not yet been fully developed makes reference to its use in reporting: one example is the Women's Health Watchdog, which has a web page that offers the facility of a link between doctors and patients. Public participation is relative.
Once more the audience –like throughtout all the conference– wanted to take part. A Chilean citizen made the point that, if it is true the Internet has made possible a better reporting of science news, it does on the other hand pose new problems. If on the one hand research into scientific topics can be done on the Internet, on the other hand Chilean scientists may find they cannot pay the subscription to the relevant science magazines, which are mostly from the USA. The response of another participant was that "the law is set and so is the trap", and that "a pdf file can circulate on the Internet, although a magazine has the rights to the text".
In the session about "Science and the daily newspapers: a cultural question?", the speaker Javier Cruz, National Autonomous University of Mexico, thinks that scientific information is very badly treated by the press. He focused the reflection, declaring that "the science must be put back into scientific journalism" and invited consideration of which part of science should be reflected through journalism. For Blanka Jerkovic from Croacia, the media have a "very commercial orientation" and "the sensationalist press is proliferating". The comparison was made with economic topics which receive a wider coverage in the media, and this has meant many NGOs have been able to show their disagreement with economic policies. They think the same must happen with science, but this only happens in the case of some topics which nowadays are not such an essential subject in journalism. Among the aspects that stand in the way of accurate science information, and of any other field for that matter, is the "sensationalist research", "the errors in the information" and "the habit of highlighting aspects which are of less interest". She considered that the communications media have a very commercial, sensationalist orientation, tending towards dramatization, which gives an extreme spin to the results of scientific communication and makes it impossible for it to play the social role which was being assigned to it.

The socialization of scientific communication

Knowledge and scientific research must be socialized, opening it up to citizens, who are –or should be– the real main beneficiary. To do this, popularization efforts must be made, which should, among other things, explore new communication routes that are more effective than the current ones. Science and scientific research must be handled as an issue of general, common interest. In this way, both the objectives and the results of scientific research can become known, used and, at the same time, *monitored* by citizens. Citizens –society– must be considered as the principal beneficiary of science, but for this to be true and for there to be *feedback* between citizens and scientific research, this task

of popularizing –*vulgarising*– science is necessary. Shared public interest in and knowledge of science has to stem from, and at the same time can generate, the climate of credibility and trust required for this communication bridge to be possible and useful. So, science must be vulgarized and socialized putting it within reach of everyone and making it participative, so that it belongs to and is for everyone. This is in order to democratize it, not only in terms of knowledge, but also in the decisions about what should and should not be researched. That is, so it can be bi-directional.
An effective way of achieving this will be to use new ways of popularizing science. For this reason, there is an attempt to involve disciplines like art, theatre and entertainment in science or to use examples within reach of everyone to make it more comprehensible. In addition, the new information and communication technologies can play an important role in this popularization task.
The lack of understanding and communication between scientists and citizens generates a fracture that limits the productivity and applicability of scientific knowledge. Scientific communication must be socialized and "*vulgarized*", according to the expression used by Young Hwan Choi, chairman of the Korean Scientific Foundation, so that the knowledge reaches the public adapted to its capabilities for assimilation and contextualized in daily life, and may in turn, feed off the actual needs of the public. The "Science Korea" project, presented by Hwan Choi, is based on a concept of *socialization* of scientific communication through science programs for daily life aimed at the domestic sphere. Scientists must maintain a permanent dialogue with the public; they must remain receptive to its responses and suggestions. For his part, Chris Edwards, from the Open University, United Kingdom, persisted with this idea, declaring that "scientists must not forget that they are also citizens".

The media must be more critical

Ultimately, there was an agreement in declaring that public dialogue is positive so that citizens can take part in supporting and *controlling* the consequences of scientific knowledge. Moreover, this citizen participation becomes a necessity for making scientific research not just an issue of interest for governments and companies, but also a crucial aspect of the progress of human knowledge.
In order to play the role of media and communication space between the scientific community and citizens, scientific communications professionals will have to explore new, more effective and innovative methods. Making use of other languages, such as those available through art and museums, or taking advantage of the possibilities of new information and communication technologies are important for improving the capacity of scientific contents to penetrate society.
In the various contributions from the audience, the discussion concerning the type of profile required to be an effective scientific communicator (scientific training for journalists *vs.* communication training for scientists) became clear.
For his part, John Noble Wilford, creator of the science supplement in the newspaper *The New York Times* and twice a winner of the Pulitzer prize, raised the need for the communications media to be more critical, condemned the lack of opinion articles about science, and highlighted the importance of the responsibility of journalists when it comes to checking the truth of their sources of information, especially those appearing on the Internet. In this sense he drew attention to the danger of the Internet since "it is an advantage that everyone can put their opinions on the net, however in the case of

science there is no way of guaranteeing scientific accuracy and that is very dangerous". He went on to say that it is precisely at that point that the responsibility of journalists to check the accuracy of the news arises. He continued by saying that the great news of the 21st century will be medical and biological research into matters relating to the brain and genetic engineering, with very important economical, social and ethical consequences. The fight for the survival of news in the capital market hampers scientific communication and degrades it even further. To save it, all possible communications media need to be used to put science across to a greater number of citizens and to show the ethical position of the scientific community.

Multimedia platforms are a tool with various favourable applications both for scientific study and for its popularization. In effect, the Internet and the publication of web pages with scientific content make it possible to share knowledge around the world, immediately, from the place of study. An example is the safety at work project shown through documentaries, programs, books and television broadcasts in England. However, the problems inherent in the accumulation of information on the Internet which is often unsatisfying and only increases the bulk of knowledge must be identified. This largely explains the phenomenon of junk information.

There appears to be an increase in pressure on journalists, who, faced with the constant updating of information, may be obliged by competition to publish news items about studies that are not yet finished. The fact that news survives in the capital market means that to reduce costs, journalists are obliged to do work from the office rather than going to the place the study is being done and interact with the scientists. This is the dangerous phenomenon of lazy journalism. Wilford said that journalists have the responsibility for access to news, that is, they have to interpret, check and evaluate the importance of sources of information, above all on the Internet. He proposes grouping journalists from different areas to get an overall view of the subjects being dealt with. In this way, journalists who know the issue will have more weight and will not be lost in the appearances. Concerning appearances, Wilford told a thousand-year-old Egyptian story which was already questioning the reliability of the transmission of knowledge when a discovery appeared. The story ends by explaining that the discoverer offers the people the appearance of knowledge and many will think they know a lot when they know nothing. Wilford suspects that the problematic dynamic of scientific communication is not so new.

Science communication to understand the world

Lisbeth Fog, founder of the Colombian Association of Scientific Journalism, also vice-president of the World Federation of Science Journalists and co-president of the PCST-8 conference, proposed the presence of science in all sections of newspapers so that readers identify with it as an inherent part of life. One of the issues that best exemplifies the issues dealt with at the dialogue is that of transgenic organisms, also known as Genetically Modified Organisms (GMOs). This is a scientific and technical issue, but one with a considerable impact on public opinion. From the point of view of public perception, culture and society, it appears that what concerns citizens about GMOs are not so much the technical and scientific issues, but the ethical and social aspects, and how these could affect their personal lives. Lisbeth Fog explained that in Colombia there is a lack of scientific journalists and that editors need to be convinced that publishing science is worthwhile. She added that at a general level the right criteria must be identified to define what is and what is not science, understand the importance of advances, place

science in all media (vulgarize it) and foster scientific ethics through opinion articles in newspapers.

José Mariano Gago, professor of Physics at the Lisbon Higher Technical Institute and minister of Science and Technology in Portugal from 1995 to 2002, closed the PCST conference with a critic to the current tendency of science to work towards future developments in terms of economic interests rather than in the search for answers to the problems of humanity. In his closing remarks for the "Scientific Knowledge and Cultural Diversity" conference he urged science information to be delivered in more general terms to all regions of the world. He also emphasises the importance of scientific difusion to maintain an adequate level of scientific vocations in the world and the importance of women to integrate into the creation of scientific knowledge . Finally he insisted in the necessity for the scientific policies of different administrations to really incorporate activities of public communication in science with sufficient and lasting resources. The objective of these policies should go further that a simple understanding of science: "it is not about achieving a major public comprehension of science, but to get to a better public comprehension of the world, with the help of Science".

The International Public Communication of Science and Technology Network

A brief historical overview

Pierre Fayard, Paola Catapano and Bruce Lewenstein
[*on behalf of the PCST network Scientific Committee*]

Introduction

A brief historical perspective
The development of modern science was accompanied almost simultaneously by the birth of practices to make specialized knowledge available for the public. Since the very beginning, various expressions were used: popularization of sciences, public understanding of science, public awareness of science, science literacy, socio-diffusion of science, cultural scientific action, public awareness of science or public communication of science and technology (PCST).
Through all over these formulas and periods, it is possible to identify a historical goal that includes three components. First of all, the *political* one. Because the production of specialized knowledge (i.e. scientific) requires specific organization (terminology, institutions, ways of verification…) that isolates the world of scientific production from the community as a whole, PCST aims to rebuild community by recreating links between science and society. The second component is *cognitive*. In order to share specialized knowledge communication tools are adjusted to make this knowledge available and understandable by non-specialized people. The third component could be called *creative* and strives to foster the intelligence and capability of non-specialized audiences, enabling them to integrate this knowledge in their daily lives. Through history it is possible to identify several representations of this triple "political ends" of the public communication of science. In the 18th Century (*Siècle des Lumières*), the *Encyclopedia of Denis Diderot and Jean*

d'Alembert aimed at gathering all the knowledge and know-how humanity had produced to make it available for the ones able to read (the so-called *honnetes hommes*). This first major enterprise of PCST involved hundreds of philosophers from all over Europe. In order to be widely accessible, the Encyclopedia used a vulgar language (French, that was the communication language in Europe) instead
of the elite one (Latin). Printing was the technology that allowed it, mainly clandestinely. The struggle against despotism moved the philosophers.
In Europe, in late sixties and the seventies a deep and wide libertarian movement took place and made an impact also on traditional ways of popularization. Science was considered by political activists and by some scientists as the private ally of central authorities. This activist movement aimed to renew PCST from the non-specialized audiences point of view, allowing them to use scientific knowledge to promote their own interests. The traditional one-way diffusion model of popularization was denounced.
By the end of 20th century, European cities set up the construction of huge brand new science centers or renovated existing science museums. Recreating community, sharing specialized knowledge and enabling people still is the global goal of PCST.
Another interesting evolution is noticeable today in PCST outside Europe. Though modern science is international (global) by definition, when it comes to public communication of science, the local social and cultural values play a major role. Through history and all over the planet, civilizations and cultures used to produce, validate and disseminate specialized knowledge creating specific devices, ways and means. Investigating about these ways allows to renew them on a strong cultural basis in order to match them with PCST contemporary aims and issues.

Birth of networking
In this early 21st century, the role of science as a means of creating innovation, development and progress in the modern world and of improving the wealth and well being of nations is undisputed. Yet, despite the contribution that science has and continues to make to the growth of the world's economy, a large fraction of the public and governments in most countries is still mostly uninterested, uninformed or badly informed, if not afraid, sceptical or concerned about the directions that science is taking and the possible consequences to them and future generations.
For many people concerned about the relationship between science and society, de-mystifying science and focussing on the benefits of education and innovation are critical to gaining public support for science. For others, better public understanding of science means better ability of citizens to shape, direct, and even criticize scientific institutions so as to keep them accountable to public concerns. No matter which view is taken, the range of people to be communicated with is wide and diverse, making collaboration and networking both desirable and necessary.

The PCST International Network

In the last decade, many formal and informal networks have been set up world-wide to collaboratively promote the public communication of science and technology. The International Network on Public Communication of Science and Technology (known by the acronym of PCST: www.pcstnetwork.org) is one of the first, most general in scope and probably the widest of the international networks operating today for the public

communication of science and technology. It was born in 1989 after the first International Meeting on Public Scientific Communication that took place at Poitiers, France. The 130 participants from 14 countries decided to meet again to discuss the public's growing need for more information about scientific and technological matters and all the problems and developments concerning science communication.
The aim of the network is to multiply opportunities for exchange and co-operation among both researchers of PCST and PCST professionals who work in the many diverse but complementary fields of public communication of science and technology. It especially intends to facilitate these interactions on an international basis to foster exchanges between different cultural approaches. PCST members include science journalists, science museum and science centre producers, science theatre directors, academic researchers who study aspects of PCST, scientists who deal with the public, public information officers working in scientific institutions, teachers and trainers, educators and lecturers, and many others interested in these issues. The PCST Network sponsors international conferences, electronic discussions, and other activities to foster dialogue among the different groups of people interested in PCST, leading to cross-fertilization across professional, cultural, international and disciplinary boundaries. The PCST Network seeks to promote new ideas, methods, intellectual and practical questions, and perspectives.
Its declared aims are:

- To foster public communication of science and technology (PCST).
- To encourage discussion of practices, methods, ethical issues, policies, conceptual frameworks, economic and social concerns, and other issues related to PCST.
- To link practitioners of PCST, researchers who study PCST, and scientific communities concerned with PCST.
- To link those from different cultures and countries world-wide, in both developed and developing parts of the world, concerned with PCST.
- To provide opportunities for meetings, electronic interactions, and collaborations among people interested in PCST.

Operation
The PCST Network operates through:

1. A Scientific Committee led by an Executive Committee
2. An electronic discussion
3. Regular international conferences
4. Other activities as the scientific committee determines.

The Scientific Committee

a) The Scientific Committee is composed of not more than 25 people.
b) No more than 6 new members of the Scientific Committee may be appointed at any one time.
c) The term of the Scientific Committee members starts at the end of one PCST international conference and lasts until the end of the following conference.
d) The Scientific Committee meets at least at each international conference to discuss items such as: selecting the host for subsequent meetings or determining the composition of the new Scientific Committee.

New members of the Scientific Committee are nominated and selected in the following way:

- Members of the Scientific Committee make nominations before each international conference to the Executive Committee.
- Any individual may request to a member of the Scientific Committee that a specific name (including his or her own) be placed in nomination.
- The Executive Committee recommends to the Scientific Committee those members whose terms should be extended, based on the active involvement of those members and the need to maintain diversity of gender, background, and geographic region.
- The Executive Committee recommends to the Scientific Committee other members from the nominations received.
- The Scientific Committee discusses the recommendations of the Executive Committee and select new members.
- The chairs of previous International Conferences of the PCST Network serve as honorary non-voting members of the Scientific Committee.

The Executive Committee

The Executive Committee consists of the following people:
The Chair of the previous conference (who will convene the Executive Committee and serve as chair of the PCST Network); the Chair of the current conference; the Chair of the next conference, and two members elected from the Scientific Committee.
The Executive Committe has the task of suggesting new members to the Scientific Committee, assisting the chair with the process of selecting the hosts of succeeding conferences, making operational decisions between the meetings of the Scientific Committee, designating other activities as provisional affiliates of the PCST Network, until the next meeting of the Scientific Committee and issuing an annual report. The Chair of the most-recently concluded International Conference serves as Chair of the PCST Network.

PCST electronic discussion

Much of the activity of the International Network on Public Communication of Science and Technology takes place via electronic discussions. The primary locale for these discussions is PCST-L, an electronic mailing list devoted to public communication of science and technology. PCST-L provides an opportunity for discussion, exchange and co-operation among practitioners, researchers, and scientists with an active professional interest in science popularization and related topics. The audience includes science journalists, public information officers at both profit and non-profit institutions and organizations, museum educators, scientific popularizers, communication researchers, journalists, educators and others. The list is explicitly intended to cross international, cultural, and professional boundaries. The list is technically-hosted at Cornell University, Ithaca, New York, USA. It is semi-moderated, meaning that contributions are routed through designated moderator(s) for approval. Messages are either accepted or rejected in their entirety, not edited. No on-topic messages are rejected unless, in the moderator(s) s judgement, they will be seen as disruptive or offensive.

PCST Conferences. Main outcomes

The International PCST Network meets approximately every two years. The International Conferences are intended to be opportunities for sharing information about best practices,

current research, conceptual issues, and other matters of interest to the PCST Network. Efforts are made to hold the meetings at diverse locations world-wide. About six months before each International Conference, a general invitation is issued calling for proposals to host the conference four years ahead. The issues to be addressed in the proposals are:

- Opportunities for culturally diverse participation (to address this issue conferences will be encouraged in countries where they have not been held before).
- Those organizations that will support the conference in the host country.
- Budget.
- How delegates from developing countries will be supported to participate in the conference.
- How the host country will support attendance of members of the PCST Scientific Committee (minimally, through complimentary conference registration and accomodation; if possible, through travel assistance).
- A suggested theme for the conference.
- The use of English as the primary language, with other languages and translation arranged as appropriate.

These proposals are put to the Scientific Committee at their meeting at the International Conference, and a representative of each bidding group is invited to make a short presentation and to answer questions. The Scientific Committee will make its decision by the end of the International Conference. During preparations for each International Conference, the Scientific Committee leads discussion on the program and acceptance of paper abstracts. The Chair of the conference appoints a local Organizing Committee. The Organizing Committee is responsible for all operations of the meeting, including issuing calls for papers, arranging meeting space and accommodation, setting up social activities, etc. The Organizing Committee is responsible for coordinating with the PCST Network Chair, who leads the work of the Scientific Committee in evaluating abstracts and planning the program (table I).

Table I List of past and currently scheduled conferences

1989, May:	Poitiers (France)
1991, May:	Madrid (Spain)
1994, April:	Montreal (Quebec, Canada)
1996, November:	Melbourne (Australia)
1998, 17-19 September:	Berlin (Germany) – Science Without Frontiers (http://www.fu-berlin.de/pcst98)
2001, 1-3 February:	CERN, Geneva (Switzerland) – Trends in Science Communication Today: Bridging the Gap between Theory and Practice (http://www.cern.ch/PCST2001)
2002, 5-7 December:	Cape Town (South Africa) – Science Communication in a Diverse World (http://www.PCSTNetwork.org/PCST7.html)
2004, June:	Barcelona (Catalonia, Spain) – Scientific Knowledge and Cultural Diversity (http://www.pcst2004.org)
2006, August:	Seoul (Korea)

Main outcomes of most recent conferences

PCST6 at CERN, Geneva, February 2001: "Bridging the gap between Theory and Practice". Will communication be able to bridge the gap between Science and Society? What is the impact of science communication on the public? How do novel means of communications change the perception of science for the general public? These were the main issues addressed at the 6th Public Communication of Science and Technology meeting, held at CERN, the European Laboratory for Particle Physics, on 1-3 February 2001. Over 250 people from all over the world attended the conference, whose main focus was on the impact of science communication on the target audience. All the themes chosen for the plenary sessions of the programme as well as for the afternoon workshops reflected the need for more cross-fertilization between academia and practice in science communication. Great attention was also devoted to research and practice in science museums, particularly in terms of evaluation of their success. Another main theme of the programme was novel means of communicating science to the public, and no venue could be better chosen than CERN, the birthplace of the WWW. Locating one of the PCST conferences on the very site of one of the largest scientific laboratory in the world also reflected the need for integrating scientists into the communication process. Connected to the conference, a public debate entitled "What does Science do for Society?" was organised in a Geneva movie theatre, with the participation of scientists, politicians and communicators.

PCST 7 in December 2002, Cape Town: "Science Communication in a diverse world". The meeting was organized by the South African Foundation for Education, Science and Technology with the primary sponsorship by the Department of Science and Technology and was headed by Marina Joubert. The venue was the University of Cape Town campus, on the slopes of Table Mountain. Over 300 participants represented more than 30 countries from around the globe. The conference main aim was to explore novel ways of communicating science and engaging new audiences, and to promote networking and linkages between science communication theory and practice in developed and developing countries. Three plenaries, 47 parallel sessions (with a final one entitled "Communicating in the savannas") and three poster sessions took place. From among numerous interesting sections, one can mention the following ones: Science on the road; Environmental communication; Public perceptions and knowledge of science; Reaching out to rural communities; Celebrating science; Inspiring the young; Scientific uncertainty and science communication; Visualizing communication; Science theatre; Science-media interfaces; Showtime at science centers. During the event it turned out that the public communication of science and technology is a fast-developing field in Southern Africa, and the conference was a catalyst to this process for the entire region.
The meeting provided an opportunity for intensive interaction between science communicators and science communication researchers from around the world. The conference did emphasize sharing of experiences, ideas and best practices between developed and developing states.
The development aspect was dominant at PCST-7. The conference was followed by a specialized workshop organized by the convenor Marina Joubert of the South African Foundation for Education, Science and Technology (FEST) and Bruce Lewenstein of Cornell University, USA, with the support of the US National Science Foundation. The goal of the workshop was to explore differences between how "public understanding of

science" is perceived in the developed world and how it might be perceived and defined in the developing world. It brought together over 50 individuals from 16 countries and six continents –journalists, scientists, museum and science centre staff, policy analysts, community outreach co-ordinators and academic researchers. One of the main results of the two-day workshop was that new definitions of science literacy are needed to ensure that public communication of science and technology addresses the real needs of people and societies in the developing world. In the developed part of the world, which is infused with science and technology, it seems obvious that it is desirable that more people understand scientific research and how it can be used to improve life. In developing countries, modern science and technology offer hope for addressing the pressing needs of improved nutrition, public health, safety, and shelter. Although the "public understanding of research" –understanding the scientific process and the results of cutting edge work– is essential for any modern society, whether in the North or South, our vision of what makes a good public understanding programme in developed countries does not obviously have any relevance in the developing world. In the developed world, debates about topics such as nuclear power or genetically modified foods take it for granted that access to energy or nutritious meals is not at stake, and that individuals are free to make meaningful choices. Moreover, developed-world scientists take as a given fact that science is as fundamental a part of modern culture as music or art. Even the definition of science in the developed world often seems unproblematic: science is the product of cutting-edge research conducted by methods and techniques that have emerged from Europe since the 17th century. But for much of the developing world, public understanding of research is about much more basic issues: providing clean water for drinking and cooking, learning the essential link between unprotected sexual intercourse and HIV infection, and so on. In this developing-world context, it is not clear that museum exhibits about electricity or magazine articles about in-vitro fertilisation are relevant in addressing the needs of most of the population. Public understanding of science in this community is not about the latest immunological results, nor about acquiring greater political power, or improved use of scientific instruments; it is about addressing fundamental barriers to scientific information. These barriers are not caused by ignorance or hostility, but by the core conditions of the developing world –local languages, poverty, lack of public health, lack of economic infrastructure and lack of education.

One of the main conclusions of the workshop was that it is necessary to redefine our terms of reference. The developed world has the luxury of detached interest in reliable knowledge about the natural world. In contrast, public understanding in the developing world must focus on knowledge upon which one can act immediately. Some of the more practical conclusions were: create databases of successful projects and opportunities for training, improve access to web-based materials and provide ongoing support to people and projects. Some reinforced the continuing need to evaluate the effectiveness of particular programmes and to recognize that there is no one "best" practice, as all projects need to be adapted and used in particular local contexts. The more far-reaching conclusions forced the workshop to redefine science literacy itself. Instead of "practical" science literacy, Nalaka Gunawardene, a veteran science and environment journalist from Sri Lanka, talked about defining public understanding as "the minimum knowledge to make life better". He advocated thinking in terms of survival: of preventing dehydration of babies, of campaigning for better road safety, of promoting the safe use of pesticides. Similarly, "civic" science literacy looks different in the developing world. Carlos Setti, a Brazilian science writer, reminded the participants of the gaps between rich and poor in

developing countries and urged to always put public understanding programmes "at the service of overcoming social and regional inequalities" –a reminder that choices about how to allocate scientific and technological resources are not politically neutral.
The final conclusion was still that research –including open and honest appraisal of the reliable knowledge embodied by indigenous systems– offers tools of great value to the developing world and that public understanding of research is necessary to convey the excitement of research, especially to children. After all, recruiting the next generation of scientists is as critical, perhaps more critical, to the culture of the developing world than to the developed world.
Presentations at PCST-7 are available on the conference website:
http://www.fest.org.za/pcst

PCST-8 in Barcelona, June 2004: "Scientific Knowledge and Cultural Diversity".
The 8th International Conference on Public Communication of Science & Technology will take place in Barcelona, Spain and will include electronic links with Latin America. Its main theme will be "Scientific Knowledge and Cultural Diversity".
Under the motto Scientific Knowledge and Cultural Diversity, the 8th PCST Conference opens up a field to debate about the global discourse of science in a range of local culture and knowledge environments. In a time in which the world is convulsed by ideological and economic power conflicts, the universality of science may be one of the possible ways to allow for developing a dialog among cultures. The different ways in which science is conceived, interpreted, communicated and applied, depending on the cultural view of each person and each community will be addressed at the Conference. In the year 2004, Barcelona will be the capital city of cultural diversity. The 8th PCST Conference is included into the framework of the Universal Forum of Cultures 2004 The Universal Forum of Cultures is a new type of world event, of spirit and scale similar to the Olympic Games and International Exhibitions, but based on the cultures of the world. It is, in other words, the premiere adventure in a new sort of international encounter for the Knowledge Era. Barcelona is, then, currently engaged in a process of dialogue and exchange to define the conditions that will allow the 21st century to be a century of peace instead of a period of wars. A century in which ethics is paramount, while selfishness is disregarded. A century in which pacific co-existence between different ways of looking at the world goes over the intolerance between ideologies. Details: www.pcst2004.org
The 9th International Conference on Public Communication of Science & Technology will take place in Seoul, South Korea in August 2006.

The challenges still ahead in the Public Communication of Science and Technology

Because of humanistic, democratic and educational motivations, governments, scientific institutions and diverse associations advocate for broad persuasive campaigns in favor of scientific literacy or public awareness of science. Such an aim sounds so great and so generous by itself! People may declare "science is very important", visitors of science centers and readers of science magazines are still too limited to scientific literate ones, school children, students or "science addicted ones". How to reach also the wider non-specialized audiences that represent the core historical target public of PCST ? Defining a fantastic and generous goal (end) is one thing. Achieving it is another one. To tackle PCST issues in the knowledge-based society, one has to consider the characteristics and

challenges of the so-called society, the technologies involved and the role of scientific knowledge, workers and institutions inside it.
During the age of agriculture, specialized knowledge was coming from the past. One had to use it in order to reproduce what made survival possible. The age of industry used modern sciences and technologies and "opened the future". Within the still-to-be-defined knowledge society, information and communication technologies (ICT) are used to transform information in order to produce information! To allow these processes in an overwhelmed information world, networking devices are essential.
Previously, PCST was focused on explanations about nature. Within this open and global 21st early century, its main function is that of a kind of social and cultural laboratory to face issues and challenges created by the development of scientific knowledge, activities and applications. The power of science and technology has reached such a high level that science today cannot just decide by itself where to go. Consensus and citizens conferences are crucial to deal with this kind of central issues.

Report / Conclusions

The 8th International Conference on the Public Communication of Science and Technology

Scientific Knowledge from, for and through Cultural Diversity

Vladimir de Semir and Gemma Revuelta
Science Communication Observatory, Pompeu Fabra University*

Under the theme of "Scientific Knowledge and Cultural Diversity," Barcelona brought together in the first week of June 2004 more than six hundred people from every continent at the 8th International Conference on the Public Communication of Science and Technology. This open network of professionals extends to more than fifty countries and embraces the different aspects of science communication, including journalism, museology, research into scientific communication, and policies for scientific culture promotion, among others. On this particular occasion, the need to establish effective dialogue between the different forms of local knowledge and scientific knowledge was discussed and developed. The aim was not only to preserve cultural diversity but also to contribute to developing human knowledge and instilling a culture of peace. Various experiences demonstrated the essential role of the scientific communicator in this context.

Key words: Science communication; public communication of science and technology; PCST; cultural diversity; local wisdom; native knowledge; science journalism; scientific culture; policies on science communication.

"The important thing is not to inform but to communicate." [1] With these words, Federico Mayor Zaragoza, President of the Culture of Peace Foundation and former General Director of the United Nations Educational, Scientific and Cultural Organization, opened

* Authors' Note: Please address correspondence to Gemma Revuelta, deputy director, Science Communication Observatory, Pompeu Fabra University, Passeig Circumval·lació, 8, dept. 201, 08003 Barcelona, Spain; phone: 34 93 542 24 46 fax: 34 93 402 70 90 e-mail: gemma.revuelta@upf.edu.
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the eighth conference of the international network, Public Communication of Science and Technology (PCST-8). He emphasized that the objective of communication should not be that of simply making information public but that it was essential to establish effective relationships of understanding between the different groups of people involved in this information.

On this occasion, the biennial meeting of the PCST network was held in Barcelona on June 3–6, 2004, organized locally by the Observatori de la Comunicació Científica (Science Communication Observatory [OCC]) of the Pompeu Fabra University and the Commissioner for Scientific Culture of the Barcelona City Council. In addition, the conference took place within the framework of the Barcelona Forum of Cultures 2004, an international event focusing on dialogue between the cultures which, between May and September, gathered together millions of people from all over the world in this Mediterranean city.

The PCST Network: History and Future Prospects

Under the theme "Scientific Knowledge and Cultural Diversity," PCST-8 brought together more than six hundred people from every continent (more than 50 countries) and from a range of professional sectors, including journalism, museology, institutional communications, research, and policies for promoting scientific culture, among others. This network, one of the first of its kind and probably the one with the greatest scope, originated in Poitiers, France, in 1989, at the First International Meeting on Scientific Communication. Since then, the network has met in Madrid (1991), Montreal (1994), Melbourne (1996), Berlin (1998), Geneva (2001), Cape Town (2002), and Barcelona (2004). The number of participants and countries represented has grown progressively, and at the same time, the network has been consolidating its structure and defining its objectives. Currently, the network's activities mainly focus on international conferences, at which dialogue and cooperation are fostered, and on its electronic discussion list (see http://www.pcstnetwork.org), which keeps the network's activities constantly updated. At the closure of PCST-8, it was announced that the network will be taking a big step forward, expanding its activities with the creation of an entity aimed at studying and preparing a documentary archive for reference and reflection in the sphere of scientific communication. This entity has been given the provisional name of Knowledge Society Academy, Science, Culture and Communication. The academy will essentially be an online operation but will also have a founder headquarters ar Pompeu Fabra University.

Who are the Members of the Network and What Do They Do?

The open-call system for abstracts to be presented at the conference provides a general overview of who the people are that currently make up the PCST network and what themes they are working on. Thus, a study of the 341 abstracts that resulted from the open call shows that the network has a presence in every continent in the world, although at the moment, European countries still clearly predominate (see Figure 1). The countries that contributed the most abstracts to the open call were Spain (ninety-five), the United Kingdom (thirty-two), Brazil (thirty), the United States (twenty-three), Italy (twenty-three), Australia (nineteen), Mexico (eighteen), South Africa (seventeen), France (twelve), Portugal (ten), Germany (nine), India (seven), and Belgium (five). The other twenty-three countries that responded to the call sent fewer than five abstracts each. This breakdown also allows us to corroborate the fact that hosting the conference

Figure 1 PCST Network as Geographical Distribution of the 341 Abstracts That Responded to the Open Call

NOTE: PCST = Public Communication of Science and Technology.

has a significant local impact in the country responsible for organizing it (Spain, South Africa, France, Australia, etc.). According to the professional field in which they work, the breakdown of authors of the abstracts was as follows: university (203; 59.6%), research centers (70; 20.5%), museums and science centers (23; 6.7%), entities involved in promoting science (20; 5.9%), mass media (11; 3.2%), associations and foundations (9; 2.6%), and others (5; 1.5%).

Finally, an analysis was made of the keywords chosen by the authors to define their abstracts. Specifically, the form allowed a maximum of three keywords to be selected, which had to be placed in order –in first, second, and third place– in accordance with their ability to define the abstract. Thus, by placing all the words selected from the authors in first, second, and third place in a radar-type graph, we obtained a good impression of the main areas of interest of the members of the network (see Figure 2). Curiously, the shape that emerged from this representation is very reminiscent of a boat. Taking advantage of this analogy, we can conclude that the main mast of the PCST network rises up from the term communication (the most quoted word in first place). In second place came the expression public understanding of science and the term education, forming a wide boom, while mass media and journalism jut out sharply like a big oar. In third place, the authors overwhelmingly selected the expressions scientific knowledge and popularization, which clearly define the centerboard of the PCST.

In other words, in Barcelona the PCST dealt with a series of themes that could be defined by the keywords communication, public understanding of science, education, mass media, journalism, scientific knowledge, and popularization. As can be seen from the graph (Figure 2), these central issues were debated from the perspective of the central theme of the congress (cultural diversity) and the different subthemes (social participation, history, etc.). Meanwhile, also worth highlighting is the fact that although a large number of authors of the abstracts work in the sphere of museums and science centers, curiously enough, when it came to defining the thematic focus of their proposals, they did not select

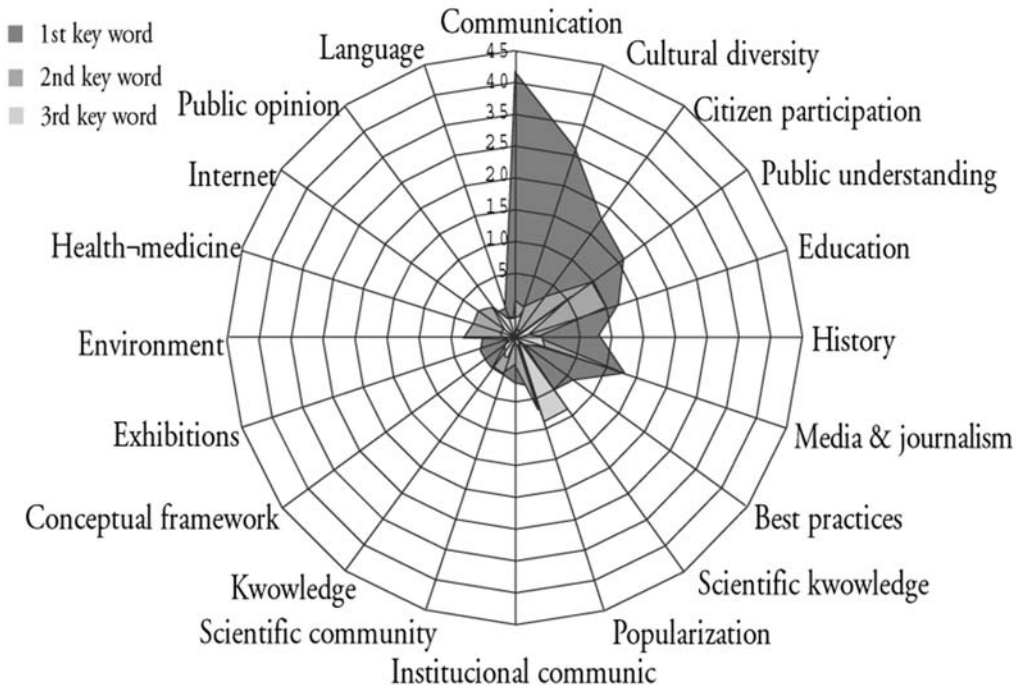

Figure 2 Main Areas of Interest
NOTE: Radar-type graph showing distribution of the keywords selected from the authors in first, second, and third place to define their abstracts

the keyword science museums. Finally, other words on the list proposed in the form were either not selected by the authors (ethics, gender, etc.) or were used very circumspectly.

Program Highlights
Following the planned program, the conference was structured around three main thematic areas.

Native Knowledge and Modern Science
This subtheme started off with an initial plenary session moderated by Vladimir de Semir (chair of the PCST-8 and current chair of the PCST network) and was participated in by Germano Bruno Afonso (Federal University of Paraná, Brazil), Enric Banda (Fundació Catalana per a la Recerca, Spain), Yuwanuch Tinnaluck (ASEAN, Thailand), and Patrick Luganda (Climate Journalists in the Greater Horn of Africa, Uganda).

Science Communication: Historical Perspectives and New Trends
With a plenary session moderated by Luisa Massarani (Museum of Life's Study Centre, Brazil), this subtheme included the participation of Bernadette Bensaude-Vincent (Université Paris X, France), Jon Turney (Penguin Press, UK), Bernard Schiele (University of Quebec at Montréal, Canada), and Young Hwan Choi (Korea Science Foundation).

Science Communication and Social Participation
The session that opened this subtheme was moderated by Lisbeth Fog (cochair of the PCST-8 and vice chair of the World Federation of Science Journalists). Participants were Eduardo Posada (Colombian Association for the Advance of Science), Jenni Metcalfe (E-Connect Science Communication Consultants, Australia), Hans Peter Peters (Research Center Jülich, Germany), Cheng Donghong (Chinese Association of Science and Technology), and Prakash Khanal (secretary of the World Federation of Science Journalists, Nepal). One of the key conclusions to emerge from the conference was that an understanding of cultural values and respect for traditional knowledge are both vital to the successful communication of science. Science and local knowledge are not that far away from one another, but we need to share space and time between scientists and native people.

A New Form of Participation
In addition to the three plenary sessions, we experimented with a new format for the parallel sessions. This new endeavor was designed to seek greater audience participation in this kind of session. The authors who had responded to the open call and passed the scientific committee's review sent in the texts of their works some weeks before the conference. These texts were then posted on the PCST-8Web site (http://www.pcst2004.org) so that everyone could consult them in advance. During the actual session, a "relater" (a student in the Pompeu Fabra University masters in scientific communication course) summarized the main points of the authors works, following which the moderator, authors, and audience began a process of reflection and debate based around a central issue, taking the works of the authors as a reference. Finally, the relaters drafted some conclusions, which were also posted on the Web site for general consultation. An evaluation of this new format was carried out by Núria Güell, from the Autonomous University of Barcelona and also by the scientific committee of the PCST network. It concluded that, generally speaking, this system effectively allowed greater audience participation and that the opportunity given to young people (the relaters) to work in collaboration with the seniors (the moderators) was also seen as very positive. However, the need to fine-tune certain aspects of this new format was also noted. In addition to these parallel sessions (a total of twenty-five), three workshops were held and one hundred posters exhibited, with the enthusiastic participation of the general public.

Health Museums and Science Journalism in the World
Two activities were held before and after the main conference. On June 2, the workshop New Models on Health and Life Museums was held, organized jointly by the Hospital de la Santa Creu i Sant Pau and the OCC. The aim of this meeting was to explore the different functions attributed to health science museums (dissemination, education, conservation of historical heritage, etc.) and to reflect on future prospects.
On June 6 and 7, a seminar titled Science Journalism in a Diverse World was held, organized jointly by the Spanish Foundation for Science and Technology and the OCC. Some of the most eminent figures in the sphere of international science journalism took part in the seminar. The seminar began with a review of the role that specialist journalism has historically played in science. This was followed by a debate on the function science journalism should serve in a diverse world that is geared, in an irregular way, toward the knowledge society.

Information relating to the conference and its activities is available to the general public on the PCST-8Web site (http://www.pcst2004.org), as well as in a monographic issue of the journal *Quark* (http://www.imim.es/quark), titled Scientific Knowledge and Cultural Diversity, published in Spanish and English. Here, too, you can find information about the forthcoming network conferences: Seoul, Korea, 2006 (http://www.pcst2006.org), and Los Angeles, California, 2008. The latter venue does not yet have a Web site, as the proposal from the United States was actually selected during the conference in Barcelona.

Note

[1] These words were originally spoken in Catalan: "El més important no és comunicar, sinó comunicar-se."

Who is who in the PCST's scientific committee

Executive Committee

Vladimir de Semir (Spain, 1948). Associated professor of Scientific Journalism and Director of the *Observatori de la Comunicació Científica* (OCC) research center at the *Universitat Pompeu Fabra*, Barcelona. City Council's Commissioner for Scientific Culture Promotion in Barcelona. He is director of *Quark Magazine (Science, Medicine, Society and Culture)* and the *Informe Quiral* (*Quiral report) (Medicine, Society and Information)*, published by the OCC. He is founder and editor of the science and medicine supplements of *La Vanguardia* newspaper (1982-1997). He was City Councillor for the Knowledge City at Barcelona (*Ciudad del Conocimiento*) from 1999 to 2003. In 1994 he was granted the Scientific Journalism award by the *Consejo Superior de Investigaciones Científicas*. He is a member of the European Commission's Experts Commission for the Scientific Culture. He is also a member of the *European Network of Science Communication Teachers (ENSCOT)* and the *World Technology Network.* Member of the Public Perception of Biotechnologies of the European Federation of Biotechnology. He is also member of the Scientific Commission of the Science and Technical Museum of Catalonia and of the *Museo del Hombre* of *A Coruña*, as well as member of the Technical Commission of *A ciencia e a Técnica nos Medios de Comunicación en Galicia*, of the Culture Council of Galicia.

vladimir.semir@upf.edu

Pierre Fayard (Senegal, 1951). Master in Communication Sciences & Technologies, *Université de Grenoble III* (France, 1980). Doctor in *Sciences de l'Information et de la Communication*, at the same university (1987). From 1981 to 1988 he worked as a science journalist and as a science communicator at the *Centre Culturel Scientifique & Technique,* in Grenoble. From 1988 to 1996 he was senior lecturer at the faculty of *Sciences fondamentales et apliquées* at the *Université de Poitiers*, France, and from 1996 to 1998 he was chair professor at the *Centre National d'Enseignement à Distance*, *LARIC (LAboratoire de Recherche sur les Industries de la Connaissance), Poitiers – Futuroscope*. He is currently chair professor at the *ICOMTEC, Institut de la*

COMmunication & des nouvelles TEChnologies, Université de Poitiers (from 1998) and director of *LABCIS, LABoratoire de recherche sur la Communication et l'Information Scientifique & technique*, *Université de Poitiers* (from 1993). He is also a visiting professor at the *Universitat Pompeu Fabra* in Barcelone, *Universidad de Salamanca* and the Brazilian University of *Caxias do Sul*. He was First chair of the International Public Communication of Science & Technology Network (PCST) from 1989 to 1993.

pmfayard@aol.com

Thomas Gascoigne (Australia, 1945). Bachelor of Arts at the Australian National University. Diploma of Education at the University of Tasmania. Since 1992, he has run (with Jenni Metcalfe) workshops in media and presentation skills for scientists across Australia, and also in New Zealand and South Africa. For 8 years until 2004, he was Executive Director of the Federation of Australian Scientific and Technological Societies (FASTS). Since January 2004 he is Executive Director of CHASS, a peak council representing the interests of Australians working in the humanities, arts and social sciences. He is also President and a founding member of Australian Science Communicators (ASC), which has 430 members, including journalists, scientists, media managers for research organizations, freelance writers and editors. He has published, with Jenni Metcalfe, several science communication articles and books.

director@chass.org.au

Marina Joubert (South Africa, 1963). Master of Science *cum laude* in Agriculture from the University of Pretoria (1990) and a Honours Degree of Journalism from the University of Stellenbosch (1987). From 1989 to 2001 she was Corporate Communication Manager at the South Africa's National Research Foundation. She's currently Science Communication Manager at South African Agency for Science and Technology Advancement (SAASTA), a business unit of National Research Foundation, where she takes the lead in a number of science communication initiatives in South Africa, especially in the field of increasing quantity and quality of science journalism. She also manages a number of thematic programmes in public awareness, particularly a national programme on improving Public Understanding of Biotechnology. She serves on the council of the Southern African Association of Science and Technology Centres (SAASTEC). She's founder of the Southern African Science Communication Network (SASCON). She is also on the Advisory Board for the SASOL National Science Festival in South Africa.

marina@saasta.ac.za

Hak-Soo Kim (South Korea, 1951). M.A. at the Seoul National University. Ph.D. degree in Communication Theory and Methodology from the University of Washington, Seattle, USA (1982). He's a former President of the Korean Society for Journalism & Communication Studies, as well as chair of the Deliberation Committee of the Korean Broadcasting Commission and commissioner of the Korean Press Arbitration Commission. He's currently a full time professor and investigator at Sogang University in Seoul. He is also a member of the Board of Directors of the Korea Science Foundation and a President-appointed member of the Korean government's National Science & Technology Council. He has published numerous articles and three books in Korea. He is

the originator of the APEC Youth Science Festival first held in Seoul, 1998, which is now held every two years in an APEC member country.

hskim@sogang.ac.kr

Bruce Lewenstein (USA, 1957). M.A. in History and Sociology of Science by the University of Pennsylvania (1985). PhD in History and Sociology of Science, and Science and Technology Policy by the same institution (1987). From 1998 to 2003, he was editor of the journal *Public Understanding of Science.* He is currently Associate Professor of Science Communication in the Departments of Communication and of Science & Technology Studies at Cornell University, Ithaca, New York, USA. He is a Fellow of the American Association for the Advancement of Science. He also serves as co-chair of Cornell's committee on ethical, legal, and social issues involved in genomics. Lewenstein's articles on science popularisation and the history of science communication have appeared in many journals and magazines world-wide.

b.lewenstein@cornell.edu

Other members

Rick Borchelt (USA, 1956). Bachelor of Arts, Biology, Southeast Missouri State Univesity (USA, 1978). Director of communications and public affairs at The Whitehead Institute for Biomedical Research, an independent research institute focusing on fundamental biological sciences. He has had a varied career in science communications and science public policy, including stints as media relations director for the National Academy of Sciences; press secretary for the U.S. House of Representatives Committee on Science, Space and Technology under the chairmanship of the late Rep. George E. Brown, Jr.; special assistant for public affairs in the Executive Office of The President during the Clinton Administration; and director of communications for the Department of Energy's Office of Science. He also spent a year abroad in Nairobi as executive speechwriter to the Undersecretary General of the UN, Liz Dowdeswell. While affiliated with Vanderbilt University, he chaired a three-year study, funded by NASA and DOE, on best practices in communicating to the public about science, technology and health. The study, by a blue-ribbon panel of Pulitzer-Prize winning journalists, scientists, public affairs officers, and science writers, culminated in the March 2002 conference "Communicating the Future", the first peer-reviewed international conference of its kind. He was elected a Fellow of the American Association for the Advancement of Science in 2004, where he serves on the Committee on Public Understanding of Science and Technology and is chair-elect of AAAS Section Y (General Interest in Science and Engineering).

rickb@nasw.org

Massimiano Bucchi (Italy, 1970). Master Degree in Sociology at the *Università di Trento* (1993) International Ph.D. in Social and Political Sciences at the European University Institute, Florence, Italy (1997). He is a founder of the Observa – Science and Society, a non-profit organisation and research centre that intends to create a bridge between scientific research, political decisions and public opinion. He has carried out research and given seminars at several universities, such as Sussex University, Universität Bielefeld, ETH Zurich, University of Wisconsin, University of Edinburgh Science Studies Unit, University of Tokyo and the Museu da Vida Rio de Janeiro. He is currently professor of Sociology of Science and Sociology of Communication at the *Università di Trento*, Italy.

mbucchi@soc.unitn.it

Paola Catapano (Italy, 1963). Degree in Conference Interpreting at the University of Trieste, Italy (1987). Master in Science Communication at SISSA –ISAS (International School for Advanced Studies), Trieste. She worked as a simultaneous conference interpreter and translator specialised in scientific terminology until 1990. That year she started working at CERN as personal assistant to the Director general of the Organization, Nobel laureate Carlo Rubbia. She was leader of visits and exhibitions until 2002 in the same institution, and presently she's working in *Events and Sponsoring* and is a leading member of the *Livefrom CERN Multi-media productions group*. As PCST member, she was invited to speak at the UNESCO World Conference on Science in Budapest in June 1999. She has published several scientific articles in Italian magazines and newspapers such as *Galileo, Newton* and *La Stampa.*

Paola.catapano@cern.ch

Michel Claessens (Belgium, 1958). Michel Claessens has a Ph D in physical chemistry. He worked successively at the Free University of Brussels, Department of organic physical chemistry, at the Erasme Hospital in Brussels, Department of radiology (during a non-military national service), then in the biotechnology and in the chemical industry. In addition, Michel Claessens has been a free-lance scientific journalist since 1980. He joined the European Commission in 1994.
Within the European Commission Michel Claessens is currently Head of the Unit Information and Communication in the Research Directorate-General. Among other responsibilities, he conducted the latest Eurobarometer public opinion surveys on science and technology and is responsible for the European Science Week. He is also the editor of the magazine on European research, *RTD info*: http://europa.eu.int/comm/research/rtdinfo.html. A science writer, Michel Claessens has published 250 articles and 4 books on several aspects of modern science and technology.

michel.claessens@cec.eu.int

Donghong Cheng (China, 1953). Graduated in Physics at the Langfang Teacher's College (1978). As a Hubert H. Humphrey Fellow she studied at the Pennsylvania State University (US). She is currently the Executive Secretary of the China Association for Science & Technology (CAST), where she has also been Director-General of the Dept. of Children & Youth Affairs and Director-general of the Dept. of Science Popularisation. She has been taking the leadership of many national PCST initiatives, such as the Head of

Office of the National Scheme for Scientific Literacy, and is the national focal point of the Asia-Pacific Network on Gender, Science and Technology of UNESCO. She is also a Member of the Executive Board of All China Women's Federation and a Board Member for the China Association for Science Instructors.

dhcheng@cast.org.cn

Suzanne de Cheveigné (Canada, 1950). Ph. D. (*Doctorat d'Etat*) in Solid State Physics, *Université Paris VII Denis Diderot*. She's a researcher at the CNRS in the Science-Technology-Media and Society field. She's also a visiting professor at the University of Geneva and an expert for the European Commission (Science and Society). Member of the editorial board of the French journal *Hermès – Cognition –Communication – Politique* and of the Communications collection of the publisher CNRS Editions. She's also a member of the scientific committee of the Evaluation and Consideration of Natural and Technological Risks program of the French Ministry of Ecology and Sustainable Development.

cheveign@ehess.univ-mrs.fr

Sook-kyoung Cho (Korea, 1964). Bachelor in Physics Education from the Seoul National University (1987), M. Sc in History of Science at the King's College of London (1990), Doctor in History of Science by the Seoul National University (2001) and Post. Doc on Public Understanding of Science & Technology (PUST), Science Museum at POSTECH University (2002). She is Director of the Department of External Cooperation in the Korea Science Foundation. She's also an acting member of the National Council for Science & Technology and writes articles in some newspapers. She has translated several books on history & philosophy of science and has been co-author of some publications. She has been a representative of PUST in making 'National 5 year Plan for Science and Technology'.

skcho@ksf.or.kr

Lisbeth Fog (Colombia, 1957). M. Sc. in Science Journalism at the Boston University (1993). For several years she worked as a reporter, journalist, editor and anchor-woman for Telediario, a news broadcast program in Colombia. From 1994 to 1996 she was Chief of the Communications Branch at the Colciencias, the Colombian Institute for the Development of Science and Technology. She has worked as a scientific journalist for different media such as UNIVERSOS (a series of 50 scientific TV programs) and the *Colombia, ciencia y tecnología* and *Innovación y Ciencia* magazines. She is founder of the Colombian Association of Science Journalism, ACPC, which she headed from 1998 to 2004. She currently writes for *El Tiempo* and *El Espectador* newspapers.

lisfog@tutopia.com

Winfried Goepfert (Trier, Germany, 1943). Diploma of Computer Sciences at the University of Karlsruhe in 1970. He's been science editor in both radio and television of *Sender Freies Berlin* (public radio and television station of Berlin). He worked as science reporter and science producer at major science magazines in German TV channel I. Until 1990 he was head of science department of *Sender Freies Berlin*. In 1990 he was appointed as full time professor of science journalism at the *Institut fuer Publizistik und*

Kommunikationswissenschaft (Institute of Journalism and Mass Communications) at *Freie Universitaet Berlin*. He currently presents a monthly health magazine on German TV channel 1. Winfried Goepfert is involved in the ENSCOT-Network, the *European Network of Science Communication Teachers*. He published *The German Handbook of Science Journalism* in 2000.

goepfert@zedat.fu-berlin.de

Luisa Massarani (Brazil, 1966). Master degree on Science Information at the Federal University of Rio de Janeiro. PhD degree on Medical Biochemistry, also at the Federal University of Rio de Janeiro, with a thesis on public understanding of genetics in Brazil. She has worked as a journalist in the editorial Staff of Ciência Hoje (Science Today), and was editor-chief of Ciência Hoje das Crianças (Science Today for Children). She is currently co-ordinator of the Museum of Life's study centre at Fiocruz in Rio de Janeiro, and the Latin American and Caribbean regional co-ordinator of SciDev.Net (Science and Development Network). She has published articles on science popularisation in several magazines and newspapers such as the Folha de São Paulo newspaper.

lumassa@coc.fiocruz.br

Jennifer Metcalfe (Australia, 1959). M. Sc. in environmental studies at Griffith University (1986). Batchelor of Business Communication majoring in journalism and audiovisual production techniques from Queensland University of Technology (1990). She has been journalist for ABC TV and a freelancer writer for various newspapers and magazines. She worked for six years as a communication manager for Australia's science research agency, the CSIRO. She has run science communication workshops across Australia for 12 years, and more recently in New Zealand, South Africa and the Philippines. Since 1995 she is Director of Econnect Communication Pty Ltd, a science and environmental communication company in Brisbane Australia.

jenni@econnect.com.au

Jill Nelson (UK, 1959). B. Sc in Food Science from de University of London. She worked for 13 years at the *Royal Society* in London as part of the senior management team leading a major programme of education and outreach. She currently works at the BA *(British Association for the Advancement of Science),* where she's Director of Programmes and is responsible for directing an annual festival of science, UK national science week, and for publishing *Science & Public Affairs* magazine. She directed *Creating Sparks*, a science and arts festival in London to mark the millennium and she also directed the *Science Year* programme for the BA in 2002/03. She is also a member of the Engineering and Physical Sciences (EPSRC) Strategy Advisory Board on Public Awareness.

jill.nelson@the-ba.net

Manoj Patairiya (India, 1961). M.Sc., Zoology (Environmental Biology), Ph.D. in Science & Technology Communication. He also did Postgraduate Diploma in Journalism and Mass Communication. At present, Dr. Patairiya is serving as Director (Scientist 'F'), at India's National Council for Science & Technology Communication. He is the editor of

an international journal titled *Indian Journal of Science Communication*. He has authored a number of books on science communication, science journalism and popular science topics. Dr. Patairiya's professional interests included popular science writing, TV and radio anchoring and imparting training to budding science journalists, especially in vernaculars. So far, he has conducted over 200 workshops training around 10000 trainees, including journalists, writers, scientists, teachers, students and science activists, etc. He is a practicing science communicator and is deeply involved in academics and research in science communication and teaches science communication at various universities/ institutions as Visiting Faculty. He is actively associated with the Indian Science Writers' Association (ISWA). Dr. Patairiya has been honoured by a number of national and international awards and recognitions; the most recent one is "International Award for Global Advancement of Science Popularization 2003" by Centre for Global Studies, c/o NASA, Texas, USA. He is very much interested and dedicated to the cause of developing science communication profession.

manojpatairiya@yahoo.com

Hans Peter Peters (Germany, 1955). Degree in physics and social science by the University of Cologne (1981). Ph.D. in social science from the University of Bochum (1984). He is a social scientist at the Program Group Humans, Environment, Technology of the Research Center Juelich, Germany. Since 2001 he is head of the research focus "The Public, Politics and Mass Media". He teaches, as visiting lecturer, science communication, risk communication and methods of empirical communication research at the University of Duesseldorf. He is principal investigator of the project Climate change in the public sphere and co-investigator of the project Consumer perceptions of food biotechnology at the Food Policy Institute, Rutgers University (USA). Member of the Scientific Advisory Board of the German Committee for Disaster Reduction.

h.p.peters@fz-juelich.de

Carol L. Rogers (USA, 1944). Ph.D. degree in Mass Communication from the University of Maryland. M.A. degree in special studies from the George Washington University. She has been a science communication consultant for a number of non-profit organizations, science writer and associate public information officer at the *National Academy of Sciences*. She was also a staff writer at the American Chemical Society and head of communications for the American Association for the Advancement of Science *(AAAS)*. Since 1994 she has been on the faculty of the Philip Merrill College of Journalism at the University of Maryland, USA and since 1998 she is editor of *Science Communication*, an international interdisciplinary social science journal. Dr. Rogers is a member of the board of the Council for the Advancement of Science Writing, and of the Committee on Public Understanding of Science and Technology of the AAAS.

cr46@umail.umd.edu

Bernard Schiele (France, 1943). Ph. D. by the University of Montreal (1979). He studies the role and impact of media on the procedures of sciences and culture information diffusion, more specifically the discourse of science and science museology. He is former director and founder of the CIRST (Center of research on sciences and technologies). He has co directed, with Jacqueline Eidelman, the evaluation program of

the *Galerie de l'Evolution du Musée National d'Histoire Naturelle* in Paris. He is currently professor at the Department of Communications at the University of Quebec in Montreal (U.Q.A.M.), for the joint doctoral programs in communications and in museum studies. He has organized many international congress on science literacy. With Michel Van Praët he is directing a three years comparative study between France and Canada on professionalization in the museum field. He is a science culture advisor for several organisms such as Auditor General of Canada, and the *Conseil de la Science et de la Technologie du Québec*.

schiele.Bernard@uqam.ca

Yuwanuch Tinnaluck (Thailand, 1957). Bachelor of Mass Communication from Chiang Mai University, Thailand (1978). Master of Science in Communications from Illinois State University, U.S.A. (1990). She's currently a Ph.D. candidate at the Scientific and technique communication and information laboratory – LABCIS, ICOMTEC, of the University of Poitiers, France (since 2000). Her specialised area of study is the interfacing of local wisdom and modern science and technology. From 1982 to 1996 she worked as Head of Public Relations for the Science Centre for Education of the Ministry of Education, and since then until 2002 as Public Relations Manager for the National Science and Technology Development Agency. She's a Committee member of the Science Writers and Publishers Forum (Science Society of Thailand). She also teaches communication and science communication in private and public universities in Thailand.

yuwanucht@yahoo.com

Brian Trench (Ireland, 1945). BA (first class) and MA in Modern Languages (French and German) from Trinity College Dublin. Postgraduate studies at University of Bordeaux, France, and University of Birmingham, England. Between 1973 and 1992 he's been a full-time journalist as a freelancer or as a staff journalist at different media such as Media Vox, RTE Radio 1, Hibernia magazine and Sunday Tribune. Group leader on EU-funded ENSCOT (European Network of Science Communication Teachers) project, 2000-2003. He is President of the Irish Science and Technology Journalists' Association, 1994-1996. He was member of government advisory body, Irish Council for Science Technology and Innovation between 1997 and 2003. He's currently Head of School in the School of Communications, Dublin City University, and a senior lecturer in journalism and science communication. He is also a member of the management committee of the Centre for Society Technology and Media (STeM), and leader of the Biosciences and Society group at the National Institute of Cellular Biotechnology.

brian.trench@dcu.ie

PCST-8 Sessions

Native knowledge & modern science

Proceedings

Parallel session 1

The role of science communication in dissemination of local knowledge

INDIGENOUS KNOWLEDGE IN SCIENCE COMMUNICATION: DILEMMA AND PERSPECTIVES

Cesar Carrillo Trueba

Revista Ciencias, Departamento de Física, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad Universitaria, 04510 México, D.F. México. Tel.: 525 56 22 49 35, fax: 525 5616 03 26, cesarct@servidor.unam.mx

Abstract

Relations between science and the knowledge developed by indigenous peoples all over the world have oscillated from disdain to idealization, and more recently to its validation (i.e. the methodological study of isolated knowledge considered useful and fit for integration in science). Science communication has adopted a similar position towards indigenous knowledge, disdaining, idealizing, and facilitating diffusion of some fields of research that validate it. This paper offers a brief overview of this topic and the possibilities created by social studies of science to enhance an equality relation between science and indigenous knowledge, in which science communication can play an important role.

Key words: indigenous knowledge, science communication, equality, pluriculturality.

Text

We live in a pluricultural world, where between four and five thousand indigenous peoples subsist, each with its own world view, language, territory, history, and knowledge.[1] And notwithstanding, although on paper they have been declared equal, the reality is that the relations that define their coexistence are far from equitable. Instead, they are characterized by a profound asymmetry, which in turn has permeated the different images of indigenous peoples that have been developed in western culture. Science's view of its homologue, indigenous knowledge, has not escaped this context, oscillating between disdain, idealization, and validation. And echoing this vision, science communication has reflected these three currents over time.

Disdain

This attitude has been the most common, and although it has its origins in ideas regarding pagan idolatry, it took shape in the 18th Century with the enlightenment vision in which the civilized nations, possessors of the only true knowledge, had an obligation to shed their light on the world's savage peoples, who lived immersed in superstition and ignorance. The idea of progress rendered such peoples' knowledge anachronistic, seeing it as cumbersome cultural baggage that needed to be eliminated though science, as part of the broader notion that the world's inferior peoples needed to be civilized by their superiors. The idea of revolution[2] (Neolithic, industrial, etc.), dominated by the cult of the tool,[3] with technology as the embodiment of knowledge, became the cornerstone of this vision, which in turn took it upon itself to judge the knowledge of other peoples, both ancient and contemporary. This scheme can be observed in the unwaveringly linear historical perspective of numerous textes of science communication, and constitutes the core concept of the most widely held theories of biological evolution.[4]

While it is true that this vision lost considerable ground in the second half of the 20th Century, this decline was far less pronounced with regard to its assessment of knowledge, as confirmed by the terms that we continue to use when referring to indigenous knowledge (empirical, traditional, local, etc.), and the wholesale imposition of technological and educational models that ignore the knowledge of the people involved. One of the clearest examples of this attitude can be found in policies regarding nature conservation, in which science reduces the role of the peoples that have inhabited the regions that concentrate the Earth's greatest biodiversity, imposing a logic foreign to their culture and laying the blame for environmental deterioration on their ways of using and managing ecosystems. The way these and other related issues are communicated to the general public is a reflection of this vision.[5]

Idealization

This vision grew out of the idea of the noble savage, pure and wise, whose main exponent was Rousseau, but which New Ageism and other post-modern currents have exalted to counter the scientism predominant in western society. It is based on a vision critical of science, mainly for its lack of spiritualism, and therefore often reopens fields of enquiry hitherto unexplained by science in its efforts to reaffirm their metaphysical dimension[6] and the profound wisdom they encompass. Its diffusion is common in the more sensationalistic publications.

Validation

Validation is the process of investigation whereby science examines isolated aspects of indigenous knowledge, passing them through the sieve of method and experimentation and integrating them in its own vision. Non-western medicine is one of the best known examples, and has served as a guide for extensive research in many areas, such as that related to medicinal plants. The problem is that this often leads to a pillaging of indigenous knowledge,[7] which today goes by the name of biopiracy. Also, what science can explain is limited by its approaches and instruments, as a result of which it ignores many knowledges that could prove extremely valuable, and maintains a focus that proves unfavorable to intercultural dialog due to its inherent contempt for cultural context.[7-9] It represents, notwithstanding, the most rigorous means of communicating indigenous knowledge, and by confirming its validity, has contributed to its reassessment, even if on a limited scale.

Equality

As countless studies have shown, science is not neutral, and represents a confluence of social, philosophical, and ideological factors, among many others.[8] The separation between nature and culture established in the western world view is totally artificial, and consequently there are only natures-cultures,[2] and relations between the knowledges of different cultures –including western culture– must be on an equal footing. Thus, it seems valid to me to use as metaphor the Banach-Tarski paradox regarding the comparison of non-measurable systems, in which if we take two different systems, regardless of their size –the moon and a ping-pong ball, for example– for each element we define in one (1,2,3,…*n*) we will find an equivalent in the other (1',2',3',…*n'*), by virtue of which they will both be equal. This would be the beginning of a genuine intercultural dialog, between two types of equally dynamic knowledge, which, while they are equally conservative, are open to exchange, and to the construction of a pluriverse.[2]

Diffusion of indigenous knowledge ought to be based on this vision of equality –without idealization or disdain, without the constant need for validation–, requiring a strict correlation of categories, classifications, causal schemes, between indigenous knowledge and science. Finally, as Darrel Posey writes, indigenous knowledge is not local knowledge, "but knowledge of the universal as expressed in the local".[9]

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SCIENCE AND INDIGENOUS KNOWLEDGE TOGETHER ONLINE

Allen Rooney
Manager, Indigenous Programs. Questacon. arooney@questacon.edu.au

TEXT

Questacon is Australia's largest Science and Technology Centre and is taking a leading role in developing cross cultural communication processes in science communication. Questacon's Indigenous Outreach Programs aim to overcome the cultural and geographical challenges that arise when sharing information between cultures. In Australia these challenges include:

- Language: A large proportion of Indigenous people living in remote areas have English as a second or third language.
- Distance: Some communities in Australia are thousands of kilometres from major population centres.
- Cultural diversity: Today there are hundreds of groups of Indigenous people living in Australia, each with its own distinct knowledge and stories.

Questacon recognizes that many Indigenous Australians still hold their traditional understandings of the world. In the past, education institutions have attempted to replace these understandings with "correct, modern" knowledge causing confusion, uncertainty and some resentment. The cultural identity of the young Indigenous students was also threatened. Questacon acknowledges the importance of Indigenous ways of "knowing" whilst offering alternative explanations for phenomena.

The way they do this is through exchange, not delivery. This is done through establishing contact and gaining confidence within the communities and acknowledging place and culture. Through these links Questacon aims to have a genuine sharing of knowledge and stories with understanding and respect for others view of the world.

Questacon's ***Burarra Gathering Online*** exhibition draws on the content of the gallery exhibition ***Burarra Gathering: Sharing Indigenous Knowledge*** which presents contemporary and traditional knowledge and technology of the Burarra people of Arnemland. The exhibitions were developed through close consultation with the Burarra people and present a means for their community to preserve their knowledge and culture while sharing their knowledge with other Australians.

The award winning online experience has drawn very positive feedback and has highlighted some unexpected benefits in the field of Indigenous education.

The ***Burarra Gathering Online*** experience, together with Questacon's program of community visits, come together in an exciting new project which aims to facilitate the sharing of science and Indigenous knowledge in person and online.

This project aims to create more opportunities for on-line experiences in other areas. Students and communities will be involved in the research, development and construction of on-line resources and material where traditional stories are told alongside modern-day science stories. This hopes to encourage a greater understanding and knowledge of modern communications technology while also facilitating links between schools, communities and stories old and new.

About the author

Allen Rooney has a strong background in education and has been involved in science communication at Questacon for the past nine years. He has been involved in a range of programs including exhibition development and support, national teacher programs, public programs and the development of educational workshops for students. He manages Questacon's growing range of programs for Indigenous Australians.

This paper will be presented by Miss Lish Hogge, Coordinator- Shell Questacon Science Circus.

The Shell Questacon Science Circus is the major outreach program of Questacon, The National Science and Technology Centre in Canberra.

TO DEVELOP THE ROLE OF PCST RESEARCHERS IN CREATING STRATEGIC KNOWLEDGE COMMUNITIES (SKC) TO NURTURE THE CULTURE OF CREATIVITY AND INNOVATION IN LOCAL COMMUNITY

Nuta Supakata

Ph.D. Candidate at LABCIS (LABoratoire de recherché en Communication & Information Scientifique et technique), ICOMTEC, University of Poitiers, France. Lecturer at Department of General Science, Faculty of Science, Chulalongkorn University, Thailand. nuta.s@chula.ac.th

Abstract

To create SKC in fostering the culture of creativity and innovation, PCST researcher has developed four phases: creating partnership for enhancing collaboration for action, crystallizing and systematizing local knowledge, assembling local knowledge and scientific knowledge in creating new invention, and disseminating new invention.

This participatory action research using SKC has been conducted in Mahanam Village, AngThong Province in the central part of Thailand, this village is participating One Tambon (sub-district) One Product:OTOP project (developed by the government to make the community in each sub-district self-reliant by using own resources and wisdom) by producing fabricated handicrafts from weaving dried water hyacinth stems. To make Mahanam Village handicrafts acceptable to the international market, PCST researcher organizes the process to create SKC for villagers in cooperating with scientific scholars to develop their OTOP production and new creativity.

Key words: SKC, Local Knowledge, Scientific Knowledge, Culture of Creativity and Innovation.

Text

SKC is abbreviated from Strategic Knowledge Communities. This hypothesis was first conceptualized by Prof. Pierre Fayard,[1] who originally founded PCST in 1987. This Western hypothesis is the counterpart of the Japanese concept of 'Ba' which roughly means 'place' in English. Based on a concept developed by Ikujiro Nonaka,[2] Ba is the place where individual knowledge can be shared through interactions with others.

In this research, the researcher will organize the process to create 'SKC', which can be detailed in four phases as follows.

Phase I: Creating Partnerships for Enhancing Collaboration for Action

To develop a positive interaction between the PCST researchers and the community, collaboration must be conducted between equal partners upon trust (care + love + mutual respect) and understanding by initially getting to know the community 'leader'. PCST researchers have to transparently introduce themselves and thier objectives to the leader, this step is the meaningful starting point for PCST researchers to launch the project. Second is getting to know the 'community'. PCST researchers must enrich our understanding of the grassroots. In the last step, creating 'network' between community and PCST researchers, networking will bring about coordination between PCST team and community, makes them work in a more collaborative way, energizes them to cooperate in project activities and interests them to communicate through sharing and exchanging of feelings, information, and ideas in achieving their goals.

Phase II: Crystallizing and Systematizing local knowledge

PCST researchers will start with studying local knowledge and its practice. Following with analyzing local knowledge, PCST researchers will analyze local knowledge, its

practice, and its problem that exists in the community by involving the community members through interaction. Ending this phase with documenting local knowledge, PCST researchers will implement database and document of local knowledge to preserve, and to promote local knowledge.
This collection of knowledge will be considered as baseline information for them to manipulate 'SKC': a meeting place (physical, virtual, mental) for the community and scientists to prepare the operational plan and to direct indicators for monitoring and assessing outcomes in the coming phases.

Phase III: Assembling local knowledge and scientific knowledge in creating new invention
In this phase, PCST researchers will begin researching for scientists or specialists related to local knowledge then getting to know the scientists or specialists by introducing themselves and presenting their objectives based on mutual respect, understanding, and transparency. Next, creating 'network' between scientists/specialists and PCST researchers to identify the possible solutions based on the knowledge collected in Phase II. Experimenting with community and scientists, the role of PCST researchers in this step is the mediator in conducting participatory actions among community and scientists/ specialists. The last is monitoring and evaluating to improve this new invention.

Phase IV: Disseminating new invention
PCST researchers start Phase IV by conducting communication process to disseminate the new invention to community members. This phase is closely related to "learning-by-doing" which allows each member of the group to access the new knowledge: methods or solutions about strategy, innovation, or improvement via action and practice.
After operating participatory actions in Phase I and Phase II, the Mahanam villagers and PCST researcher found that the defect of water hyacinth stems caused by fungi was the first priority problem. The methodology is to protect their products from this microorganism. Accordingly, PCST researcher began Phase III by cooperating with researchers from the Thailand Institute of Scientific and Technological Research (TISTR) and representatives from Alphani International Co., Ltd. who provided the sample fungicide for experimenting. The result was satisfied, however the villagers denied to use this solution due to its high cost. PCST researcher re-operated Phase III by joining with Dr. Srisook Poonpholkul, plant pathologist at Plant Protection Research and Development Office, Department of Agriculture of Thailand, who provided the alternative lower cost fungicide. Although the experiment was failure at first, good collaboration among stakeholders made the experiment succeeded finally. Then, PCST researcher started Phase IV by conducting communication process to disseminate the acceptable solution to the villagers. This phase was closely related to "learning-by-doing" which allowed each member to access new knowledge.
From this participatory action research, although partnerships among community, scientists and PCST researcher have been established and the problem has been conquered, the process of creating culture of creativity and innovation requires time for nuturing it. Consequently, the future direction of research will focus on providing the learning process, information about scientific issues and impacts related to local knowledge. Hopefully, this would bring the harmony between science and the public particularly rural area.

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PCST ENABLES INDIGENOUS RICE VARIETIES AND THE COMMERCIAL ONES TO CO-EXIST: A CASE STUDY FROM THAILAND

Yuwanuch Tinnaluck

ASEAN Handicraft Promotion And Development Association (AHPADA). Secretariat Regional Office, Bangkok, Thailand. Ph.D. Candidate, LABoratoire de recherche sur la Communication et l'Information Scientifique et technique–LABCIS, (ICOMTEC) Université de Poitiers, France.
Tel: + 66-9-771-4064, +66 35 255 038, fax: +66 35 255 037, yuwanucht@yahoo.com

Abstract

This paper reports on a case study from a rural village of Thailand about rice which is the staple crop of the country for over a thousand years, hence the "rice culture". It analyses how PCST has undertaken a significant role in bridging local wisdom (LW) and modern science and technology within co-intelligent process. Problems of indigenous rice varieties being replaced by the higher yielding commercial ones, and dependency on commercial seeds were resolved. It shows that the synergy of different knowledge systems, with PCST as a catalyst, could provide perspective for LW and modern science & technology to co-exist and enrich each other.

Key words: local wisdom, civic scientist, modern science.

Text

Deep-root Problems in the Fields

To all Asian countries, rice if life. Thailand has been known as a "Rice Bowl of Asia". However, thousands of indigenous rice varieties are at risk of being replaced by a few higher yield commercial ones. This not only poses a threat to biodiversity of rice varieties but also to the social and cultural aspects in knowledge of traditional rice farming.

The commercial varieties are produced by hybrid rice technology. Rice harvested from these hybrid varieties cannot be used for replanting because hybrid vigor is lost, resulting in lower yield and non-uniform crop stand. Then, the condition creates dependency on buying new seeds for each next planting season.

But in the case of the inbred (indigenous) rice variety, its flower contains both male and female organs, hence, it can self-pollinate and produce seeds that can be replanted (Fernandez, 2004).

Quest for Solutions

In Tapaan Hin district, Pichit province, central plain of the country, Sinchai Boon-aaj a young man returned to his hometown from the impact of economic crisis in 1999. He observed that the farmers in his village spent large amount of money on rice farming every year, but with minimal income. Expense on chemical fertilizer was the biggest part. He tried to find ways to use local natural fertilizer to lower the cost. Though it did not work, Sinchai never gave up.

After his own trial-and-error and observation in the fields, he hypothesized that commercial seeds were technically and chemically treated from the start. So, they acquired the taste for chemicals and did not thrive on natural fertilizer.
Where could he find the commercial Khaow Ploog or rice seeds for planting that would have simple taste for natural fertilizer?
Another frustrating fact he discovered was that most of the farmers did not grow the indigenous varieties they preferred to eat. Instead, they bought. Because they had to save space for growing commercial varieties that gave higher yield for better income from the flour industry.
He, together with a few villagers, continued the quest by reading, talking with the old wise men in and out of his village, and traveling everywhere in search of knowledge. The wise men they met taught them how to identify indigenous rice varieties, some traditional formula for natural fertilizers, pesticides, and how to deal with some common rice diseases. And they went to see Decha Siriphat, a retired scientist who now runs Khaow Kwan (rice guardian angel) Foundation in Suphanburi.
The scientist explained and taught them a simple way to regain hybrid vigor of replanting. And he demonstrated an innovative way of propagating the seeds using low cost and low-tech technique to produce high quality Khaow Ploog. This technical knowledge seemed impossible for them at the first glance.
After coming back to their village, they experimented by themselves and were surprised of the success. They have been sharing the acquired knowledge ever since among other farmers through networking and mass media. Now in their area, farmers grow indigenous rice varieties for their own consumption almost ten percent of the land. The yields are as high as the commercial ones. And for producing Khaow Ploog seeds of indigenous and commercial varieties, there are growing number of farmers using the technique.

The Role of Public Communication of Science and Technology –PCST

We witness more and more of the role of PCST as the country strives to enter a knowledge-based society logic. Fayard (2002) argues that "…when changes occur in the way of producing scientific knowledge, in the scale and the impact of their uses or in the availability of communication tools, as a consequence ways of doing PCST change too." In this case study, a civic scientist - a scientist who involves himself more in the public arena, made possible the use of scientific knowledge to complement local knowledge. PCST might not just identify new audience, new channels, or new media for PCST's sake to be more effective in promoting modern science in the rural context. But it is a new perspective of communication that creates good condition for these two systems of knowledge to interact and collaborate with mutual respect within sustainable framework. Then, later dissemination of this hybrid knowledge can be considered to reach all sectors with different ways and means. PCST would find itself to reach more people taking into account cultural and social values of the community.

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IN THE PATH OF POPULAR WISDOM

Maria Joao Faceira
University of Tras-os-Montes e Alto Douro / CIEIA.

Abstract
In a little village in the northeast of Portugal there is a congress of popular wisdom (around hills and popular ways of treatment). A local priest organizes the congress, already on his XVII edition. Because the village is very isolated and has no doctors nearby, the priest wants to promote the local knowledge and the local ways of heal. A few years ago, the bishop interdicted him to be the organizer of this congress and named the congress as the witches meeting. Suddenly, the unknown congress becomes very known and popular for impostor and quacks. We decide to go there for two years with a team composed by an anthropologic expert and a sociologic person specialized in this kind of popular wisdom. We decide to make recoil of opinions and make a descriptive study of this congress (that we have transform later in a documentary). Working with a camera we have found four categories of persons: Those that have a popular wisdom about herbs and his power of heal some hills. Those who are true impostors and that work in the domain of beliefs and palliatives. Those that are informed and look for different experiences and different ways of heal. Finally those that are not well informed and that believe in supernatural ways of heal and go there looking for learn something with the impostors. But talking with the autochthones persons we wonder stood that in the beginning the congress was different. There were no impostors. Local persons argue that impostors arrived with the bad advertise made around the removal of the priest. The conference will be presented with the support of images from the documentary that was produced with this team.

INTELLECTUAL CAPITAL OF THE SOCIAL SPACES: CULTURAL CAPITAL IN THE CREATION OF SCIENCE AND TECHNOLOGY

Eduardo Bueno Campos
University Institute of Business Administration (IADE)

Abstract
Science and technology have acquired a prominent role in the social system of the Knowledge Age. Scientific knowledge, defined as technoscience, opens a multidisciplinary discussion about the knowledge creation processes based in the relationships between science, society and technology. Cultural diversity provides native, historical and traditional knowledge to these processes that take place in the global arena where species and populations mix (Bordieu, 1997). By doing this it is built a social space where a new concept, cultural capital, creates an intangible value (Intellectual Capital) added to the economic capital (material capital). The several social spaces which made up the Knowledge Society offer essential and relational concepts for the creation of Intellectual Capital. The road to Intellectual Capital is constructed by the agents of the social spaces that take part in the creation of science and technology. They combine native knowledge and modern science in a episode in which the Cultural Capital and the Economic Capital of the social space is developed. The value of the intellectual and material wealth possesed by nations, regions, counties or towns emerges throuhgout this dynamic process. The concept of Intellectual Capital of the social spaces is based in the interdependence between Cultural and Economic Capital. The interdependence between both concepts express the posibilities for the development of science and technology in a globalized context. According to Stiglitz (2003) the key value of culture may discredit some of the socioeconomic myths of the nineties. Therefore, it is time to develop an international science and technology system respectful to cultural diversity.

Parallel session 2

Main challenges in the coexistence between native knowledge and modern science

KNOWLEDGE FROM EXPERIMENTATION AND KNOWLEDGE FROM EXPERIENCE

Josep M. Basart

Computer Science Department, Engineering School, Universitat Autònoma de Barcelona, 08193 Bellaterra, Catalonia, Spain. Tel: +34 93 581 2167, fax: +34 93 581 3033, josepmaria.basart@autonoma.edu

Abstract

Technoscience can be outlined by means of words like control, efficiency, rules (theories), abstraction, verification, artefacts (devices), description, system or invention. We call this the experimentation frame. Quite different is the non-scientific knowledge acquired through personal involvement in both nature and traditional culture. This kind of knowledge is related to words like adaptation, harmony, commitment, concretion, coherence, tools, sense, community or cultivation. We call this alternative the experience frame. By well-known reasons, in post-industrial countries the experimentation frame is the prevailing one. From an intercultural outlook, our goal here is to show its influence on the weaker world of experience and to underline the increasing importance of keeping alive this today unbalanced and frail coexistence.

Key Words: Experience, Experimentation, Technoscience.

Text

1. Context

Along the last decades, and as a result of the close links among science, technology and industry a new and very pervasive force has settled its place in the middle of all modern societies. Technoscience is the name we will use for this coalition. Some consequences of the technoscience presence are obvious in almost every activity and practice of human life (business, communications, education, nourishment, medicine, leisure…). Culture, in its broader sense, like social and personal relations are not exceptions to this general

rule.[1] It is important to keep in mind that technoscience is not just machines but a many-sided system which also encompasses new ways of economic and political relations together with different schemes of social organization. This system not only shows *what* we can do but also *how* it should be done.
When considering the new and pressing challenges raised by the intercultural dimension of our actual world, it seems to be more than appropriate to elucidate which is the importance of the unavoidable tensions appearing when knowledge is formulated and evaluated among different cultures or traditions.[2,3] So, let us now address our attention towards what kind of knowledge technoscience develops and promotes in front of other types of knowledge not suitable to its structural requirements.

2. The experimentation frame

At least since the works on astronomy by the English Franciscan monk Roger Bacon (1214-1292), mathematics and experimentation have been accepted to be the core of the modern scientific approach. Three centuries after Roger Bacon, another Bacon, Sir Francis (1561-1626), announced without hesitation what could be his main lemma: *Scientia et potentia humana in idem coincidunt* (Human knowledge and human power meet in one). Contemporary technoscience appears as the pitch we have reached by developing this lemma neither weakening nor saving efforts. So, now the most praised knowledge is the scientific one, which allows us to dominate and deeply transform nature and matter. In fact, the truth of this knowledge relies on its power. From a formal point of view its validity is founded on both, the coherence with previously accepted knowledge and the possibility of verifying every prediction.
Under the scientific eye everything can be manipulated as an object over which it is possible to carry as much experiments as necessary in order to selecting and quantifying relations and properties considered outstanding. The result of the scientific research is a description of the phenomenon formulated as a set of rules or a theory, system, law or mechanism. Technology applies itself to use this abstract knowledge –in an efficient way– to produce all sorts of goods, artifacts and techniques devoted to increase some specific power or to open up new opportunities.
Perhaps the main characteristic of the technological enterprise is that it cannot conceive a stable position, not to mention a final one. The main principle is to look always ahead, because it is always possible to perform something faster, smaller, bigger, easier, stronger or more sophisticated. The best is just a promise waiting for us somewhere in the future.

3. The experience frame

In the Preface of his book[4] the American social philosopher Lewis Mumford wrote,
"Furthermore, in defiance of contemporary dogma, they [his books] did not regard scientific discovery and technological invention as the sole object of human existence; for I have taken life itself to be the primary phenomenon, and creativity, rather than the 'conquest of nature', as the ultimate criterion of man's biological and cultural success."
The rationalist approach to knowledge is not the only one, nor is always the fittest everywhere. Other perspectives are and have been alive inside and outside Western culture. By considering the pattern established by modern science, we find that men and women have created and developed non-scientific ways of knowing where coherence, sense, harmony and adaptation take the role of verification, model, efficiency and control respectively. In these softer choices of knowledge it is common that people pay special attention to aesthetics. Also, they often look for establishing links with some aspects of

their social or spiritual life. So, commitment and respect –to nature, community or tradition– appears where science puts self-explaining theories and systems.
In this frame, cultivation is more relevant than invention. The latter points to something standing outside of the inventor, as a final product of his or her ingenuity. The former expresses growing, a calm but continuous process of learning where someone is at the same time the learner and also part of what is learnt. Artisans, poets and artists are good examples; they labor to create something using what they know by experience, or strive to show in a work of art what they just know by intuition.

4. Final remarks

In many places around the world, the experimentation frame exists side by side with the experience frame. But this proximity does not mean a living together, because this is not a balanced relation. Technoscience is growing every day and its –many times undesired– effects extend without ceremony everywhere. This powerful expansion often damages, or finally destroys, human practices or activities neither able nor interested in competing against it. It is easy to understand that because of this ruthless behaviour, violence appears in some people or groups as the only possible reply.
Ends and means are equally important; in a harmonious life both should always be rational and reasonable enough.[5] Nevertheless, our main necessities as human beings point to ends, not to means. This signifies that human life –in fact, any form of life–, is quite different from a technical problem. On the one hand technoscience is among us, there is no way back. On the other we have and must take the choice to put it at our service.

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BETWEEN ORAL HISTORY AND ICT: CREATING NEW SPACES FOR SOCIAL CHANGE IN GHANA

Dr. Christine Müller
Institute of Global Society Studies, University of Bielefeld, Germany. anett797@compuserve.de

Abstract
The article examines the relationship between two forms of communication: oral history and ICT. Both forms generate new structures of knowledge production and are constitutive for the dynamics of societal knowledge repertoire in Ghana today. The actors creating these dynamics are women's organisations and networks trying to act and react in a changing social environment. They have established social and virtual spaces for politicising knowledge aimed at transforming the knowledge order as well as political institutions along the local-global scale on interaction. The two features of "communicability" and

"explication" of knowledge are significant indicators for the gradual transition of a Southern country to a knowledge society.

Introduction: Glo*c*alisation, Knowledge and Communication

Academic debates on the emergence of knowledge societies have extensively focused on the transition in northern countries and have yet to include southern countries. According to Nico Stehr, the importance of a cross-cultural discussion concerning the nature of knowledge, the locations of knowledge production, and the control of knowledge lies in the insight that " (…) knowledge is not only the key to the secrets of nature and society, but the key towards the becoming of the world" (2003: 22). One common characteristic of knowledge societies is the fact that a growing part of societal room of manoeuvre and of results of agencies is driven and governed by knowledge (Stehr, 2003: 19). Empirical evidence in multiple sub-disciplines of sociology indicate that knowledge is one or even *the* major factor for contemporary societal change.

When conceptualising knowledge as a dynamic social process between actors, its new frame of reference lies in processes of globalisation and the new configuration in which knowledge is produced and generated: local and translocal. The interplay and communicative connections between localities constitute "glo*c*alisation" (Robertson, 1995: 26). These connections are opened by and continue to open social and virtual spaces for the building up of new knowledge repertoires. The actors I refer to are women's groups and women's organisations in Ghana, who have formed an "epistemic culture" at local, regional and even national level which extends beyond being connected with the interactive social and electronically supported World Wide Women's Web. The common aim is to bring about social change through politicising knowledge. The establishment of this local-global framework took place over the last 25 years, during and in the aftermath of the four World Conferences on Women. Using different and multiple forms of communication emerging as a necessity for bridging distances, borders and in connecting localities as well as in connecting the electronically "connected" with the "unconnected" those living in rural parts of Ghana who do not have direct contact to new communication media. My intention is to show how multiple forms of communication co-exist. I argue on the basis of plurality and complementarity of communicative media indicating the existence of "multiple modernities" within one region.

Narrating the Past – Shaping the Future

Oral history is a practice of remembering its own past in the presence. In present Ghana, history is actively embedded by women's groups in a process of "reflexive modernisation" (Lash, 1994: 113-115): by reflecting and acting on social constrains women groups refer to, reconstruct and include historical aspects in their discursive and strategic struggle for expanding their room of manoeuvre from the private to the public sphere. The core of struggle is to (re-)gain social and political power, which women have lost in post-colonial Ghana. At village, regional and national level, historical knowledge serves to claim for participation in political institutions. In new social spaces such as formal/informal meetings or forum women reflect on the decay of living conditions, critically examine the development of the modern (knowledge) system e.g. in agriculture or medicine, analyse the reasons for the "pathologies of modernity" (Habermas, 1981) and attribute it to their absence in powerful political institutions. In reference to the wisdom of the knowledgeable and well experienced old women in the family, younger women claim to be the keepers of knowledge and wisdom and use this identity for

claiming political participation. In their everyday life, they use their historical knowledge for re-defining long-gone social and symbolic practices and fill it with new elements of knowledge whether concerning environmental, social, economic or educational issues. New elements of knowledge also based on scientific research results circulate through individual mobility in-between social spaces and through networking with global women's health, peace and environmental movements. Practising "innovative history" contains four aspects: historical and scientific knowledge, reflection on everyday knowledge and active transformation of the social order of knowledge. These four aspects create along a meta-level *knowledge on knowledge*. History as a re-representation in real time becomes even more important in a globalised age, contributing towards shaping the social and cultural diversity of localities and the formation of knowledge repertoires.

Strategic Information Channelling between Worlds

Using the Internet as a medium for communication and as a strategic tool for development has attracted women's organisations, groups and movements world-wide. The expansion of the scope of communication geographically towards a global "communicative accessibility" (Luhmann, 1997) among women, serves not only to connect different local realities but to transcend the diversity of local realities onto a global sphere. Gilian Youngs termed this power of transcendence towards the global level "shared politics" (1999). Shared politics is the active sharing of local realities at a global level meaning that people in Ghana know what is of concern for women living in other parts of the world.

Electronic networks not only distribute power, but enable new forms of power, constituting the double feature of the electronic space as "cyber-segmentation" (Sassen, 2000: 144). The network WiLDAF (Women in Law and Development Africa) uses ICT for distributing up-to-date newsletters, for emergency letters or for mobilization and extends beyond Africa in terms of common petitions addressing international development organisations (IMF, World Bank) and their specific interventions into national politics. The use of the Internet becomes in a political struggle over "conflicting views" (Sassen, 2000: 163) an expression of resistance, empowering women to act and react on external interventions. In its core, the electronic space is used for the defence, maintenance and security of the local lifeworld by combining the two processes of 1. strategic linking and 2. the links of strategies. The "disembedded", "deterritorialised" global sphere emphasises and empowers local actions. Many virtual actions like *www.womenaction.org*, *www.femmeafric.org*, *www.flamme.org* are well documented in the book *Women@Internet* (Harcourt, 1999) drawing our attention to the growing importance of virtuality as a new condition for defending localities in a global arena.

Conclusion: Belonging to Multiple Spaces of Knowledge Production

The current societal knowledge repertoire in Ghana is composed of different sources, which do not stand in isolation but are connected along multiple internal and internal-external relations. Three key elements form the societal knowledge content: historical, scientific knowledge and "informational" knowledge. Individuals now belong to multiple social and virtual spaces. More important: the new feature of societal "explication" and "communicability" on knowledge in the public makes knowledge a current relevant factor for social change and speeds up the emergence of this particular knowledge society through having the power of establishing a second order knowledge. Articulation and politicising knowledge enhances the growing control over one's own resources of

knowledge. The sites of knowledge production will remain context-dependent, therefore keeping and maintaining cultural diversity; making one's own knowledge potentials even more independent on external knowledge and interventions.
"Explication" and "communicability" of knowledge are sustained by two forms of communication: Oral History and ICT. The specific difference are:

Oral History	**ICT**
Limited scope: local audience	Unlimited scope: global audience
Communicative focus on local life-world	Communicative focus on glocal life-world
Microcosm, limited personal mobility	Macrocosm, global mobilisation
Context-specific (language)	Context-independent (language)
Subject dependence	Technical dependence

The composition of knowledge and relation thereof refer to a pluralistic pattern of internal and internal-external relations. As researchers we have to deal *not with one or the other, but with one as well as the other*.
Coming to the overall topic of this conference of scientific knowledge and cultural diversity we can conclude that cultural diversity remains exclusive through its existence in a process of globalisation. Exclusiveness not as a cut-off product, but as exclusiveness through interwovenness. Fluid integration between scientific and local knowledge via mutual learning processes remains a challenge. Theoretically we must follow an agency and process-oriented approach for understanding the dynamics of knowledge repertoires in a locality. Practically, as outside researchers we can follow the manifest of Kwasi Prah who suggested that: "*First we have to learn to look at ourselves, hear others about ourselves, and above all, allow others to speak for themselves*" (Prah, 1997: 444-445).

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MAKING SENSE: COMMUNICATION THROUGH ENGAGEMENT

Peter Thomsen

Menzies School of Health Research and Cooperative Research Centre for Aboriginal Health.
Audiovisal Unit Manager, MSHR/CRCAH, PO box 41096, Casuarina NT 0810 Australia.
Phone: +61 8 8922 8196, petert@menzies.edu.au

Key words: Native knowledge, culture and communication

Text

As an Aboriginal man involved in the research industry in Australia and in communicating research findings, I have a keen appreciation of why research has such a bad name among my Indigenous brothers and sisters around the world.
We've been objects of research and not participants and so researchers rarely appreciate what they can learn from us.
They don't give us feedback because they're not really engaged with us in the first place.
I set up a video production unit at a prestige health research unit in Northern Australia to try and correct this problem because video is a good medium for telling stories and I know that's how our people learn.
We start learning from a very early age to use our senses to make sense of the world.
The story telling part has always worked because I know how to do it.
I always try to use local Indigenous people as my video crew to build on skills they already have and get them involved in telling the story.
That means they tell it their way.
I want researchers to go further than just using video.
I want them to understand that they need to approach Aboriginal people as potential partners and then as people who are in a position to exchange knowledge about the particular problems that interest the researcher.
We need to promote respect for Indigenous intellectual traditions and respect for Indigenous ways of doing things.
And we need to promote the idea that research is about exchange and development for all the people involved.
For me, research is not a product and communicating knowledge from research isn't about selling a product.
It's all a process of engagement.
In Aboriginal terms, people belong to groups and they have to collaborate for survival or they die. This is still an expectation among Aboriginal people from all kinds of social and cultural environments today - remote, urban, rural. Individual action, without reference to others, was virtually unknown. People understood that survival needs collaboration and cooperation.
In our terms, people who do research do it on their own. They gather skills and knowledge which they claim to own and which they don't necessarily share. They have control over their domain – a wealth of knowledge and experience, kudos, the ability to attract funds for projects. These help them survive and prosper in the academic world. They don't always help them negotiate their way successfully through the Aboriginal worlds, though.

Aboriginal people's experience of research reflects these cultural differences. I've seen two ways of doing research. You can call them good and bad, positive and negative or whatever opposites you can think of. But they boil down to:

- on the one side, a collective, inclusive and collaborative approach that is directed and managed by the Aboriginal people involved in and affected by the research; and
- on the other the individual-centred, exclusive approach that is driven by the needs of the researcher.

But 'research' isn't a value: it's a series of processes and activities. And because it involves people, it needs to engage people and accommodate them. When you're gathering new knowledge from among people of a different culture – doing 'research', then you need to make sure it is useful, it can give people knowledge and insights and generally add to the human story that we all share.

In the process of thinking these things through, I began to think about how researchers approached people in communities and how they left them at the end of the research process. The researcher-oriented approach seems to have involved people coming in with their minds made up about what *they* want to do, and their objective is to talk Aboriginal people round to seeing things their way and agree to their agenda and their timeframe. This approach is called '***consultation***'. But consultation doesn't mean much to Aboriginal people. Because it means you, the researcher or government official or businessman, doing what you wanted to do in the first place. It means leaving little room for people to tell their stories. It's not about communicating in an appropriate way. And the appropriate way is ***negotiation***.

People 'consulting' might also bring printed material to support their argument - brochures, pamphlets, posters etc – which they're familiar with and which they might use to tell their story to a non-Indigenous audience. That audience is familiar with, and comfortable with, the idea that you absorb information through bits of paper.

There is a place for printed material, sure. But it's probably a waste of time if people can't speak or read formal English, which is the way researchers try to transmit project information. For most Aboriginal people the oral tradition is what still counts.

Part of the blackfella way of doing things is to sit down and talk: people develop stories to identify problems, discuss courses of action and negotiate agreement on what needs to be done. Everyone gets heard, no matter how long it takes. Aboriginal people have is a rich oral tradition – a way of negotiating information by talking it through until everyone has had a say and everyone's satisfied.

What matters is the story (the research agenda): how the team can develop it, how it incorporates other people's stories and how you reach agreement over all the detail. You can't do any of this without having a real relationship that blurs the distinction between 'researchers' and the 'researched'.

My experience of working with researchers has had its share of ups and downs. The really basic questions still keep cropping up, like:

- Who gets empowered?
- Whose skills get developed?
- Who owns and manages the process?
- What happens to the information – does it get taken away for good or does it come back?
- Who gets the accolades?

LOCAL KNOWLEDGE/GLOBAL SCIENCE?: CHALLENGES TO WESTERN GEOGRAPHIES OF EXPERTISE

Annette Watson
Geography Department, University of Minnesota

Abstract
Whereas the natural sciences typically maintain a divide between 'experts' and 'amateurs,' some scholars argue that this divide discounts local and indigenous peoples who contribute to Western environmental knowledge, but whose legitimacy the professionalization of science has erased. This globalization of science ultimately threatens local decision-making power over land use and economic development, with the 'experts' informing policy located far away from the places where the data was gathered yet immediately affected by the decisions. However, with the increasing recognition of the validity of Indigenous Knowledges, what is happening is more than a policy shift that incorporates native knowledge into the science. Guided by geographic theories of scale,
I suggest in this paper that there is a change in the very definition of expertise and the structures of environmental management, forwarding a compelling political as well as epistemological challenge to Western positivism.

NUCLEAR ENERGY IN RUSSIAN CIRCUMPOLAR NORTH. ASPECTS OF PUBLIC COMMUNICATION OF SCIENCE AND TECHNOLOGY

Efremenko Dmitry
International Independent University of Environmental and Political Sciences, Moscow, Russia

Abstract
The development of nuclear energy in Arctic can be considered as a great challenge for local societies and highly vulnerable circumpolar nature. Taking into account historical roots of industrial and technological activity on the Russian Far North special attention should be paid to the analysis of political, technological, social, cultural and environmental concerns of local population.

Text

The main objectives of the paper are:

- to provide interim results of the case study on public involvement in technological and environmental decision-making in the field of Peaceful Atom' in Russian Arctic (Murmansk / Kola and Bilibino/Chukotka nuclear power plants);
- to highlight complex interconnections between technological activity and social, cultural and environmental problems in the mentionned regions of Russian Arctic,
- to clarify influences of technological activity in the field of nuclear energy and its social consequences on the practices and lives of indigenous peoples (Chukotka/ Bilibino);
- to evaluate existing strategies of public communication and participation in technological and environmental governance.

The methodology of the paper is a historical analysis based on a systematic qualitative approach and reviewing existed literature. Content analysis of relevant publications in

media, and interviews aimed at the specification of both communications between science & engineering community and general public, and expression of public attitudes are also used as complimentary methods.
Although the paper highlights the results of the work-in-progress, interim conclusions will be made. By analyzing the aspects of PCST in connection with the development of the 'peaceful Atom' in Russian Arctic it will be possible to reach a more comprehensive insight of the national PCST landscape, and to indicate prospective strategies in governance of science and technology in the region. The failure of some existed strategies of communication, especially with indigenious population, makes it necessary to implement alternative strategies and practices.

THE VALUE OF IDIGENIOUS KNOWLEDGE AND ITS RELATION TO MORDEN SCIENCE

Nonceba Shoba

Albany Museum, Somerset Street, Grahamstown. Eastern Cape, South Africa

Abstract

Indigenous knowledge or Traditional knowledge is very important in it's context. Science has been practiced by various cultural groups long before modern technology was introduced. This we can gather from story telling, materials and performance. Native knowledge is a metaphor for what happens when humans experience and participate with the natural world. This incorporates knowledge of ecosystem relationships and code of ethics governing appropriate use of the environment. The people possess ecological knowledge that is traditional in nature and depend extensively on this knowledge for maintaining their relationship with animals and providing food from their families. This is all gained from experience. Then natural laws are put in place. Native knowledge is not static hence modern science. Native knowledge has sacredness, livingness and soul to the world. This all been stored and passed on to generations by elders who are keepers of this native knowledge. This also helps the sustenance and survival of the cultural identity. Native knowledge is also evolving and new knowledge is generated from the traditional knowledge hence modern science. Contemporary scientific knowledge denies the relevance of traditional knowledge and sees this knowledge as a means of denoting all that they know imposes a way of life on them that is shackled to the past and does not allow them to change. If this kind of knowledge can be used as a foundation to modern science in schools understanding of scientific concepts will be much easier as spontaneous knowledge is recognized. If spontaneous knowledge can be recognized this will inform and give new meaning and value to traditional and experimental knowledge. The richness and complexity of local knowledge systems derive principally from the fact that they incorporate, and are often the resolution of two very different world views. Therefore researchers cannot exclude any component of traditional knowledge when dealing with modern science. Modern Scientists or researchers just have to acknowledge whatever they incorporate from the past into the present.

INNOVATIVE CULTURE IN THE SCIENCE AND TECHNOLOGY SYSTEM: THE MIXTURE OF KNOWLEDGE AND CULTURE

Eduardo Bueno Campos
University Institute of Business Administration (IADE)

Abstract
In the beginning of the 21st century has returned the old discussion about the role of culture within the relationships between science, technology and culture. The idea of the wide gap between science and humanities (Snow, 1963) has been followed by those who deny the social nature of science. Therefore, it is necessary to develop a scientific theory of culture (Malinowsky, 1970) shaped by the idea that knowledge is mixture. It is clear that science has existed as long as society has existed. According to Popper (1962) science involve proposing hypotheses and finding evidence to contradict predictions made from them. Due to these it is convenient to study the notion of innovative culture as a mixture of scientific and humanistic knowledge. In this process, culture is the key factor that defines the economic and social value of knowledge. In this sense, it might be convenient to remember the affirmation of Gell-Mann, Nobel in Physics in 1969 for his discovery of the quark -particle of the atom which forms all the other particles- when he indicates that still nowadays the tension between the universality dreamed by the Illustration and the necessity to preserve the cultural diversity persists. Such cultural diversity is in itself a valuable inheritance that would have to be preserved. In short, to preserve the cultural diversity must be compatible with the understanding of the scientific knowledge. For this reason, our proposal of culture, in its taxonomy "innovative", attempts to improve the understanding of the different agents involved in the "Tech-Net Age", so that relations between concepts such as simple and complex, or individual and universal might be conciliated.
In our paper we will study as well the cultural and cognitive processes of towns such as Barcelona, Toledo, London, Istanbul, New York, San Francisco, etc characterized at best by its identities in a time of rapid progress.

DEVELOPMENT OF COMMUNICATION CHANNELS IN INDIAN MEDICINE

Ramesh Kundra
National Institute of Science, Technology and Development Studies. New Delhi (Nistads)

Abstract
Medicine has always been a significant part of the Indian heritage. Flourishing about 2000 BC, the architectural design of Harappa does point to a conscious concern for public health and sanitation. The Atharvaveda was probably the first repository of ancient Indian medical lore and these were later transmitted through the Brahmana texts. It was magico-religious in nature in nature and incantations (mantras) were frequently resorted to. Ayurveda as 'the science of (living to a ripe) age', sans mantra, appeared around Buddha's time.. The concept of humorous or doshas which is central in Ayurveda, is nowhere seen in the Vedic literature. Nor it does reflect Hippocratic or Galenic thinking. The protagonists of this system may have been inaccurate in their knowledge of human physiology but they were extremely good at plant morphology, its medical functions and therapeutics. On the other hand Charaka and Sushruta placed emphasis on direct observation. But unfortunately their texts and later commentaries have no anatomical or surgical illustrations. It is difficult to see how such techniques as rhinoplasty could have persisted purely textually. In any case Ayurveda remained a living and fertile area of research and interpretations. The scenario became even more interesting with the introduction of Galenic traditions by the Islamic medical men. Gradually appeared the a hybrid Muslim-Hindu system known as the Tibb.

They differed in theory, but in practice both traditions seem to have treated and borrowed from each other. History books galore with examples of their close connections.

These system of medical practice never received the due place in society (even till date) especially in society were it originated for many reasons. Historians have discussed some of these. Their main concerns have been the highly divisive caste system very peculiar to South Asian society, the combination of caste and faith, ruinous separation of theory from practice, of mental work In the practice the blowing heavy wind of taqlid (tradition) and the dimming of the lamp of wisdom… the door of "how" and "why" has been closed and questioning and enquiry have deemed fruitless and tantamount to paganism. On the other hand when modern medicine entered the new lands riding the colonial wave they over took these traditional system in less than one and half decades. Apart from developing professionalism the Western medical discourse occupied an extremely important place in the colonization of India.
Taking the clue from Charak Samhita the western medical practioners organized periodically conferences and meetings. They not only met at time of medical calamity but on regular basis academic and scientific gatherings of scholars and thinkers took place. This paper traces the advent of Western medical science and its strong communication channels in India. It analysis the strong institutional roots in the development of medical societies, journals and academic institutions so to overtake the traditional medical practices. It is argued that through these strong communication channels the western medical knowledge tried to bypass the strong Indian medical practices that existed for more that 2000 years. How effective has been the borrowed knowledge is question that requires an answer.

Parallel session 3

Contributions and challenges of cultural diversity in public communication of science

TRANSFER OF SCIENTIFIC INFORMATION FROM ENGLISH INTO SPANISH

Sílvia Coll[1] *and Patrícia Paladini Adell*[2]

[1]Observatori de la Comunicació Científica, Universitat Pompeu Fabra (OCC). Passeig Circumval·lació, 8, dept. 201, 08003 Barcelona. Tel: +34 93 542 2446, silviacoll@upf.edu

[2]Departament de Traducció i d'Interpretació. Universitat Autònoma de Barcelona. Edifici K, Campus de la UAB. 08193 Bellaterra. patricia.paladini.adell@menta.net

Abstract

Translation is sometimes considered as a process to transfer contents from a source language to a target language. It is widely known that it involves other processes that include knowledge of a cultures, society, policies, etc. Therefore translation is another way of communication. Medical translation is a specialty within this area that must be also considered from the point of view of science communication. Translators have to take important decisions when translating medical-related texts, such as the selection of words that scientists, journalists, teachers or other science communicators will use in their daily activity; the use of structures that belong to the common target language; the translation from a culture to another one.

To follow the evolution in the Spanish medical discourse when the information comes from English sources; to detect the possible changes that have cultural and social implications.

This study shows how the information from journals is transformed until its publication in the Spanish general newspapers. Corpora includes articles from *Nature*, press releases and news items from Spanish newspapers about stem cells. The analysed aspects are basically the selection of the terminology and discourse related to social and cultural aspects.

Key words: medical discourse, translation, newspapers.

Text

Introduction

When newspapers publish medical news, they usually use as sources press releases (e.g. *Nature*, *Science*, *The Lancet*), news agencies, sometimes as a secondary source (EFE, Reuters), and the original paper published in several journals. When it comes to publish the news in Spanish newspapers, the original information in English included in the journal can suffer some modifications during the translation process (terminology, register, structure, etc.). They may eventually lead to conceptual errors. Articles analysed in this study tackle the topic of stem cells that is increasingly present in the newspapers due to its health implications for the society.

Objectives

This proposal aims to analyse the translation process followed by ideal medical specialized journalists (physician, journalist, translator, etc.) from the original article to the published news item.

Method

To create the corpus for this project a press release from Nature and a series of related articles published in different Spanish newspapers have been selected: *El Periódico, ABC, El Mundo*, Europa Press, *La Razón, Diario de Sevilla, La Voz de Asturias, Córdoba* and *Diario Médico*. The last title from the list is not a general newspaper, but a publication addressed to the medical community. *Diario Médico* has been considered a second source of information to better understand the contents of the original paper from Nature.
The analysis has been performed on a comparative basis, focusing on the following aspects of the discourse:

- Terminology: parameters to describe each aspect are specialized, general
- Register
- Structure

All articles were published on December 10th and 11th, 2003 in their corresponding sections: *sociedad* or *salud*.

Results

According to the three aspects considered for the analysis, the main results were as follows:
El Periódico used a popularising discourse, including strategies to help the reader to understand concepts such amplification, that is the addition of more signifiers to cover semantic gaps [(e.g. *células reproductivas* (*óvulos y espermatozoides*)].
There are other aspects revealing the intervention of other voices, which were not in the original paper such as quotations. As for terminology, it is not highly specialized. The author of the article uses words used in everyday language (e.g. *típica cola*, referring to flagellum or *hembras*, referring to the female mice). Europa Press, a news server that issued an article from the abstract of the original English article, used a more accurate terminology, although it included some calques (e.g. continuously growing lines as *línea continuamente creciente*). It must be highlighted that this news server has a section entitled *salud* (health) differently from the other publications that include this kind of news in *Sociedad*. *La Voz de Asturias* and *Córdoba* used the same source as *El Periódico*.

They only showed minor differences which are not relevant for the analysis. *El Mundo, La Razón* and *Diario de Sevilla* used also the same source of information. The most remarkable difference among them is that *La Razón* used a discourse closer to a general public (e. g. *rizar el rizo*). In the *ABC*, the lack of specialized terminology was the main feature. The article seems to be a summary of the abstract of the original paper. In order to simplify a concept that could be hard to understand, it reduces the whole explanation in a few empty words (e.g. *mediante un complejo proceso*).
It must be pointed out that some terminology mistakes were found during the analysis. The source of these errors should be studied from the process of transformation of the information taking also into account translation aspects.

Conclusions
This preliminary study is a first approach to an analysis of the process that an original article suffers from its publication in a journal to its appearance in the general press. In order to carry out this proposal of analysis, the criteria must be more accurately defined. According to the aspects considered previously, we consider there is a huge field of analysis that could be done to better understand this process.

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CHALLENGING REASON: HOW DO YOU COMMUNICATE SCIENCE IN A MAGIC COUNTRY LIKE MEXICO?

Carlos Chimal
Freelance writer at the Center of Research and Advanced Studies, Physics Department, CINVESTAV, CP 07300, Mexico, 74174@terra.com.mx

Abstract
How can a scientific culture be fostered in a land possessed by figments of the imagination, an ancient, multicultural nation immersed in the animistic, prelogical thinking? What should a novelist do if he wants to promote an idea of progress in the society in which he lives? Perhaps the rationale that guides him is that having a certain level of democratic life is not enough to guarantee the existence of a new scientific culture.

Key words: multiculturalism, scientific illiteracy.

Text
In *The Magic Mountain*, Thomas Mann introduces a strange character, Leon Naphta, who runs up against Settembrini, an advocate of the Enlightenment and a member of an "international league to organize progress." Naphta is a Jewish convert who later enters the Jesuit Order. Naphta does not believe in progress, peace or humanitarian action. In his messianic frenzy, he preaches the virtues of illiteracy. Against "western" ideals, professes a passivity that he himself describes as "oriental". A sort of terrorist mission aiming to restore a pre-modern world where work had a virtuous value and action was only the

prelude to contemplation. A world in which all that mattered was fate, a world remote from the "satanic kingdom of money and its business".

Today, like Naphta, Mexico is experiencing a vulgar materialism. Faith is the organ of knowledge, although the immense majority of young people, both in the cities and in rural areas, do not seem to believe in anything special, and they devour everything with parsimony and implacable speed. When we walk on the surface of volcanic soil, we seem to hear the moans of the rocks on which we tread and we try to apologize for our impertinence.

Mexico was a multicultural country even before the arrival of the Spaniards. Many centuries ago the people of Mesoamerica were trading with the locals who already inhabited the southeastern coasts. The cultural shock with Europe in the XVI Century produced contradictory sentiments both in the peninsula and in the new colonies regarding the role of the intellect. The new American culture dedicated itself to the reivindication of scholasticism, seeking to see Copernicus fall, vanquished by Ptolemy. Today, this can still be seen, for example, in the State of Oaxaca, a region in fourth place in the world in biodiversity, where 16 different ethnicities still live, each with its own language; some of their members also speak Spanish. Nevertheless, Oaxaca is one of the poorest, most backward states in the country, and the emigration of its Mixtecan Indians in search of the American dream is one of the most numerous in recent decades.

Anyone who is concerned about the perception citizens may have of science and technology, such as those who themselves are the communicators, should also know the settings in which these disciplines are conceived. Without an orderly understanding of humanity's social history and its cultural and religious manifestations, it is useless to try to communicate scientific knowledge. It is the best way to expose the bridges for communicating with the public to the corrosive agent of twisted meanings and semi-ignorance. As we all know well, in that case it is better to be completely ignorant. That is why I launched into the adventure of clarifying substance in a highly surrealistic country where prelogical thinking predominates. I must confess that from the beginning, I knew that writing about science for the most influential media in the country would hardly be enough to ensure the application of a code of values in my works or those of anyone else. Fortunately, the opening experienced by Mexico at the end of the 1980's, following the irrational repression in 1968 and 1971, allowed me to establish a code based on more profound, impersonal issues that have to do with the manner of approaching a scientific topic, beyond just wanting to explain a disease or in order to entertain those who can understand the strange, noble ideas that are derived from the discoveries of science.

Thus, I did what many years later Bruno Latour and Steve Woolgar would call "lab life". I had to study every scientific subject in order to be able to go back to the researchers to ask questions that would not only be relevant but truly profound, seeking to achieve the "difficult simplicity" to which St. John of the Cross and many other writers have aspired in practicing the literary craft, always directed towards an audience.

It is said that a society that does not produce much science cannot communicate it well. What matters to us is not cosmetic and corporatist bias but encouraging the consolidation of a scientific culture. Not only because we are curious human beings, but also because some of the most interesting ideas and most stimulating findings have to do with science. Even for reasons of survival. Democracy by itself is not a guarantee of anything; it must proceed very quickly to become a meritocracy so that the social order will not be broken, and so the Naphtas of today will not have arguments for thinking that science is a faith,

just like the rest, although stupider and more evil than any other. As the physicist Jorge Wagensberg said, "Eating and learning go hand-in-hand, not one ahead of the other." So, if we want there to be wider, more alert communication capable of building the bridge, the first thing there must be is an historical stimulus for scientific research, and even more so for education, and the rest will follow, as the Bible says.

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MISUSE OF SCIENCE IN ADVERTISING

Ricard Guerrero,[1] Mercè Piqueras[2] and Carmen Chica[3]

[1] Department of Microbiology. University of Barcelona, Av. Diagonal, 645, E-08028 Barcelona, Spain. guerrero@iecat.net

[2] Catalan Association for Science Communication. Centre Internacional de Premsa, Rambla de Catalunya, 10 1r, E-08007 Barcelona, Spain. mpiq@retemail.es

[3] Catalan Foundation for Research. Pg. Lluís Companys, 23. E-08010 Barcelona, Spain. carmen.chica@fcr.es

Abstract

Many companies use science to bias the opinion of consumers regarding their products. They take advantage of the poor scientific and technological knowledge of the population for their benefit. We analyzed several cases: *a)* Medical products and methods (advertisements and articles in a monthly magazine distributed with a newspaper). *b)* Dairy desserts based on yogurt pasteurized after fermentation (advertisements and scientific articles). *c)* Products of technology (advertisements in newspapers and brochures). *d)* A distorted image of scientists.

Key words: advertising, science and technology misuse, public perception of science.

Text

Companies may misuse science and technology in different ways to reach their objectives. They can disguise advertisements in the shape of a scientific text; show properties that the products advertised do not have; and emphasize what are the usual properties of products of the same kind. We will comment on several cases we analyzed.

a) Medical products and methods

Salud & Vida (Health & life) is a monthly magazine distributed with *La Vanguardia*, a newspaper of wide distribution in Catalonia. It comprises several sections including "Currently", "Health-prevention", "The doctor informs you", "Health leisure", "Dietary issues", "Welfare-fitness", "Welfare-beauty", "Welfare-tips" and "Flashes". We analyzed four 2003 issues, of which, full-page advertisements were a mean 22.59% of the total number of pages of the magazine. Each issue included also several half-page or a-quarter-page advertisements. The products advertised were related mostly to beauty; they included dentistry (whitening of teeth), spa, body shapers, plastic surgery and weight control. The "Currently" section, along with some health tips and news items, comprises also advertisements disguised as news. Even more, the section "The doctor informs you"

is always an advertisement of some health center, and other sections hide often also advertisements under the shape of information articles.
In the 1990s, *La Vanguardia* used to publish a weekly magazine on science of great quality, and later it published also one on medicine. Those publications were useful tools to improve the public understanding of science. On the contrary, *Salud & Vida* is a kind of catalog of products that apparently improve our health or help us to be in good shape and it advertises therapies that do not have a scientific basis.

b) Dairy desserts based on yogurt pasteurized after fermentation
Although many studies have reported that probiotic effects of yogurt are due to the presence of live bacteria, some companies started marketing pasteurized yogurt claiming that their products had the same qualities as non-pasteurized yogurt. They disregard the standards approved by the FAO and WHO Codex Alimentarius Commission regarding the nomenclature of yogurt subjected to pasteurization. In addition, they disregard the opinions of experts, and they even fund research to find some results that might support their claim that the nutritional and probiotic properties of yogurt are the same in traditional yogurts that in those pasteurized. By definition of what yogurt is, the lactobacilli that ferment milk into yogurt must be alive in the final product. This is the reason why yogurt must be kept at low temperature. One of the biggest dairy Spanish companies, which produces that yogurt-derived desert, shows pasteurization as an added value for its products ("they do not need cold nor additives for preservation", "they keep the whole nutritious values of yogurt").
In the last times, that company has changed its advertising tactics: Instead of focusing their advertising campaigns on the beneficial effects of the so-called "pasteurized yogurt", now they insist in the prebiotic properties of other products, such as orange juice and soy drink, which they claim to promote growth of "good" bacteria that are already present in the intestines.

c) Products of technology
The terminology used to advertise products of technology such as computers, some appliances and cars is often incomprehensible to lay people. Some terms, expressions, as well as abbreviations and acronyms that we found in advertisements of cars were: TDI engine, a maximum torque of 320 Nm, Bi-zone climatronic, Tempomat cruise control, triptonic gear, ABS, SAFE, ASR, ESP. In computer's advertisements, along with familiar terms and acronyms such as DVD, CDROM, MP3, wireless, firewall, ethernet, we found others such as IEEE1394 port, WLAN, SmartMedia, VGA adapter, GPU, ATI Mobility Radeon, TFT screen, digital BBE processor, and DRC technology. The more incomprehensible the description of cars and computer are, the more advanced and updated they seem to be.
Lay people get the impression that technology is the province of an elite. They are not acquainted with those terms, but do not dare to tell that they see the emperor naked and to ask to have that jargon translated into a comprehensible language.

d) Scientists as evil intelligence
"We cannot accept that the lack of collaboration of researchers delays discoveries." That was the sentence at the top of a full-page advertisement in *La Vanguardia* (29 January 2004, p. 7) As a matter of fact, the advertisement was the announcement that drug makers Sanofi-Synthelabo and Aventis were planning to merge to become the largest European

pharmaceutical company. Placards in subway stations announced in spring 2003 a play station game whose name was written in tiny characters at the bottom of the advertisement. The text that most attracted the attention of the "metro" travelers stated: "If you think your baby is a little monster, wait until he or she grows up. If you knew that this baby would become a mad scientist able to create a lethal virus that would erase life from the Earth surface, what would you do?" Advertisements of these kinds convey a distorted image of scientists, who are seen as monsters capable of destroying the world with their inventions. This image makes it difficult that people realizes that scientists are neither better nor worse than other professionals are, and that society improves due to scientific and technologic development.

Conclusion

Scientific culture would enable people understand the real scope of science and to perceive when science is misused for business purposes.

CULTURAL DIVERSITY IN SCIENTIFIC COMMUNICATION: ENGLISH VS SPANISH MEDICAL RESEARCH PAPERS

Sonia Oliver del Olmo

Universitat Politècnica de Catalunya/Universitat Internacional de Catalunya. Departament de Projectes d'Enginyeria (Secció d'Anglès). ETSEIT. TR5. C/Colom, 11.08222 Terrassa (Barcelona).
Tel: 93 417 38 78/ 646 84 22 84, fax: 93 739 81 01, Sonia.Oliver@telefonica.net

Abstract

Some authors believe that there are considerable differences in styles of writing in particular cultures (e.g., see Mauranen 1993b) and, in fact, some others see non-native speakers fail to modulate their writing (Bloor & Bloor 1991 and Hyland 2001). The appropriate use of hedging in scientific discourse is a vital skill for writers presenting their knowledge in the discourse community, as it both qualifies categorical commitment and facilitates discussion with the audience. In our presentation we will examine this rhetorical device from a crossgeneric (Case Report/Research Paper) and a crosslinguistic (Spanish/English) point of view. The results of this study seem to indicate that hedging may vary across these two languages and cultures.

Key words: Scientific Communication, Cross Cultural Studies and Languages for Specific Purposes (LSP).

Text

Introduction

"Hedges are words or phrases whose job is to make things fuzzier" (Lakoff, 1972). The earliest definition of the term was by Lakoff in 1972 and since then many other authors have been studying this rhetorical phenomenon in different languages and genres (Salager-Meyer, 1994, and Piqué *et al.,* 2002, among others). However, after reviewing the literature available on the topic we have observed that most of the studies have been focused on the way scientific writers modulate their discourse in English. A possible explanation could be that nowadays there is a dominance of English in scientific research publications hence the need of non natives to publish in this language.

The aim of this study is to explore the hedging differences and similarities in medical RPs and CRs in English and Spanish. Therefore, in this paper I will examine the range of expressions that are commonly known as "hedging": expressions whose aim is either

i) to allow scientists to present their knowledge cautiously, *ii)* to be "vague", *iii)* to encourage dialogue with the audience or iv) to follow genre conventions.

Methodology

So as to achieve our goal a Spanish corpus of 20 RAs (Research Articles) was selected from six different Spanish medical journals: 10 original RP (Research Papers) and 10 CR (Case Reports). The articles were chosen from 6 outstanding medical journals in Spanish: *Archivos de Bronconeumología* and *Medicina Clínica*, among others. Our English L2 corpus consisted of 10RAs from outstanding journals such as, *British Medical Journal*, *Chest*…

As a second step in our study, we developed a hedging taxonomy in Spanish using Salager-Meyer's model (1994) as a starting point. Her taxonomy included: 1) Shields, such as "to appear", "to seem", "probably", "likely", "to suggest", "to speculate". 2) Approximators, for instance "approximately", "roughly", "somewhat", "often", "occasionally". 3) Author's personal doubt and direct involvement, for example "I believe", "to our knowledge". 4) Emotionally-charged intensifiers, as in "dishearteningly weak", "particularly encouraging".

5) Compound hedges, as "It may suggest that…", "It would seem somewhat unlikely that…". However, in our taxonomy we didn't include her fourth or fifth category but added a fourth category: Agentless strategies and we focused on a pragmatic rather than a lexical point of view (table 1).

Our data and results

After carrying out a crossgeneric and a crosslinguistic analysis of hedging, we have come up with the results we show in figure 1 (the percentage of hedging according to the section of the RAs or CRs they appear) and figure 2 (the frequency of hedging types in the total hedging scoring throughout the three different corpora).

Conclusions

According to our results Spanish and English scientists seem to modulate their writing differently as former tend to hedge much less and thus, may sound slightly more assertive than their Anglo-Saxon counterparts. However, we could relate this greater modulation of English scientists to a historically and culturally entrenched tradition founded on skepticism, doubt and refutation.

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Table 1. Hedging taxonomy proposal in Spanish

Categorías pragmáticas	**Funciones en el discurso**	**Ítems lingüísticos**	**Nivel lingüístico**
Escudos	El autor utiliza estas expresiones para protegerse y anticiparse a una posible reacción negativa *("boomerang effect")* por parte de la comunidad discursiva a la cual pertenece (Salager-Meyer, 1994)	1. a) verbos modales b) semi-auxiliares c) adjetivos de probabilidad d) adverbios de probabilidad e) verbos epistémicos	A) Léxico
Aproximadores	Se emplean para indicar probabilidad e implicar cierta "vaguedad" en las afirmaciones (Fortanet, Palmer y Posteguillo, 1998)	2. Adjetivos y/o Adverbios y locuciones adverbiales de: a) cantidad b) grado c) frecuencia d) tiempo	
Expresiones de duda personal e implicación directa del autor	Sirven para enfatizar la dimensión interpersonal: evaluar y valorar el propio material, así como para negociar el estatus de los postulados de uno (Ferrari, 2003)	a) condicional b) subjuntivo c) marcas de 1ª persona (posesivos, desinencias y pronombres)	B) Morfológico
Estrategias de desagentivación	1) Sirven para modificar e incluso esconder la actitud del escritor hacia las proposiciones presentadas en el texto. 2) Sirven para esconder quién es el responsable del valor de la verdad de lo que se está diciendo (Lewin, 1998)	Formas no personales* * Las formas no personales pertenecen al nivel morfológico pero su función es desagentivadora a) voz pasiva desagentivada y pasiva refleja b) despersonalización (verbos activos con sujetos inanimados y nominalizaciones)	C) Sintáctico

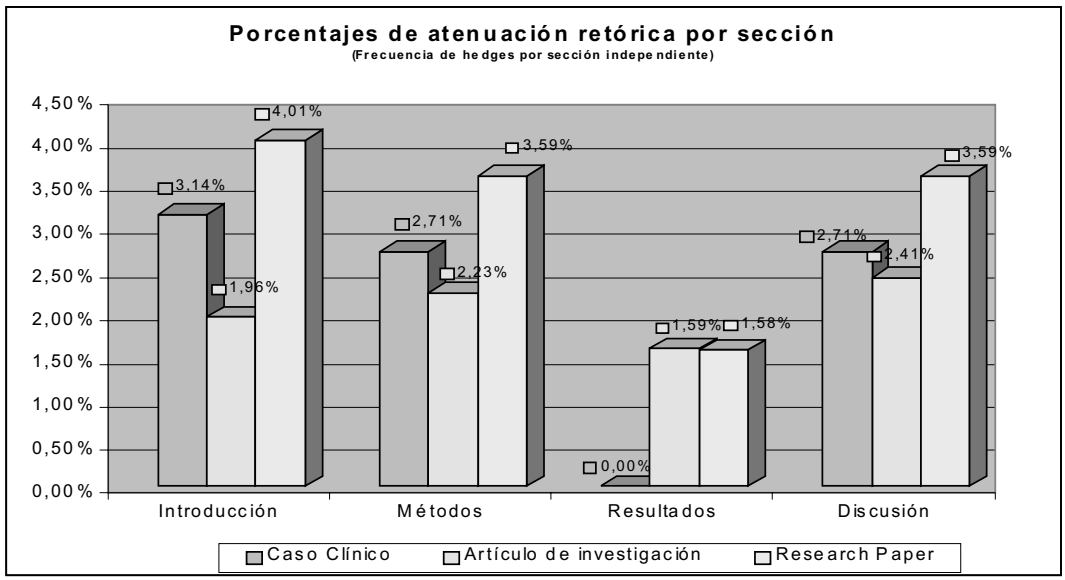

Figure 1 Percentage of hedging according to IMRD section

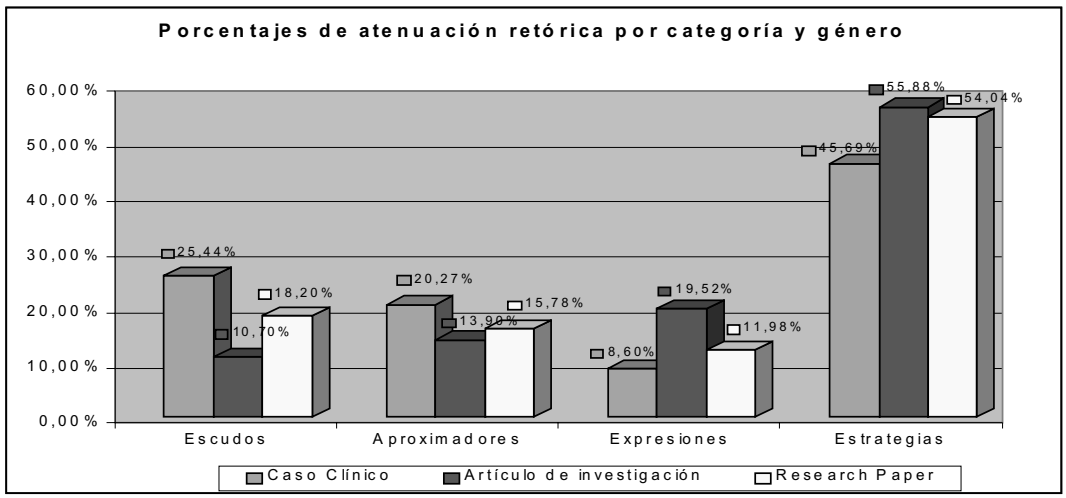

Figure 2 Frequency of hedging pragmatic categories according to genre (RP and CR) and language (English and Spanish)

DICYT: A PROPOSAL FOR REGIONAL SCIENCE COMMUNICATION

Marcelo Sabbatini,[1] Betania Maciel,[2] Ignacio Coll,[3] Pedro José Gómez López,[4] Ana Victoria Pérez Rodríguez,[5] Beatriz González Amandi[6] and Miguel Ángel Quintanilla[7]

[1,4,7] Instituto Universitario de Estudios de la Ciencia y la Tecnología – Universidad de Salamanca. Paseo de San Vicente, 81, 37007, Salamanca, Spain. Tel: +34 923 29 48 34, fax: +34 923 29 48 35, sabbatini@usal.es.

[2] Universidade Federal Rural de Pernambuco – Associação de Ensino Superior de Olinda Rua. Dom Manuel de Medeiros s/n, 52171-900, Recife, Brazil. Tel: +55 (81) 3302 1450, fax: +55 (81) 441 1711, betania_maciel@terra.com.br

[3,5,6] Agencia para la Difusión de la Ciencia y la Tecnología, Junta de Castilla y León. Paseo de San Vicente, 81, 37007, Salamanca, Spain. Tel: +34 923 29 48 34, fax: +34 923 29 48 35, coll@usal.es

Abstract

Based upon a theoretical framework of specialized and regional communication, we propose a regional oriented science communication model, in terms of purposes, media products and strategic actions, with the objective or reaching a more efficient representation of the local reality and a better public understanding of science. Applied to practice, we present DICYT (Regional Agency of Scientific and Technological Communication), whose main challenge is to promote scientific and technological culture in Castile and Leon, Spain, through the diffusion to local mass media of results of the scientific research and technological projects, both public and private, generated in the region.

Key words: communication, theoretical framework, cultural diversity.

Text

Regional communication: theoretical framework

What is the place for regional science and technology in the present globalized and impact and sensationalism driven mass media scene? In a study of the regional press in Castile and Leon, Sabbatini *et al.* (2004) found that there is an imbalance between major questions in science and technology, present in newspapers through editorial genres and through social problem and policy framings, and the information found in news, which theoretically should support such a public debate in an informed way. Scientific and technological news were found to be communicated mainly through short pieces of information, provided by international news agencies and resulting in an absence of contextualization, even opposing views of the same subject. So, what strategies could be used to harness a true regional science communication, one that could serve as a bridge between society and the science and technology system, in order to place the scientific knowledge at the heart of a region's development?

The DICYT proposal

In this context, we propose DICYT, Science and Technology Communication Agency, a part of Novatores Project, developed by Junta of Castile and Leon and Salamanca University (Quintanilla *et al.*, 2004) and whose objective is to create a Regional System for Science and Technology Communication, bringing science and technology activities closer to society and harnessing its social valuation.

As a communication agency, DICYT has as final users the mass communication media (radio, press, television), with special interest in those that carry out their activities in the region. To these clients, DICYT offers exclusive and ready to use information about science and technology related subjects in different genres (news, articles, interviews), completed with additional elements like infographics, video and audio clips.

Its main contribution to the region's public institutions and companies is to establish a reliable communication channel, with information being prepared by specialized science communicators, and being an agile method for communicating advances in the science and technology that the rest of the society should know.

Technical infrastructure and operation

The DICYT agency offers its services through a Web page (http://www.dicyt.com), with access granted only to users with a personal registration password: journalists in communication media and also to its many collaborators. The Internet platform has a double objective: by one side, to allow the agency's journalists and editors to have a content management tool, common to their labors. On the other hand, to allow clients quick and time-space independent access to news. In the future, information will reach each user through electronic mail, according to a profile with declared interests on subjects or spatial coverage. The platform has been developed as independent and own software, using free software technologies. For new production, the Agency counts on a network of correspondents, spread across 7 of the 9 region's provinces, besides Madrid. As a previous step in its establishment, a production manual was elaborated, covering style rules and the journalistic methodology and routines used. Dealing with specialized communication, it was also intended to have recommendations upon how effectively work with sources and process information, both necessary to explain, translate and rebuild scientific knowledge to a general audience. In the future, it is expected to have a set of recommendations and case studies related to the ethics of science and technology communication incorporated (Sabbatini, 2004).

First findings

Since the beginning of its operation in 18th December 2003, news agency DICYT has signed agreements with more than 20 regional communication media and has prepared more than 700 pieces of information, according to the following tables:

Table 1 Information pieces by genre

Type	Short News	News	Articles	Other	Total
Proportion	35%	50%	10%	5%	100%

Table 2 Pieces of information by geographical location

	Total
Ávila	40
Burgos	70
León	50
Palencia	35
Salamanca	150
Segovia	35
Soria	85
Valladolid	180
Zamora	50
Region Total	695
National and International	40
Total	**735**

Regarding the use of information supplied on behalf of its clients, DICYT is performing a follow up, with identification of news published in main newspapers. Although up to this moment there is no formal study, two main modes of news utilization have been detected. The first, concerning breakthrough and topical subjects are used the following day after publication in the agency's Web page; in second place, permanent interest subjects, like fight against cancer, astronomical and space exploration discoveries, are retrieved from the archive several weeks after release and are used as aid in the elaboration of special articles. Regarding geographical coverage, news related with the immediate surroundings, e.g. in the local and province scopes, have a greater chance of being reused, while national and international news are less frequent to be published.

Conclusions

In its future development, DICYT considers the possibility of expanding its services, for example, promoting Castile and Leon's science and technology institutions, as well as companies, in Spanish and international scopes. Another line of action, already tried out, is to prepare information under requests, in an exclusive way for a specific medium, trying to convey an original and rigorous approach to a subject. This later would have a financial cost, while the daily information service is free.

In conclusion, DICYT is taking the first steps in bringing science and technology closer to the regional media in Castile and Leon. Although there are still many barriers to surpass, mainly related with a lack of value's perception of this kind information, it is the cornerstone for developing innovative strategies, in order to create favourable conditions for a scientific and technological culture across society in its whole.

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Parallel session 4

Cultural identity implications in genomics research and communication

SCIENCE COMMUNICATION THROUGH SOCIALLY CONSTRUCTED MONOLOGUE

Anda Adamsone-Fiskovica

Centre for Science and Technology Studies, Latvian Academy of Sciences Akademijas laukums 1, Riga, LV-1524, Latvia. Phone: + 371 7220725, fax:+371 781, anda@lza.lv

Abstract

By applying 'social constructivist' and related 'public understanding of science' (PUS) perspective paper empirically examines the social construction and communication of the Latvian Genome project through media discourse analysis with emphasis of its underlying pattern of expert-lay relations. Major part of media coverage on this issue is occupied by technologically deterministic expert discourse leaving little room for lay people's narrative. Public interests are somewhat externally constructed via medical, national, economic, political and other rhetoric with yet only limited attempts made by other relevant social groups to modify and oppose those.

Key words: genome project, science communication, media discourse analysis, expert-lay divide.

Text

Context

Following the lead of many countries in regard to national gene pool exploration Latvia has recently initiated the population genome project anticipating to create national gene database for medical research as well as development of preventive and treatment measures. However, despite voiced promises of gene technology it is increasingly being subjected to critical assessment as to its implications for social realm. With its potential positive and negative consequences extending to various aspects of human life there is a need for wider involvement of society in the discussion and appraisal of these issues.

Objective

Building on the ideas of social constructivist perspective (Bijker, 1995, 1999; Pinch, Bijker, 1999; Gergen, 2000) this study aims to perform a qualitative media discourse analysis regarding the ideological basis and attributed meanings of this gene technology in printed media. By utilizing related concepts of the PUS research (Wynne, 1995; Gregory, Miller, 1998) this study also aims to detect the character of expert-lay relations within the framework of this science communication case.

Methodology

In line with constructivist perspective, through analysis of language used in a particular field of social practice, discourse analysis admits the existence of manifold realities and alternative perspectives with diverse underlying assumptions and values (Fairlough, 1995; Van Dijk, 1997; Lehtonen, 2000; Wetherell *et al*., 2001). Based on the notion that media are among prime agents involved in defining social reality and communicating science, media discourse analysis as one of general discourse categories and one form of public discourse was chosen as basis for studying social construction of this technology and interrelations of relevant social groups. Empirical data in the form of articles were obtained from a range of most widely distributed 11 national newspapers of Latvia covering period of time from January 1999 to February 2003.

Results

The media discourse analysis of the project points to a rather persistent dominance of the so-called public deficit model, which basically implies a monologue instead of a democratic dialogue with major part of contribution constituted of ideas voiced by project initiators and lack of strong alternative discourse by other relevant social groups. Lay people present a very low involvement with no special resources to influence the forming discourse while it is rather high to the genome project group involving various potentialities. By suppressing dominating latent interests of researchers these are being transformed into manifest universal values - advancement of national science, national self-respect and self-determination independent of foreign interests, contribution to economic prosperity of the country, future promises for healthcare, diverse control options over 'national property', nature, future, etc., thus redefining the problem and the meaning of technology in order to please groups that might not comply with its initial formulation. Project promoters acknowledge a need for discussion on the subject in a wider public while understanding it as a unidirectional – informative and educational – communication. The main stress is laid on the refutation of existing negative information instead of discussing the problematic aspects since the former is seen as created by unsubstantiated fears, lack of trust in novel developments, etc. It is not the new technology but the attitude that is considered problematic and alterable. Public is seen as a passive mass with no actual choice options given before launching a project with only some *post factum* options of discussion.

Conclusions

Media discourse analysis of the Latvian genome project let to categorize it as a complex discourse formed by a range of more specialized discourses – both dominating and subordinate ones. In this sense it is rather ample discussion of this technology with certain interpretative flexibility due to the range of meanings attributed to it beyond its strictly medical and biotechnological interpretation. Nevertheless, it is rather one-sided by

the dominant relevant social groups represented by experts trying to highlight mainly the benefits but not that much the accompanying disadvantages, risks and threats. Since the latter is less likely to be done by those directly involved in the project widening of the discussion area is essential through the development of civil society, increased public participation and making ones own choices. Alternative argumentation and views are important especially under current conditions when the particular technology has not yet reached its closure.

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TALKING WITH YOUNG PEOPLE ABOUT GENOMICS: NEW STRATEGIES FOR DEVELOPING A SCIENCE EXHIBITION

Maria Emilia Beyer

Dirección General de Divulgación de la Ciencia.Universidad Nacional Autónoma de México. Circuito Cultural Universitario s/n, Coyoacán, 04510, México City. Tel: +5255 56 22 73 36, fax: +5255 5665 46 52, mariaemi@servidor.unam.mx

Abstract

Mexican people deal with media information about genes, cloning, stem cells, etc. But how accurate is the information they get? And how can people integrate this information to their everyday knowledge? I analyzed the previous conceptual framework that young students (16-20 years old) have about genomics in order to promote significant relationships between a museum exhibition and the previous knowledge that they have about this topic.

The methodology involved a meeting with students at school. They were submitted to a survey to find out their conceptual frameworks concerning genomics. Data will serve as a guide for developing a science exhibition.

Key words: science exhibition, conceptual frameworks.

Text

Context

For the last decade scientific terms as "cloning", "gene therapy" and "transgenic" are available to people through the mass media. But how do people understand these words?

How do social constructions of genetics relate to media information? And how can the Science Museums use these conceptual frameworks to enhance communication with the public? During the elaboration of a guide for a genomics exhibit I was surrounded with this questions. Young students between 16 to 20 years old are the expected public for the exhibit. Therefore, I decided to ask them their opinions, conceptions and misconceptions about genetics.

Objective

This study will help to identify the previous ideas that Mexican students have about genomics in order to develop a guide for developing a science exhibition at Universum Museum.

Methods

100 male and female students between 16 and 20 years old were submitted to a 5 questions survey concerning genetic terms. After the application of the survey, students were exposed to a one-hour lecture and workshop with an expert. The answers are being analyzed and constitute the preliminary considerations for developing a science exhibit at Universum Science Museum.

Results

Some questions brought to light interesting and surprising misconceptions that show the confusion that stands after mass media exposure (radio, press, TV and movies) to genetics terminology without enough scientific backgrounds. It is important to point out that the survey took place at a school. The answers came from students who had at least basic understandings of chemistry and biology. Nevertheless, the study shows that students do not integrate mass media information from their everyday activities with the science lessons they learn at school.

For every question, the highest percentages are discussed below; only in particular but interesting cases we selected some answers to be presented.

The first question asked for a definition for “genome”. All answers (correct and incorrect ones) were short and simple. The most common answer involves 20% of the students, who wrote, “It is the genomic information”. A high percentage could not answer the question (18.5%). Some students (11%) considered that it concerns “a gene that science can manipulate” while others (7%) specified that it is a “substance that rules how the person will be in the future”.

About genes and their location, 22% answered that genes “are located inside the cells and they have a circular shape”, while another 22% wrote that genes are “inside DNA and have a cell shape”. A particular student said: “genes are located inside the brain, because they rule everything”.

It seems to me that the establishment of a relationship between DNA, genes and cells is not being understood. Students establish a conceptual network between genes being located inside the cells, and cells having a rounded shape (which, by the way, is not a necessary condition of all cells). Therefore, genes must have a circular shape.

A third question about genes manipulation brought these main answers: 30% of the students think that genes manipulation has to do with “cloning stuff”. 28% did not answer, and 15% consider that “it is a good method to cure illnesses”.

Students emphasized the importance of mass media communication: 28% of them agreed in getting their opinions through television. TV is followed by the internet (18%). School

got only 11%. The highest percentage was reached by students who did not answer the question (39%).
The last question involved their opinion about cloning. It is interesting to notice that students gave an answer that include ethical or moral issues more than considering any scientific fact.
The highest percentage was reached by students who claimed to "agree with cloning" (without giving any argument to emphasize their opinion). On the other hand, 13% disagreed. 15% said
"it is good but dangerous" and 7% believe "cloning is good because it will bring the dead ones back to life". Only 15% thinks cloning is a difficult topic and they can't give an opinion until having enough information.

Conclusions
The survey helped the museum team to notice students' questions and ideas that we should consider. Our science exhibit involving genomics must have several levels of communication. It is clear that students do not deal correctly with the molecular and the cellular level at the same time, and the exhibit can help in visualizing this information.
Although limited resources are "a museum's everyday life", after the survey we decided to include several themes about cellular biology. A new survey to find out what our visitors think about genomics and cells is taking place at Universum Museum.
Mass media coverage is responsible for some of the myths and misconceptions that Mexican students have; even if they go to school and have public libraries to attend, students seem to believe what they listen from the mass media without questioning the quality or the certainty of the information.
Metaphors and analogies can emphasize confusions in the public.
Some of the topics inside the exhibition should try legal, moral and ethical aspects because it is obvious that our public is interested in those themes.

CAN GENETICS HELP US RETHINK COMMUNICATION? PUBLIC COMMUNICATION OF SCIENCE AS A 'DOUBLE HELIX'

Massimiano Bucchi

Dept. of Human and Social Sciences, Università di Trento. Via Verdi 2638100 Trento, Italy. Phone: +39 0461 881308, fax: +39 0461 88144., mbucchi@soc.unitn.it , www.soc.unitn.it/sus/mb.htm

Abstract
Public communication of science is still largely conceptualized within a 'transfer' paradigm that describes it as a displacement of results and ideas from the specialists to the lay public, problematizing the public, the media, (sometimes) science, but very rarely the notion itself of communication. This paper is a preliminary attempt to see if the discourse about genes and the genome can help us to problematize the concept of communication in relation to science, rethink our models of public communication of science and more in general the metaphors we employ to describe communication. It is suggested that the relationship between science and the public could be better understood by viewing communication through metaphors drawn from contemporary biology, e.g. as 'cross-talk' between the specialist and public discourse or as a 'double helix' coupling the two dimensions under certain conditions.

Key words: Public Communication of Science; Communication Theory; Public Discourse on Genetics.

Text

Introduction

Scientists and policy makers routinely complain about the difficulty in getting the message of science across public opinion. Public hostility to applications of science research –like for instance those in the field of biotechnologies– is attributed to scarce receptivity on the part of the public and to the inadequacy of mass media in channeling the information provided by the scientific community. Despite several initiatives, investments and research, scarce evidence is available of the impact of public communication of science on public opinion and attitudes, let alone behaviors. Indeed, recent studies show for instance that that lack of information cannot be used as the only explanation for public skepticism (Gaskell and Bauer, 2001; Bucchi and Neresini, 2002). However, when discussing public communication of science, the public is often problematized, the media are often problematized, science is sometimes problematized, but communication itself as a concept is rarely problematized. This paper is a preliminary attempt to see if the discourse about genes and the genome can help us to problematize our concept of communication in relation to science, rethink our models of public communication of science and more in general the metaphors we employ to describe communication.

The 'transfer' paradigm

The transfer model has been now for at least sixty years the dominant paradigm for describing communication as a process concerned with the transfer of knowledge from one subject or group of subjects to another subject or group of subjects. Within this paradigm, 'successful' communication is defined as the achieved transfer of information from one party to another, assuming that: a) knowledge can be transferred without significant alteration from one context to another, i.e. we can simply 'take' an idea from the scientific community and 'bring' it to the general public; b) the same knowledge in different contexts will result in the same attitudes and eventually in the same type of behavior.

Criticisms of the transfer paradigm and sociological models of science communication

Since the 1950s, the transfer paradigm has been challenged both in general and in the area of science communication, describing science communication as a *continuum* with several stages allowing for a more complex interaction between different levels (Cloitre and Shinn, 1985; Bucchi, 1996, 1998). Despite its innovative elements, this model largely remains within the limits of the transfer paradigm: the whole process is still about transferring knowledge from one science communication level to another and even if it allows for knowledge to transform during the transfer, , the direction of the transformation remains largely pre-established, with the touchstone of the transformation firmly remaining located at the specialized level. Eventually, what the continuity model describes seems to be a more complicated transfer process.

The 'discourse of gene action': a case of public misunderstanding?

My proposal here is to use the case of genetics to step out of the 'transfer' paradigm of science communication, and eventually to find a different metaphor to think about the very process of communication. To do this, I will consider the two extreme levels of science communication, namely the specialist level and the public level. As several studies have illustrated, an analysis of in relation to genetics reveal a sharp disjunction

between them: while at the specialist level "the concept of gene is no longer useful" (Keller, 2000), at the public level we are still largely witnessing an overwhelming success of genetic determinism.
Obviously the transfer approach has a handy explanation for this disjunction as a result of imperfect transfer of specialist ideas and results, i.e. what is often referred to as 'public misunderstanding' or as 'deficit model'. Put more time, resources and efforts in communicating gene research to the public, and eventually the gap will be covered: public discourse will match the specialist one. However, there are several indications that public discourse about genetics has not arisen as a filtered or trickled down version of specialist discourse.
Is another explanation possible? Let us put aside the transfer metaphor and consider the specialist and public dimensions not as layers of the same discourse, but as two different types of discourse which are developing in parallel. One way to describe public communication of science without the mechanical strictures of the transfer paradigm is by considering the possibility that ideas circulating within public discourse and within specialist discourse can, under certain conditions, *'cross-talk'*.

The 'double helix' of science communication

A model of science communication as *cross-talk* implies seeing communication not simply as a *cause* –e.g. of changes in opinions and attitudes among the public– but also as the *result* of developments in both discourses allowing the formation of an intersection zone. Actually, if we need another form of visualization to replace that of transfer, we could indeed take the biological metaphor one step further, representing interactions between specialist and public discourse as 'double helix' –one strand representing the specialist discourse, the other strand representing public discourse– with intersection between strands taking place only at certain junctions rather than a transfer process. If we apply this metaphor to the case of genetics, our surprise and disappointment for how imperfectly results like the mapping of the human genome have been channeled to the public may well disappear, replaced by an appreciation and wonder for how richly have such achievements intersected with popular discourses about heredity and identity.

Implications for public communication of science practice

Some, and in particular science communication practitioners, could draw here the impression that public communication of science is a difficult, desperate or flatly impossible endeavor. This impression is justified only if we keep the transfer paradigm as a term of reference. Still, the model is not devoid of implications for science communication practice: since it is quite difficult for a single actor to control the communication process and communication as described here requires the concurrence of several conditions, a model of science communication as double helix emphasizes the importance for a science communicator to thoroughly map the configurations of such conditions, including conditions traditionally neglected within the transfer paradigm, e.g. fine structure of public discourses directly or indirectly related to science issues. This eventually makes the process of public communication of science –and thereby the activities in which science communication practitioners are routinely engaged– more relevant, not only as a means to achieve certain objectives but as a central space to understand (and participate in) the interacting transformations of both science and public discourse.

Notes

Please do not quote or circulate this version. The complete version of this paper will appear in a special issue of the journal *New Genetics and Society* dedicated to "The Meanings of Genomics" to be published in autumn, 2004.

GENETICS AND BEHAVIOR IN THE NEWS: THE FATE OF GENETIC OPTIMISM

Peter Conrad

Department of Sociology, MS-71, Brandeis University, Waltham, MA 02454-9110 USA. Phone: +781-736-2635, fax: +781 736 2653, conrad@brandeis.edu

Abstract

Context: Research on genetics and behavior has grown in past two decades, which is reflected in an increase in news coverage. The news media is a major source of public understanding of genetics.
Method: We examined U.S. print news coverage of genetics and behavior in major from 1970-95.
Results: The dominant frame of "genetic optimism" was identified: a gene exists, it will be found, it will be good. Despite disconfirmations, genetic optimism persisted in the US reporting.
Conclusions: The genetic optimism frame can distort, misrepresent and reify the impact of genes on behavior, and under represents criticism. Genetic optimism may vary by news culture and time.

Key words: genetics, news, public conceptions.

Text

Over the past two decades the pace and specificity of discoveries associating genetics with behavior has accelerated, which is reflected in the increase in news coverage about genetics and behavior. The news media is a major source of public understanding of genetics and a strong influence on public discourse (Nelkin and Lindee, 1995; Conrad, 1997; Van Dijck, 1998; Condit, 1999).

Method and Sample

This paper is drawn from a larger study, which examines the presentation of three cases of genetics and behavior in the news from 1965-1994: homosexuality, mental illness, and alcoholism. The data include all articles published in 5 major American newspapers (*Boston Globe* [BG], *Los Angeles Times* [LAT], *New York Times* [NYT], *Washington Post* [WP], and *Wall Street Journal* [WSJ]) and three news magazines (*Newsweek, Time*, and *US News and World Report*) for this period.
My analysis of genetics and behavior in the news I examined what "frames" were used in presenting the news. Journalists do not simply report the "facts", but rather present the news in the context of a particular frame. Journalists develop specific media frameworks, which enable them to process, report and present large amounts of information quickly an routinely (Gitlin, 1980: 7).

Rise of Genetic Optimism

This paper builds upon earlier papers (Conrad and Markens, 2001; Conrad, 2000; Conrad, 2002) and a provides brief fate of "genetic optimism." Using mental illness as the example genetic optimism has three components.

A gene exists. The idea of specific identifiable genes reflects research claims of molecular biology. The news articles frequently reported discoveries of genetic markers or linkage as if the science discovered the existence of a "genetic flaw" or "faulty gene". Genetic markers are usually particular genetic constellations, rarely specific genes.
It will be found. Even when reporters recognized that genetic markers were not specific identified genes, they displayed confidence that the gene existed and would be found. In the light of the new genetic technology, genes would be identified.
It will be good. The assumption is that finding genes for mental illness will be good for sufferers, their families and society. Most of the stories promised the possibility of accurate genetic diagnoses or new treatments for the disorder could developed soon; some suggested that a genetic revolution in treatment was just around the corner. Others believed that genetic explanations would remove blame from families and guilt from sufferers.
The genetic optimism frame was reflected in virtually all major stories on genetics and mental illness from the 1980s through 1995.

Homosexuality, "the Gay Gene" and the News
Dean Hamer's 1993 article in *Science* claiming the discovery of a marker on the Xq28 chromosome, became front page news world-wide and soon was touted "the gay gene". I compared the American and British press reporting of Hamer's study. The American press framed Hamer's work in "cautiously optimistic" terms: the science was good and it was likely to have some positive effects of gays. The British press, however, framed the stories as "the perils of the gay gene," emphasizing potential difficulties: new genetic discrimination of gays, genetic screening, aborting "gay fetuses", possible genetic therapy (see Conrad and Markens, 2001). The assumption of genetic optimism frame underlied the American reporting, but not the British. Hamer's work remains contentious, but even if it were valid, it would not constitute a "gay gene" as was commonly depicted in the press.

The Fate of Genetic Optimism
With one interesting exception, genetic optimism was pervasive in the US reporting of genetics and behavior in the news. In the late 1960s and early 1970s and early 1990s (*The Bell Curve*) there were widespread news stories of studies associating race, genetics and IQ. In both cases, however, the reporting was overwhelmingly critical of genetic explanations. There was no genetic optimism here at all. Why? Perhaps because race was a hot button in the US, because it was (bad) social science and not molecular biology, or because stories were written by news rather than science reporters.
The case of alcoholism parallels mental illness and homosexualty. The title of our paper reflects its content: "Has the gene for alcoholism been discovered three times since 1980?" (Conrad and Weinherg, 1996).
In my study period, when a new genetic discovery related to a significant social issue is discovered, it is typically presented with great fanfare and optimism. If the study cannot be replicated or is disconfirmed, and there were many (e.g., D_2Dopamine receptor and alcoholism, several genes for mental illness, the "novelty seeking" gene), this was ignored or there was a small mention in the back pages. Big news when genes are found, no news when they are lost, creating a misleading public perception about the advances of genetics.

Conclusion

While the scientific accuracy of the gene stories is high, the genetic optimism frame distorts some of the findings, misrepresents and reifies the impact of genes on behavior, and leaves no space for critics or an examination of potential negative impacts. A comparison of American and British press suggests that genetic optimism can vary by news culture. Genetic optimism presents an overly sanguine picture of the state of genetics; as we enter the genetic age it is important to balance the extraneous "hype and hope."

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References are available from author: conrad@brandeis.edu.

MEDIA COVERAGE OF HUMAN GENETICS IN SPAIN: THE CASE OF *EL PAÍS* (1976-2002)

Matiana González Silva

PhD Student, Centro de Estudios de Historia de las Ciencias (CEHIC), Universidad Autónoma de Barcelona. Córcega 640, 5-2, 08026, Barcelona, Spain. Tel.: +34 93 435 60 06, matianag@hotmail.com

Abstract

Public representations of science are influenced not only by research itself, but also by the cultural context where they develop, and both science and its popularization are laden with cultural and ideological values. In the Spanish public sphere of the late seventies and early eighties, when the country was defining most of its public policies after 40 years of dictatorship, most of the actors were very aware of the political values involved in human genetics (which they identified with right-wing positions) and preferred environmental and psychological explanations for most behaviors and diseases. But coinciding with the growth of Spanish participation in genetic research and the biomedical industry, the critics vanished. It was not just a shift among scientists. At the end of the century, journalists –closer to biological scientists than before, accepted with no questioning, the experts' discourses and presented this scientific field in very laudatory terms.

Key words: Scientific journalism, human genetics, history.

Text

Context

Historical and sociological studies on science popularization show how this process cannot be interpreted just as a diffusion of expert knowledge to broad audiences. On the contrary, diverse interests of many different actors shape media images of science, competing with each other to gain public support. In the case of human genetics, actors are not only geneticists; other professional groups like politicians, psychologists, philosophers, business men, citizens and family doctors, conveyed their peculiar representation of human genetics, while journalists had an active role choosing which theories and which people they paid attention to.

On the other hand, recent studies about popular accounts of human genetics have not reached a common view: while some specialists argue that the public image of genetics is becoming less determining, others maintain that an overvaluation of genetic factors in medical, behavioral and biological events is taking place.

Only particular case studies can reveal both the cultural determinations of science popularization, and the degree of "genetization" –if such a thing exists- in a particular local context.

Objective

The objective of this research is to reveal the Spanish peculiarities of the public account of human genetics in the last quarter of the twentieth century, as it appeared in the pages of the newspaper with greater circulation in the country.

Methods

In resorting to *El País'* database, a comprehensive corpus of more than 1,200 documents containing the words 'genetics', 'genome' 'DNA', and 'gene' was made and analyzed with particular attention to the following themes: genetics as pure science and the Human Genome Project, genetics and disease, genetics and behavior, ethical and legal implications of human genetics, and genetics as metaphor beyond scientific contexts. For the analysis, both qualitative and quantitative tools were used.

Results

What has been observed over the 27 years covered by this study, is an evolution from the image of human genetics as a secondary science, opposed to psychological and environmental explanations and full of ideological prejudices, to the idea of a fundamental field with positive medical and social consequences, which ought to be promoted and served to gain public respectability.

During the first years of the period studied, the use of ideological arguments was common among Spanish public actors, especially psychologists and psychoanalysts that perceived that geneticists were occupying their therapeutic fields. These professional groups responded linking genetics with eugenics and reductionism. During these years, everyone seemed to be aware of how any conception of disease and behavior influenced the definition of public policies in education and health, a crucial problem for Spain in those days. At this stage, ethical and philosophical implications of human genetics were treated overtly, and in very critical terms.

This situation changed dramatically in the late eighties and nineties, when the country entered a more stable political phase. Spanish research in human genetics grew and became more visible. The first prenatal and diagnosis tests became available in Spain and new scientific journalists, very close to the scientific community and shared values and interests, arrived to *El País*. Coinciding with a more aggressive communication campaign from scientists and its institutions, texts full of technical details presented science as a neutral activity, in which only experts could have a relevant opinion, but whose consequences were at a different level from scientific research. The coverage began to forget the economical, political and ethical dimensions of human genetics, stressing the hopes for magic cures for almost all human diseases, while discussions about genetic determinism or the concept of human nature derived from genetic knowledge were relegated to marginal spaces, like letters to the director. Spanish scientists discourse merged into American discourse. But on the other side of the Atlantic Ocean these discourses were part of a strategy to gain public funds for an extremely expensive research; in Spain the same arguments were used to present the local scientific community on a level with their American colleagues.

The editorial position of the newspaper itself shifted during the period studied here: it shifted from a conception of science and technology as an integral element of society, and thus, as a field in which everyone had the right to express its opinion, to an extreme defense of scientific research claiming for public support and for the isolated advance of science.

Conclusions

Scientific popularization is a historical event, and as such, it is influenced by its cultural, social and economical context. Although in the last quarter of the twentieth century a homogenization of scientific popularization took place, in every local process, numerous particularities can be observed.

"EGOS AND GENOMES": AN ANALYSIS OF BRITISH MEDIA COVERAGE OF THE HUMAN GENOME PROJECT

Dr. Lesley Henderson

Centre for Media & Communications Research, Department of Human Sciences, Brunel University, West London. UB8 3PH, UK. Tel: +1895 274000 (ext 3123), Lesley.Henderson@brunel.ac.uk

Abstract

The announcement of the human genome project 'first draft' on the 26th June 2000, appeared to conform to traditional notions of a 'scientific breakthrough' news event involving elite sources and attracting worldwide media attention. This paper demonstrates how the ethical, legal and social implications of scientific research which are rarely reported were now given prominence. It draws on systematic content analysis of all British media coverage of human genetic research in the year 2000 and interviews with key players (e.g. scientists, journalists, source organisations) to reveal how this science story was heavily orchestrated for wider media and the lay public.

Key words: media, genetics.

Text

Introduction

On the 26 June 2000 the teams involved in mapping the human genome announced to the global media that they had completed the 'first draft'. Widespread coverage of this 'landmark' in human genetic research was characterised by the discourses of hope and fear: on the one hand the media presented an optimistic future of post-genomic medicine and, on the other hand, they highlighted a pessimistic vision of post-genomic society.

The Human Genome Project [HGP] announcement was a heavily orchestrated event involving highly prestigious source activity. The dawning of the post-genomic era was heralded in simultaneous, satellite-linked press conferences in Washington and London, involving Prime Minister Tony Blair, President Bill Clinton and a host of leading public and private sector scientists.

The timing of the announcement was determined not by the trajectory of the scientific research however but by close liaison between the key players. This was partially in response to the efforts of American company, Celera Genomics, headed by Craig Venter to position themselves as 'ahead' in the 'race' with the UK based Sanger Institute, headed by Sir John Sulston. The research teams had become embroiled in an acrimonious public

struggle and an announcement was designed to bring this to a close. Indeed this context clearly influenced the emphasis of information to be circulated to journalists. As one press officer explained "because of (Celera) one of our key messages was that the information was free and publicly accessible so scientists all over the world can use this for the greater good" (Wellcome press officer).
Science journalists were acutely aware that this was not a simple 'science' story. As one reporter commented: '(The HGP) wasn't finished. It was an arbitrary date for publication. I mean the whole thing was hype. But we were much more interested in what was leading up to that and the battle of the patenting and whether it was going to make money" (TV news reporter). Another science editor stated openly that 'The [June 26th announcement] was orchestrated for political and commercial reasons' (Broadsheet Science Editor).

British Media Coverage: Key Results
Coverage of the Human Genome Project announcement represented a peak in British media reporting of human genetics for the year 2000 (see Figures 1 and 2). The prominence of the 'first draft' in the UK media was demonstrated by its coverage in all national UK newspapers from Monday 19 June to Sunday 2 July 2000 (7 front page stories, 10 editorials; 8 special features) and as the headline news story for the television evening news. This reporting typically represented the 'first draft' as a 'watershed' in history. The human genome was presented through metaphors (a map, blueprint, key, recipe, code, book); the 'breakthrough' in mapping was compared to the greatest moments of social, artistic and scientific 'progress' (e.g. the invention of the wheel). The historical associations, the use of language and the range of metaphors all implied an optimistic view of scientific progress (Nerlich *et al.,* 2002).

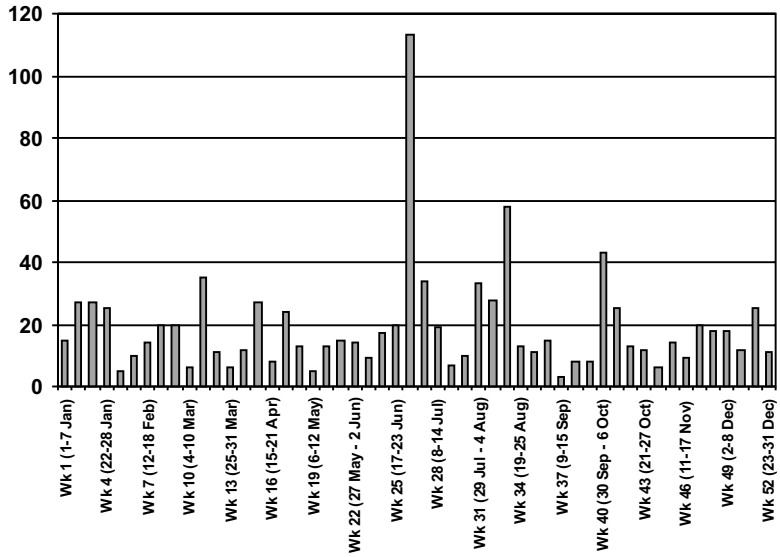

Figure 1 Graph showing the number of British newspaper reports on Human Genetic Research for each week during 2000

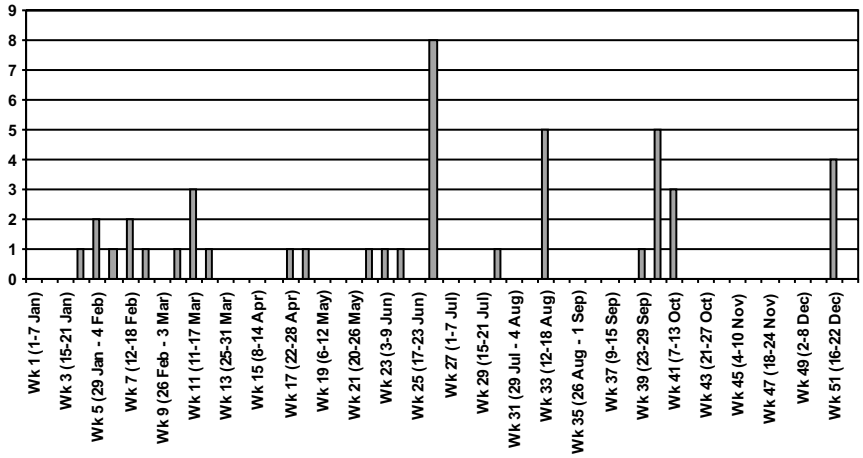

Figure 2 Graph showing the number of British main television evening news bulletin reports on Human Genetic Research for each week during 2000

Cancer cures and longevity were fore grounded as the medical promises of the post-genomic era (e.g. The biggest medical breakthrough for a generation could cure dozens of diseases' (BBC 2100, 26 June 2000). Journalists emphasized that they were careful to avoid 'over hyping' the findings however there were tensions between this and news values which required that the science should be made relevant to people's everyday lives (Henderson and Kitzinger, 1999).

Media coverage also raised implicit concerns (e.g. 'Barcoded at birth. Would anyone have let Beethoven do music if they'd known he'd go deaf? (Channel 5, 26th June 2000). Numerous newspaper articles (55%) focused on the ethical, legal and social implications of new human genetic research and this was pattern was mirrored within the television news sample (6 out of the 8 news bulletins focused on ELSIs).

Indeed it was striking that the Human Genome Project announcement served as a platform for journalists to address issues which are often absent in media reporting (e.g. genetic determinism). Twenty five percent of articles about the HGP announcement critically addressed the question of 'geneticisation' (compared to 10% of articles over the year as a whole). The issue became the main focus of several articles (e.g. 'We are bigger than our genes - thank God' (Sunday Times, 2 July 2000). This is particularly interesting in light of accusations against the media that they traditionally promote the 'geneticization' of life and it would seem that the hyperbole surrounding the HGP announcement facilitated more critical or reflective reporting around the implications of genetic testing and the promise of expanded life spans. In contrast to previous findings (e.g. Nelkin & Lindee 1995; Conrad 1997, 1999a) some press reporting did question the social value of genetic science.

Egos and genomes: framing the story

Framing the story as a 'battle' between Venter and Sulston was a common strategy which helped to dramatise some of the issues about information access; control and commercialisation. Typical headlines included: 'Locked in battle for key to life' (*Mirror*, 21 June 2000); 'Scientists at War :Two projects, two views of science' (*The Times*, 23

June 2000). Journalists utilised the personalities of Venter and Sulston to characterize and personalize the conflict. Nine articles profiled or interviewed these men; Venter's image appeared fifteen times, Sulston's appeared on fourteen occasions. Their beliefs were consistently portrayed as being diametrically opposed: 'John Sulston: altruist or moralist? Craig Venter: maverick or monopolist?' (*Guardian* 26 June 2000); 'war veteran fights ex-hippie over 'Book of Life'" (*Daily Telegraph*, 27 June 2000).

Journalists saw the opposition between these two key players as a significant opportunity in media and news value terms. As one TV science editor explained: "You had two fantastic characters. … (John Sulston) is a natural and … a brilliant scientist…. Craig Venter himself is very media savvy but comes across as a very different personality to an English audience. It was certainly very easy to set one against the other in cinema terms and word terms. I think in that case it was fair to do it because there were very different philosophies at work and Craig and John personified those two philosophies' (TV Science editor). Another journalist commented: 'Because of the characters and the race and Venter in particular, it meant that the coverage was more extensive than it would have been. People find science quite hard I think so if there are personalities to identify with it makes it easier for the readers definitely" (Broadsheet Science Editor).

This reduction of the issues to personal antagonism was influenced by the operation of news values that rate conflict and 'real' people as more interesting than consensus and 'impersonal' organisations. On the one hand it opened up the discussion to questions of funding, ownership and commercialisation that placed the science into its economic and political context. On the other hand, it was presented very much within science's own terms. As disability activist, Professor Tom Shakespeare commented: 'The debate was presented as the 'good guys' versus the 'bad guys. The scientists say 'Yes there are ethical concerns but not with us – Celera, they are the people to be anxious about. The old distancing effect.'

The social, political and economic context of genetic research and its implications were highlighted in coverage of the HGP announcement to an extent, and in ways, which it had seldom been before (e.g. concerns about commercialisation of genetic science appeared in 41% of newspaper articles compared with 15% of press coverage for the year). Debates about access and control over genetic information appeared in 36% of newspaper articles about the announcement (compared with 15% of press coverage over the year).

Conclusions

Despite the increased discussion of ethical, legal and social issues there were some specific areas which remained marginalized including civil liberties, surveillance and the complications that human genetics poses to the legal and medical professions. The potential for genetic science to become the basis for weapons technology was entirely absent and there was little discussion of the 'therapeutic gap' between genetic diagnosis and medical interventions. Reporting emphasised medical benefits and few reports discussed medical risks. Elite sources continued to dominate coverage and the vast majority of sources were research scientists, funding bodies and policy makers. The human genome project announcement does provide a valuable case study for exploring the ways in which 'science reporting' is firmly embedded within broader socio-economic issues. It demonstrates how ethical, legal and social implications may under certain circumstances move to the foreground of media reporting. This reflects the high profile given to these issues by those working in the field and shows how the announcement

offered an opportunity to address public anxiety. However the impetus behind the announcement was intrinsically tied in with concerns over access to such information and how this may operate
in practice. This raises the possibility that scientific and political sources involved in the project might emphasise the aspects of social concern that suit their needs at the time and that can
be addressed by legal and regulatory frameworks rather than raising more fundamental challenges.

Notes

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DECOLONIZING THE THRIFTY GENE THEORY

Jennifer Poudrier Ph.D.

Department of Sociology, University of Saskatchewan, Saskatoon, SK Canada S7N 5A5. Tel.: (306) 966 1793, fax: (306) 966 6950, jennifer.poudrier@usask.ca

Abstract

This paper describes elements of a decolonizing textual science study of the 'thrifty gene' theory. Grounded in the notion that the construction of scientific knowledge is deeply imbricated in cultural and historical contexts, this research uses the production of 'thrifty gene' theory as a case study to explore, to decolonize, and to clarify the potential implications of the current production of medical-genetic knowledge about Aboriginal bodies, health and wellness. Here I problematize the recently bourgeoning and uncritical linkages between evolutionary science, contemporary medical-genetic research and Aboriginal[1] peoples' health in Canada.

Key words: Thrifty Gene Theory, Decolonization, Aboriginal Wellness.

Text

The 'thrifty gene' theory is currently a simplistic and captivating explanation for the high prevalence of non-insulin dependent diabetes mellitus (NIDDM) among Indigenous peoples globally. Originally proposed in 1962 by population geneticist James V. Neel, the 'thrifty gene' theory was based upon the evolutionary notion that hunter/gatherer populations survived feast and famine living conditions because they possessed a *thrifty* genetic predisposition to accumulate and store fat. Neel (1962) suggested that under

recent conditions of rapid "Westernization" and related lifestyle and dietary changes, this naturally selected genetic predisposition, which sustained populations during times of famine, has led to the onset of obesity and diabetes among contemporary populations.
In subsequent publications in 1982 and 1999, confronted with evidence showing significant flaws in the original hypothesis, Neel re-adjusts its specifics and continues to argue, very convincingly, for the existence of the 'thrifty gene.' Despite its non-existence, the 'thrifty gene' theory does indeed exist in the current Aboriginal health literature as powerful explanation for NIDDM. While it waits, almost impatiently, for scientific authorization, the tale of the 'thrifty gene' theory is a telling sign of things to come in the construction of medical-genetic knowledge.
This paper is based on a decolonizing textual science study of the primary literature which constructs the 'thrifty gene' theory, namely the texts published by James V. Neel in 1962, 1982 and 1999, to which I refer as the 'thrifty gene' papers. This research is grounded in the traditional teachings of two Aboriginal people, Flora Fiddler and Albert Fiddler. It also draws upon the social studies of genetic science (Hedgecoe, 2002; Lippman, 1991; Rabinow, 1996) and has linkages with global decolonizing literatures (Smith, 1999; Whitt, 1998). Decolonizing the 'thrifty gene' involved three primary methods: centering indigenous epistemologies of holism; critically understanding and challenging the principles of Euro-western scientific research; and revitalizing indigenous knowledge systems geared toward the larger project of self-determination. Here I describe the analysis involved with the second principle, namely the critical assessment of the assumptions, conclusions and the implications of 'thrifty gene'.
The analysis of the 'thrifty gene' papers reveals several key findings While it is never acknowledged in current literature, the 'thrifty gene' theory is produced and reiterated from eugenic, evolutionary and neo-colonial perspectives. Where Neel explicitly looks to eugenic solutions for population health, the principles of his theory are based on incorrect categorical groups and problematic primitive/civilized binaries. Moreover, it fails to account for complex Aboriginal genealogical histories and wrongly assumes genetic homogeneity within Aboriginal communities. As such, the 'thrifty gene' not only remains an unproven hypothesis, but it also embodies an approach to Aboriginal disease where social, economic, and historical conditions (namely colonization) become naturalized or fixed. Where social conditions are treated as fixed, the Aboriginal body becomes the site of curative transformation. This shift is responsible for the way in which racialized bodies and individual moralities are necessarily blamed for illness. Already marginalized peoples become further entrenched in a biological paradigm which not only re-affirms racial categories of difference, but also bears little resemblance to Aboriginal healing knowledges, histories, communities and peoples.
Future genetic research about Aboriginal disease may not be accurate in terms of the assumptions it makes about populations, and therefore, it may not be useful in a curative sense if applied clinically. In fact, it may be harmful, not only by categorizing, stigmatizing and surveilling the peoples it describes, but also by spear-heading a trajectory of racialized genetic explanation, research, surveillance and treatment (Poudrier, 2003).
There is an additional chapter in the slick story of the 'thrifty gene' that needs to be told. It could begin with the mythical Trickster – the Raven. Like Donna Haraway's (1999) call to converse with coyote who is the manifestation of continually problematized binary distinctions, the Raven tale might break down problematic and reductionist binaries like civilized/primitive, modern medicine/Aboriginal wellness and nature/culture. It would

most certainly highlight the importance of valuing and revitalizing Aboriginal healing knowledges. Future efforts geared toward decolonizing medical/genetic knowledge remain a strong possibility for advancing the projects of self-determination and the ongoing development of appropriate and emancipatory healing knowledges in current contexts; even in the genetic future.

Acknowledgements

I respectfully acknowledge the teachings of Flora Fiddler and Albert Fiddler of Waterhen Lake First Nation, Saskatchewan Canada which embody the substance of this research.

Notes

[1] Following other Canadian scholars, here I use the term "Aboriginal" to refer to Indigenous peoples of Indian, Inuit, and Metis heritage.

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CULTURAL COMPETENCE IN GENETICS EDUCATION

Mona Saleh and Kristine Barlow-Stewart

The Centre for Genetics Education, PO Box 317 St Leonards, NSW 1590, Australia. Tel: +612 9926 7324, fax: +612 9906 7529, msaleh@med.usyd.edu.au

Abstract

There is increasing awareness of the importance of genetic information in determining family members' current and future health. The Centre for Genetics Education, in close collaboration with providers of genetic counselling services, aims to provide accessible and relevant genetics knowledge to members of the public. In order to do so, resources are developed in a variety of formats to convey information and engage the public in a discussion of genetics and it's implications. The challenge of communicating

genetics information in Australia requires attention to cultural diversity and the way in which it affects the dissemination of scientific knowledge.

Key words: Culture, Genetics, Communication.

Text

Genetic counselling is a multidisciplinary approach to providing diagnosis, risk assessment, education and support to individuals and families affected by genetic conditions. It is also a process that delves into the foundations of a family. For effective communication in genetic counselling, it is essential to understand how individuals translate genetic information within the context of their own belief systems. The fundamental tool used during the first stage of genetic counselling is the documentation of a detailed family health history (pedigree). This inevitably involves addressing issues such as hereditary, kinship and personal beliefs about characteristics of certain family members. Cultural diversity plays a major role in determining people's beliefs and opinions about such issues.

The completion of the Human Genome Project in 2003 brings with it the promise of health benefits and an improved understanding of genetic conditions. Accompanying these benefits comes the impact of the knowledge and the choices regarding the utilisation of genetic technologies. Addressing these issues is optimally done within a genetic counselling context. Issues of informed consent and communication of the consequences of gaining personal genetic information has never been more crucial. The ability of providers of genetic counselling services in Australia to address these issues is challenged by a culturally diverse population. If the new technology is to be used responsibly, and made accessible to all Australians, it is vital that genetic counselling service providers attain cultural competence and practice within a model that embraces, rather than excludes cultural diversity.

The impact of cultural beliefs on the uptake of genetic counselling and the ensuing technologies has been studied internationally[1,2] and to a lesser degree in Australia[3]. It has been documented that health providers can categorise individuals from specific cultural backgrounds and may make assumptions about their needs and opinions.[3,4] This can lead to incorrect perceptions and may jeopardise optimal communication between provider and client. Genetics education has historically been enmeshed in the genetic counselling process.[5] As genetic counselling is primarily a communication process, it is affected by the skills of the practitioner in conveying complex principles at an appropriate level to the client. The challenges faced when communicating across cultures impacts on the genetic counselling process.

Why is culture so important in genetics?

A person's background, in terms of their ethnicity or cultural practices, can be a predictor of their genetic health. During genetic counselling, information is collected from clients regarding their ancestry in order to predict the potential gene mutations present in their DNA. This can be a powerful tool in risk assessment, particularly where consanguinity is the reason for seeking genetic counselling.

Gathering what may be deemed "basic" family health history information can be challenged by cultural beliefs. When collecting a family history, simply extracting from a client the details regarding their siblings or other kinship relationships may not be as "basic" as it seems. The documentation of a family health history in genetic counselling is

governed by an understanding of biological inheritance within an Anglo-Celtic-Saxon concept of the family tree. Particularly in cultures where child rearing is viewed as a community role, rather than exclusively that of the biological parents, the definition of a sibling by the genetic counsellor may be in conflict with the understanding and beliefs of the client.

New technologies may target certain population groups as being at risk of ethno-specific genetic conditions. In the case of the genetic condition hypercholesterolaemia, the Lebanese population has been identified as being at increased risk. This condition is one of the growing number where pharmacogenetics will be used in targeting pharmaceuticals to the genotype of affected individuals. The challenge of informing this community about the issues related to genotyping such as informed consent, insurability and privacy must not be overlooked as the promise of better treatment arrives.

Genetic counselling practitioners in Australia often use educational tools and resources to assist in communicating complex issues to their clients. These tools may be in written form, either produced by the practitioner, obtained from the Centre for Genetics Education or other sources. It is important to know whether these educational tools, when used as resources to aid the genetic counselling process, do meet the needs of a culturally diverse population. The production of culturally inappropriate resources may result in the limitation of access to quality genetic counselling and enabling informed choice about the utilisation of new genetic technologies by a large proportion of Australians.

Genetics education resources must therefore reflect a diverse population and be validated by the community it serves.

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SPANISH NEWSPAPER COVERAGE OF THE TOPIC "GENETICS": A SEVEN-YEAR LONGITUDINAL STUDY

David de Semir, Raimundo Roberts, Gemma Revuelta and Vladimir de Semir

Science Communication Observatory, Pompeu Fabra University, Barcelona.
Tel.:+00 34 93 542 24 46, ddesemir@iro.es

Abstract

This study is aimed at analysing the daily press coverage of one medical topic among health and medical news: Genetics, perhaps one of the most exciting issues of health and medical subjects that promotes debate and touches ethical and political aspects. With this objective, a seven-year longitudinal monitoring of the press content of genetics (1997 to 2003) in five Spanish newspapers with the largest circulation

was carried out using the Quiral database. According to the data provided by the Oficina de Justificación de la Difusión (OJD), these five Spanish newspapers are *El País, ABC, El Mundo, La Vanguardia* and *El Periódico de Catalunya.*
The Quiral database gathers all the information concerning medical and health issues. After analysing all the news quantitatively and qualitatively an annual report is written: the Quiral report. This study was possible thanks to the support of the non-profit-making organization Fundación Vila Casas, and forms part of a larger project called *Proyecto Quiral* set up in 1996 at the Scientific Communication Observatory at the Pompeu Fabra University (UPF) in Barcelona.

Key words: genetic news, Spanish newspapers, follow-up.

Text

Since 1997, 12705 newspapers (1815 each year) have been revised and all the information regarding medical and health issues has been gathered in the Quiral database which gives the opportunity to study daily press coverage in the 5 Spanish newspapers revealing topic news that have an acute pattern of information or the ones that are covered during the whole year (chronic pattern). The news with an acute pattern and the ones with a chronic pattern have different characteristics:
Acute pattern: this kind of news attract a lot of interest but only during a short period of time. They disappear suddenly but sometimes they can get a chronic pattern, and their presence in the frontpage of the newspapers is higher than for other news. They produce more letters to the editor and opinion articles and they share very often the same title in different newspapers. These news are prone to produce more sensationalism and are more dependent on news agencies.
Chronic pattern: the news with a chronic pattern have an interest during the whole year but can get an acute pattern sometimes. Examples of this kind of news are the ones concerning cancer, AIDS, tobacco…Their presence in the front page of the newspapers is not more frequent than for other news and they don't produce opinion articles above the median. In general, the journalists that write these news that belong to this pattern use more information sources.
Table 1 shows the total number of health news, number of news about genetics and the distribution of news by newspapers.

Table 1 The percentages of news about genetics with respect to the total of news are shown in brackets

Year	1997	1998	1999	2000	2001	2002	2003	Total
Nº of news	5984	8706	11,135	11,945	11,200	15,037	12,882	
Nº of news about genetics	263 (4.4%)	526 (6%)	527 (4.7%)	743 (6.2%)	750 (6.7%)	700 (4.6%)	1023 (8%)	
ABC	1484	2360	2014	2314	2409	3824	3151	17,556
El País	1194	1780	1900	1917	2458	3445	2573	15,267
El Mundo	1386	1983	1930	1964	2289	2813	2889	15,254
El Periódico	962	1298	1389	1886	2066	2703	1974	12,278
La Vanguardia	958	1285	1502	1464	1977	2252	2295	11,733

The topic genetics covers different issues like cloning, human genome, stem cells, molecular biology, biotechnology, transgenics and genetic manipulation, gene therapy, embryology and bioethics.
As shown in the table, from 1999 to 2003 there is a median of 1000 news each month. The newspaper *ABC* was found to be the most productive with a total of health news of 17556 with respect to *La Vanguardia* with 11733 news since 1997. This finding can be attributed to the design of the newspaper and the importance given to one information or another. The *ABC* newspaper publishes a lot of brief news and short news while *La Vanguardia* and *El Periódico* publish longer news. This fact is translated in a decrease in the number of news.
The news of the year were:

1997: Cloning ("Dolly" the sheep), "Medicamentazo", Meningitis
1998: Medical assistance, Viagra, "Medicamentazo", Cloning of human beings, Eutanasia.
1999: Dioxines and Coca-Cola (food contamination), Corporative issues about doctors.
2000: Epidemy of *Legionella*, Human Genome (draft of the sequence), Mad Cows, Waiting lists.
2001: Mad cows, Cloning of a human embryo, Human genome (complete sequence), biological weapons (Anthrax).
2002: AIDS (International Conference in Barcelona), sexuality and reproductive issues, ecstasy.
2003: SARS epidemy, sexuality and reproductive issues (abortion, assisted reproduction law…).

The majority of the news about genetics was published in the "Society" section of the newspapers and sometimes in specific Science supplements and the source of information used by the journalists is very often a person with expertise in the genetics field. The ethical aspects of cloning, gene therapy, embryo research, genetic manipulation/ transgenics and human genome produced letters to the editor, opinion articles and editorials.
In a two-year follow-up of the topic Cloning we have shown that at the beginning and just after the announcement of "Dolly" the news covering Cloning were informative but changed to the ethical aspects turning to opinion news.
A qualitative study (not shown) of the total amount of news and the news concerning genetics has revealed that the Quantity of news is not always linked to a Quality of them. Instead of publishing more news it would be better to publish less news but with more quality.

Parallel session 5

PCST challenges and tools directed to young people

BRINGING BRIGHT MINDS BACK TO SCIENCE: THE ADVANCED STUDY PROGRAM

Helen Byers,[1] Paula Myatt,[1] Elizabeth McGraw,[2] Michael Bulmer[3] and Susan Hamilton[4]

[1] The Bright Minds™ Project, Faculty of Biological and Chemical Sciences, The University of Queensland, Brisbane Qld 4072, Australia. Tel.: +61 7 3346 9459, fax: +61 7 3365 1613, h.byers@uq.edu.au

[2] School of Life Sciences, Faculty of Biological and Chemical Sciences, The University of Queensland, Brisbane Qld 4072, Australia

[3] School of Physical Sciences, Faculty of Engineering, Physical Sciences and Architecture, The University of Queensland, Brisbane Qld 4072, Australia

[4] Director of Studies, Faculty of Biological and Chemical Sciences, The University of Queensland, Brisbane Qld 4072, Australia. Tel.: +61 7 3365 3353, fax: +61 7 3365 1613, s.hamilton@uq.edu.au

Abstract

Students in Australia are turning away from science. In response to this problem, The University of Queensland has established the *Bright Minds*™ Project. This initiative includes an integrated package of resources and programs designed to encourage students to study science through school and university, and build a society which values science and scientists. The project includes the Advanced Study Program in Science, which provides an enhanced learning environment for high-achieving undergraduates. The Program uses a number of innovative educational approaches to help sustain students' interest in science, and enhance their critical thinking skills.

Key words: innovation, science education.

Text

The modern biotechnology revolution will be central to both our medical and economic health in the twenty-first century. Yet a worrying trend is emerging – students in the formal education system are turning away from science (Mattick, 2002). Of great concern

is that many of our brightest and highest achieving students are leading this move to abandon science as a career (Sadler, 2002). In response to this problem The University of Queensland (UQ) established the *Bright Mindsä* project. This initiative includes an integrated package of resources and programs designed to re-awaken and sustain students' interest in science. Our multiple target audiences include school students from Year 6 to 12, tertiary students of science, parents, teachers and school guidance officers.

Our mission is to increase the retention rates of students studying science as they progress through secondary school and into tertiary education. There are many hurdles to be overcome, including the perceived lack of relevance and job options, the paucity of visible role models, and the lack of opportunities for teachers to update their skills and practices. Traditional forms of science education can lead students to pursue shallow learning strategies and even develop an "undesirably naïve view" of science (Sandoval & Reiser, 2004, p. 346). Many standard teaching practices fail to adequately develop the creative and critical thinking skills valued by employers (Wood & Gentile, 2003).

One of our educational innovations to tackle these issues is the "Advanced Study Program in Science" (ASP). The ASP targets high achieving students who are entering their first year at university and are considering a research-based scientific career. We provide the ASP participants with an enriched program of undergraduate study, challenging them to broaden their horizons, improve their higher order thinking skills, and reach their full potential. The program thus aims to overcome the problem of these students becoming disenchanted with their studies as a result of boredom, or feeling that the materials they are studying are irrelevant to their career goals.

The ASP is innovative both in its emphasis on providing unparalleled access to the university's best researchers, and its emphasis on collaborative learning. In their first semester at university, the ASP students attend a series of informal seminars that introduce them to prominent research scientists, their work and their career paths. The students find this early exposure to research culture highly motivating. Another key activity is a two day field trip which provides the students with the opportunity to get to know each other and do some field-based research. Every effort is made to provide a supportive and non-competitive environment, in which the students bond to form a cohesive learning community.

The first formal course in the Advanced Study Program (ASP) is BIOL1017 Perspectives in Science. This course investigates socioscientific issues from a variety of perspectives. Experts from both the sciences and humanities are brought in to discuss possible solutions to real-world problems. Students are encouraged to integrate their university learning into these new contexts, appreciate the interdisciplinary nature of research, discuss scientific issues from an ethical perspective, and enhance their communication skills. The course also aims to improve general levels of scientific literacy and help students gain insight into the nature of science.

Both student and staff satisfaction with this program is very high. Numerous UQ staff have contributed to the seminars and group discussions, opened their laboratories to the students and agreed to act as mentors. These participants are keen to continue their involvement, largely because they find the students' enthusiasm and program format invigorating. Applications from students far exceed the number of positions available in the ASP (in 2002 and 2003 the quota was 40 students per year, this was increased to 50 in 2004). Student entry into the program is by written application and interview. There is a good level of awareness of the program, and vacant positions are readily filled.

We believe it is important to encourage and retain the interest of those who gravitate toward science and technology, so that they are positively predisposed to considering a career in the area. Of course, not all students will want to be scientists – but in our increasingly technologically complex world, all students will benefit from possessing a greater level of scientific literacy. Our goal is to both encourage students to study science through school and university, and help build a society which values science and scientists.

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SCIENCE COMMUNICATION AT HIGHER EDUCATION INSTITUTIONS: A RELATIONSHIP STUDY BETWEEN THE KEY ROLE PLAYERS IN SOUTH AFRICA

Elsabé Conradie[1] and Anske Grobler[2]

[1]Director Corporate Communication and Marketing. University of Pretoria, Pretoria, 0002. Tel.: +12 420 2211, fax: +12 420 2262, elsabe.conradie@up.ac.za

[2]Head: Communication Management, Department of Marketing and Communication Management. University of Pretoria, Pretoria, 0002. Tel.: +12 420 2306, fax: +12 362 5085, anske@postino.up.ac.za

Abstract

The core of South African scientists is centred at Higher Education Institutions (HEI). HEI is a valuable source of scientific knowledge. A major function of Communication Specialists at HEI is communicating science to stakeholders, especially the youth. South African born Mark Shuttleworth is a walking example of motivating young children to become aware of the importance of science. More examples like these are required to enhance science. Although study results have not been finalised, it is clear that science messages do not reach the youth and other stakeholders in South Africa effectively. An improved focus on science journalism is required.

Key words: role player relationships, trust, empowerment.

Text

South African context of science communication

Challenges

South Africa, as a developing country is even more dependent on science and technology to support industries in order to reach informed decisions and to be competitive in the international marketplace. However, most people cannot distinguish between scientific, non-scientific or pseudo-scientific subjects. For these reasons, communicating science to various stakeholders –schools, government, decision-makers, general public and the media– is a necessity.

Although the covering of topics referring to science is increasing in the media, highly

technical, sometimes biased articles often dominate the media (Joubert, 2001: 324).
The youth does not receive the correct information and therefore does not understand the importance of science. More role models like South African born Mark Shuttleworth –space shuttle guest to the moon in 2001– should participate in endeavors to promote science amongst the youth.
Another challenge is to raise awareness and enthuse young people about the practical applications of science. By actively engaging learners in the scientific process of observation, interpretation and verification of information, a positive attitude towards science is instilled.

Tools
South Africa has initiated a number of science activities to communicate science to the public. Communication specialists at HEI are often tasked to participate in science activities, including National SET (science, engineering and technology) weeks, Sasol TechnoX and SciFest, Science Centres, Planetariums, Mobile science centres, such as the Tsebo Koloing (meaning "technology in motion") truck of the University of Pretoria to promote science to the youth.
Experilab, a small chain of science shops, have a few outlets throughout South Africa. This concept holds untapped potential, providing business opportunities and can also be an enjoyable leisure activity. The Internet also provides an important channel for direct communication between scientists and the public (Errington, 2002). South Africa should indulge in interactive web sites where scientists can respond to questions from the youth. Many indigenous cultures in South Africa have oral traditions where storytelling is the preferred way of communication. Science Theatres and soap operas as tools could improve the message of science.
Some scientists have used even poetry in the past to promote their science and other enlightened scientists have added a melody to their verse and created a song. South African scientists should be encouraged to promote their research through popular tools of communication.

Objectives

Determining the importance of science communication in South Africa
The most important single information source for the public about science and technology is the mass media. Unfortunately, South Africa lacks skilled science journalists and above all, proper training of journalists. Currently, science journalism is almost non-existing in South Africa.

Determining the relationship between key role players
Communication specialists specifically tasked to promote science are not trusted well enough by their institutions and are not empowered to make decisions on their own when science communication is applicable (Steyn & Puth, 2000: 34). A relationship of trust between key role players in science communication (Executive Management, Scientists, Communication Specialists and Journalists) empowering communication specialists to promote science is a necessity to reach the youth effectively.

Methods

A self-administered survey method was used in the study. Questionnaires were distributed to the abovementioned four populations (role players).

Results

Results of the study have not been finalised. However, the overview of the results states that science messages do not reach the youth effectively. Too many institutions do not participate in science activities and do not regard science communication as a high priority in South Africa.

A lack of trust among key role players and a lack of empowering communication specialists cause distorted messages reaching the general public, especially the youth. There seems to be no working relationship amongst role players. A shortage of training in science writing is a major concern. Very few of the role players obtained proper science writing training.

Conclusions and recommendations for the future

A recent study proofed that although there is a positive attitude towards science, there is a lack of understanding amongst the public and the youth does not obtain enough information on science (Joubert, 2002: 317). In South Africa the coverage of science in the media is generally very low.

Practitioners of science communication, particularly the younger generation, lack a network and work largely in isolation, with no capacity to act and lobby as an influential group. South Africa needs a more sustained and coordinated effort, backed by research, infrastructure and expertise.

Training is required for journalists, scientists and communication specialists to write about and broadcast science in various languages so that it can be comprehended by the youth. There is no graduate course in South Africa for science students wanting to specialise in science communication.

Communication specialists could be used more effectively to promote research findings, profile science achievers and build media relations with scientists and journalists to communicate science to the youth.

To enhance relationship with the young generation, communication specialists must take part in organising structured visits to science events and institutions and invite schools to interesting science experiments.

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¿CÓMO VES? A POPULARIZATION OF SCIENCE MAGAZINE FOR TEENAGERS

Martha Duhne Backhauss

Revista ¿Cómo Ves? *Dirección General de Divulgación de la Ciencia de la Universidad Nacional Autónoma de México. Edificio C del Museo Universum, 3er. Piso, Zona Cultural, C.U., Coyoacán 04510, México, D.F. Tel.: (55) 56 22 72 98, (55) 56 22 72 97, fax: (55) 54 24 01 38, mduhne@universum.unam.mx*

Abstract
¿Cómo Ves? is a magazine edited by the Universidad Nacional Autónoma de México, UNAM, with the purpose of offering its readers (mostly teenagers) a true and comprehensive panorama of different scientific themes.
¿Cómo Ves? has been published, in a monthly basis, for more than five years, which in Mexico, a country where science themes are almost non existent in the media, is a great achivement. With the idea of making it accessible to low income students, it is the cheapest popularization of science magazine in the country. This is possible because 70% of the cost of the magazine is financed by the UNAM and 30% by the readers.

Key words: popularization of science magazine.

Text

¿Cómo Ves? is a monthly magazine of the Dirección General de Divulgación de la Ciencia, an institution of the UNAM, and has been published monthly without interruption since december 1998.

Objectives

The main objective of the magazine is to give our readers a true and comprehensive panorama of different scientific themes. We are convinced that popularization of science is much more than a translation of a complex language to a more understandable one, or just a way to simplify scientific knowledge in order to make it more digestible. Our aim is that our readers understand the way science explains the world, and the paths science is obliged to travel in order to achieve its objectives, its methods and procedures, how scientific knowledge is validated, and that this knowledge is continually changing.

Methods

The magazine is divided in 15 sections (among others, science news, books, movies and web pages reviews, history of science and technology, a page written by students) and five articles.
We have a group of seven senior editors, and the editorial staff is integrated by five persons (editor, assistant editor, chief of information, chief of redaction, and designer), and two editorial assistants.
The articles are written by scientists, teachers and journalists. Each article is examined by the staff and the editorial assistants. If accepted, we ask the authors to make the changes wee think the article needs. The author has to go through and accept, the final version of the article and of the images we suggest.

Results

In more than five years, *¿Cómo Ves?* has been able to position itself in a very competitive editorial market and is recognized as a magazine that offers attractive articles for teenagers, with the depth and precision that scientific themes require. We publish 17,000 magazines monthly and it is 40 pages long.
Our readers are mainly students, but the magazine is also read by teachers, scientists and other professionals. It is also distributed by the Ministry of Public Education in 600 public school libraries.
We are very interested in communicating with our readers, and we constantly receive letters in our e-mail address, asking questions or suggesting themes. We take them into account when we are planning future contents.
Last year *¿Cómo Ves?* obtained an important recognition, awarded by UNESCO and the

Red de Popularización de la Ciencia y la Tecnología para América Latina y el Caribe, for the best popularization of science programme.

Conclusions

The main conclusion we have, is that there are many young persons interested in science, willing to make an effort to try to understand complex problems, if their interests are taken into account, and the different themes are treated with depth and are well explained. This is truly amazing, if you take a look at the lack of popularization of science materials that reach the media in Mexico. For example, in open television, that is what the vast majority of people consume, programmes with scientific contents, account for less than 1.5% of the total. And almost all of these, are not produced in Mexico.

A project like this magazine, depends on the quality of its contents, and this is made possible by the support we get from the scientific community, specially from the researchers from the UNAM.

We feel it is very important for the magazine to talk about Mexican scientists, what they are working on, what worries them, and how they contribute to the development of Mexico. One of our most important objectives is to reach to low income students, and that is made possible with the financial support of the University.

It would have been impossible for *¿Cómo Ves?* to reach our readers if this magazine was not project of the Dirección General de Divulgación de la Ciencia, an institution that for more than 30 years has been developing popularization of science programmes in museums, magazines, books, radio and television.

Lessons learned

In fiver years, we have learned about the weight the images and the design have on our readers, specially because they are mainly students, and if they don't like the way the magazine looks like, probably they won´t take the trouble of reading it.

We have also learned that our duty is not only to inform, but to transmit the passion we feel for science. *¿Cómo Ves?* is not a scientific journal, so we need to learn to reach not only our reader's minds, but also their hearts. Our best articles were written by authors that have a lot of information, but also have a vast culture, can write well and love the theme they are writing about.

SOUTH KOREAN YOUTHS' IMPRESSIONS OF THE SCIENTIST: A NATIONAL SURVEY ANALYSIS

Hak-Soo Kim

Ph.D., Professor of Science Communication, Chair of The Academy for Scientific Culture, Sogang University, C.P.O. Box 1142, Seoul, South Korea. Fax: +82-2-705-8184 (school), hskim@sogang.ac.kr

Abstract

This study shows impressions of the scientist that Korean youths hold. The "impression" concept, indicating salience and consequentiality of an object, differs from the more identificatory "image" concept. Most elements composing those impressions are found to be related to activities (not products) of the scientist, and most cognitive relations composing them imply "power" of the scientist. And the impressions seem to originate mostly from television and books rather than from school classes.

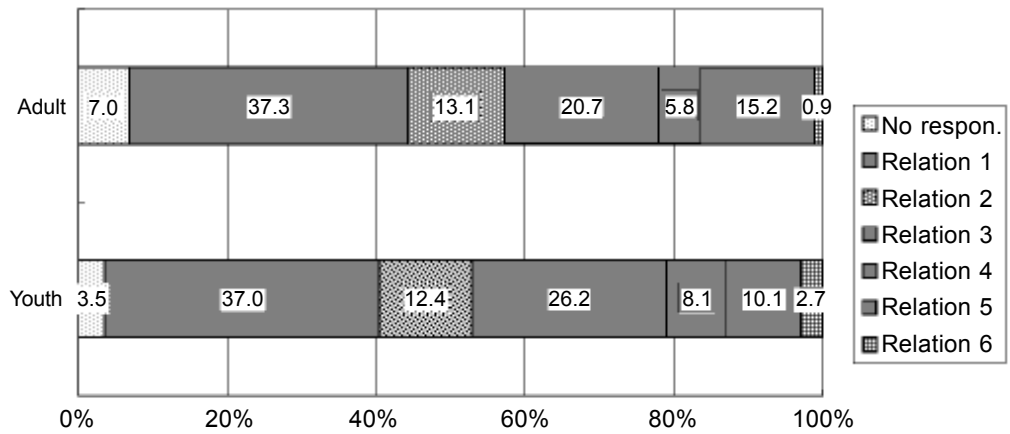
Key words: scientist's impression, scientist's image, source of scientist's impression.

Text

The main purpose of this paper is to present Korean youths' impressions of the scientist, which are considered to be products of science communication. And then we explore how to improve them. Here, the concept of impression is assumed to reflect our consequential and salient view of an object – better than that of image, usually limited to our identification of an object. Thus, we are more likely to behave in a certain way toward an object, here the scientist, based on an impression that is conceived to be "significant" and "meaningful" at a particular time and place. The impression is composed of at minimum one element evoked in relation to the scientist and using one cognitive relation that connects the scientist with that evoked element.
In late August and early September 2002, a national face-to-face interview survey of 1,204 youths (406 for 5th grade; 381 for 8th grade; and 417 for 11th grade) was conducted to find the South Korean youths' impressions of the scientist. Our major finding is that the most elements evoked in relation to the word scientist (41.9%) are the scientist's activities such as inventing, experimenting, researching, etc. (Table 1).

A surprise is that the youths unlike adults are not impressed most by the class of accomplishments or products (e.g. automobile, airplane, refrigerator, television set, etc) of the scientist. The youths are found to compose their impressions of the scientist with two major cognitive relations: the evoked element being part of the scientist (37.0%) and being a consequence of the scientist (26.2%) (Figure 1).

Figure 1 The Proportions of the Korean Adults' and Youths' Cognitive Relations Used to Compose Impressions of the Scientist
(Q: How do you relate the evoked element to the scientist?)



The relations on the right indicate as follows:
Relation 1: an evoked element is part of the scientist; **Relation 2**: the scientist is part of an evoked element; **Relation 3**: an evoked element is consequence of the scientist; **Relation 4**: the scientist is consequence of an evoked element; **Relation 5**: an evoked element and the scientist are the same thing; **Relation 6**: an evoked element is no scientist.

Table 1 Elements of the Korean Youths' and Adults' Impressions of the Scientist
(Q: What first comes to your mind as you hear the word "Scientist"?)

Class	Category	Element	By Youths*		By Adults**	
			(%)	(%)	(%)	(%)
Activity-related	Activity itself		26.7	41.9	15.2	24.9
	Tools		11.7		3.7	
	Jargons		1.2		0	
	Activity evaluation	Positive	0.9		3.4	
		Negative	1.2		2.6	
	Study activity		0.2		0	
Human characteristics	Common char.		5.4	16.0	5.3	20.6
	Evaluation of human char.	Positive	7.7		13.4	
		Negative	2		1.9	
		Neutral	0.2		0	
	Appearances		0.7		0	
Personality	Names of profession		3.1	3.1	4.2	4.2
	Specific names	Famous scientist	13.9	14.0	8.3	8.3
		Acquaintances	0.1			
Affiliated organization			1.3	1.3	5.3	5.3
Fields	General		3.4	8.7	7.4	7.4
	Specific		5.3			
Accomplishments	Specific		9.4	11.5	15.1	19.5
	General	Positive	1.8		4	
		Negative	0.2		0.1	
		Neutral	0.1		0.3	
Socio-economic conditions	Economic	Rich	0.1	0.8	0.6	0.6
		Poor	0			
		Middle	0.5			
	Status		0.2		0	
Mass media-related			0.4	0.4	0	0.0
Others			1.5	1.5	1.9	1.9
No Response			0.3	0.3	7.2	7.2
None			0.7	0.7	0	0.0
Sum			100	100.0	100	100.0

* National survey of youths(1212) impression of "the scientist" in 2002: 5th grade, 8th grade, and 11th grade.
** National survey of adults(1161) impression of "the SET"(Scientist-Engineer-Technician) in 1999.

Table 2 Sources of the Youths' Impressions of the Scientist
(Q: Where do you get mostly such an impression of the scientist?

Sources		Freq.	(%)
Mass media	TV	350	28.9
	Movie	31	2.6
	Radio	2	0.2
	Book	371	30.6
	Newspaper	12	1.0
	Internet	2	0.2
	Other	14	1.2
	School class	152	12.5
	Acquaintance	24	2.0
	Off-school activity	11	0.9
	Daily life	11	0.9
	Common sense	48	4.0
	Other	42	3.5
	No response	110	9.1
	No recall	6	0.5
	None	21	1.7
	Don't know	5	0.4
	Sum	1212	100.0

This implies a scientist's power to control or make a difference in the evoked element. These impressions are found to originate mostly from books (more for the primary school students) and television (more for the middle and high school students) rather than from school classes (Table 2). Also, the youths seem to be most impressed by Edison and Einstein (Table 3).

Finally, our suggestion for enhancing the youths' "consequential" impressions of the scientist is that we had better make them more aware of accomplishments and products through television and books.

Table 3 The Youths' Personality-related Impression of the Scientist
(Q: Who first comes to your mind as you hear the word "Scientist"?)

Personality	Freq.	(%)
Edison	434	37.2
Einstein	373	31.9
Newton	71	6.1
Yong-Sil Chang	61	5.2
Nobel	42	3.6
Marie Curie	32	2.7
School teacher	22	1.9
Stephen Hocking	20	1.7
Chang-Choon Woo	11	0.9
Pavro	8	0.7
Parent	7	0.6
King Sejong	6	0.5
Bell	6	0.5
Wright Brothers	5	0.4
Hue-So Lee	5	0.4
Galileo	5	0.4
Other	60	5.1
Sum	1168	100

SCIENCE POPULARISATION AMONGST CHILDREN IN EARTHQUAKE AFFECTED AREAS OF KUTCH THROUGH LOW-COST SCIENCE

Abhay R. Kothari[1] *and Kathan Kothari*[2]

[1]Manthan Educational Programme Society, C/1 Sukruti, Manekbag, Ahmedabad-380015. India. Phone: 91 79 26766571, manthan@satyam.net.in

[2]National Institute of Design, Paldi, Ahmedabad-380007. India. Phone: 91 79 31055176, kathan@nid.edu

Introduction

January 26, 2000 is a date which will remain etched in the minds of the people of Gujarat for years to come. For, this was the day when a devastating earthquake ripped through parts of Gujarat and created havoc. The earthquake measuring 6.8 on the "Richter's Scale" resulted in around 10,000 casualties and left thousands of others injured and disabled for life. Moreover, there was a terrific toll on wealth and property too. All major cities of Gujarat like Ahmedabad, Bhuj, Surat, Rajkot, Surendranagar, Jamnagar, Banaskantha, etc were affected.

The people were traumatized and stalked with fear due to their lack of knowledge about the scientific basis of an earthquake. For them, this was God's way of punishing them for some unknown sacrilege that they might have committed. It was difficult to educate the illiterate folk of Gujarat in the midst of belief in superstition and black magic.
The effect of such disasters on children was the strongest since they were not able to understand and interpret the happenings around them easily and also developed a lot of irrational fears in the absence of proper guidance.
At this point, 'Manthan' our NGO stepped in and pledged to help these victims by providing them proper scientific knowledge of what earthquakes really are and how one can tackle the aftershocks. The widespread myths and queries about this natural calamity were handled in an easy play-way method in order to make it comfortable for the unlettered folk and especially the children to understand and accept the knowledge.
The experience that Manthan had gained by working in Latur, a village in Maharashtra which had been hit by an earthquake in September, 1993 resulting in 9783 deaths was useful in getting an insight into the fear psychosis that an earthquake creates in the minds of people.

Aim

The aim of the project undertaken by Manthan was 'Popularization of Science' amongst children in earthquake affected areas of Kutch through low cost science communication aids.
Secondly the project also aimed at removing the myths associated with earthquakes in the quake-hit areas of Kutch. In nature, there are only consequences.

Methodology

Manthan's methodology mainly focused on communicating science to the children by means of very simply but highly effective low-cost tools. Thus to serve this purpose, the following steps were taken:

"Understanding Earthquakes" activity kits for children

First of its kind in the whole country, these innovative kits consisted of around 25 scientific toys and activity material to understand what are earthquakes, why they take place, and what to do to minimize the damage when an earthquake strikes.
The unique feature of the kits was that the toys made were very simple to use and did not involve complicated technology, and yet they managed to convey important facts about earthquakes and their aftermath.
Moreover, since the toys were attractively made and colourful, the children found it easier to study apply the knowledge they had so learnt.
For example, to teach children a subject like safe structures that can resist earthquakes, colourful cardboard pieces were provided in the kit and instructions given as to join them in different ways to come up with weak and strong structures, roofs, walls etc.
Another interesting toy was a horizontal spring called 'slinky' which could be vibrated in different directions to illustrate the types of seismic ways and educate the children about the extent of damage done by them.
Along with these, the kit also included an indigenous design to make a home-made model of a seismograph with the use of a funnel and, a bent iron rod and a card paper board and explain its working and the model of the globe on a ball to understand tectonic plates.
Secondly, activity books like flip books of fault lines on the earth's crust, maps to colour

and display the seismic zones of India and booklets elaborating on earthquake related terms and 'frequently asked questions' were prepared too.
Also, a mini book of Dos and Don'ts during and after an earthquake, multicoloured sheets giving information on seismological observatories, magnitude and impact of earthquakes of different scales and on the lithosphere were included in the kit.
Around 500 such kits were distributed in Kutch and other nearby earthquake hit areas and more are now being prepared to provide information in the other earthquake sensitive regions of India where though the calamity has not taken place yet, but it is just waiting to strike.
Thus topics like building sciences and seismology were understood by children to some extent by a very child-friendly medium.
An important thing to be mentioned here is that in this endeavour, Manthan was supported by the Department of Science and Technology, Government of India and Vigyan Prasar.

Workshops
Manthan also conducted workshops in 32 villages to explain various facts, concepts and precautions related to earthquakes using lectures and paraphernalia like charts, graphical displays, models, etc. Children were made to draw and paint so that they had a decent outlet to express their trauma and the phobias that they associated with earthquakes. These workshops also facilitated the distribution and usage of the "Understanding Earthquake" kits. During the workshops, games on safety, camps and informal events were also conducted to communicate messages regarding earthquakes. We also developed low cost disaster mitigation material and distributed it to schools and village groups.

Exhibitions
A very exclusive project undertaken by Manthan was in the form of exhibitions put up on camel-carts. These low cost mobile exhibitions were making use of the animal found commonly in the desert and something which would easily attract and sustain the interest of both children and adults. On such camel-carts, posters giving information on pre and post earthquake precautions, awareness charts on the distribution system of relief material etc were displayed and the counselors of Manthan were instructed to give vital information on earthquake related issues. In this manner, we managed to effectively combine local knowledge with modern technology to come up with the unique idea of exhibiting things on a camel-cart.
A thing to be noted here is that apart from working in the education sector, Manthan also conducted useful trainings on the health care services provided during the earthquake.

Results
The short term result of this venture was that children managed to overcome some of their fears about earthquakes and they gained a lot of information and insight which would help them in the long run.
The pictorial representation of their thoughts and fears resulted in a kind of catharsis of pent-up emotions.
The project helped people to shed their fears regarding earthquakes as with the technical know-how on the subject, their many myths were shattered.
Their ignorance had made them victims of superstition, but with this new found knowledge, they were better equipped to handle stress.

A network of NGOs doing work in earthquake prone areas emerged and is still developing.
It would be useful to point out those NGOs like 'Kutch Mahila Vikas Mandal', 'Prayas' and 'Ganthar' that they adopted this approach in popularizing earthquake related material amongst the quake-hit masses.
A long term further three years programme was designed to be conducted not just in Kutch but also in other seismic areas all over India. 10,000 kits are produced and distributed by Vigyan Prasar, DST, Govt. Of India.
Primarily under this programme, the earthquake prone North-East region of the country is being covered by Manthan, where the "Understanding Earthquake" kits are being distributed.
The earthquake related material prepared by Manthan is being translated in many languages so that it can be used more extensively.
An important aspect of the project is that due to its continuous nature and work with a large cross-section of people, mathematical estimates could not be prepared. It is a learning process that is still going on and being updated by us and so, statistics are not available about the extent of the reach of our project in different areas.

Conclusions

These kind of low-cost science popularization material and methods help in broadening the perspective of people with regard to science. They are instrumental in disbanding a range of superstitious beliefs and myths which obstruct logical thinking and are prevalent in rural areas. These kinds of scientific tools should be used in developing countries as they are easy on budget and help in creating a scientific temper in the masses which is also the ultimate goal of Manthan. Preparedness and understanding of earthquakes will help us in making our life more secure.
Nature can be both kind and unkind, the earthquakes are an unkind manifestation of nature which can't be predicted or controlled, but we must conquer them by the weapon of knowledge.

'MOTHEO' IKS PROJECT: PROMOTING THE STATUS OF INDIGENOUS KNOWLEDGE AMONG THE YOUTH BY ENGAGING LEARNERS IN PROCESSES REFLECTING ITS SCIENTIFIC AND SOCIO-ECONOMIC VALUE

Mfalatsane Priscillah Luka

Council for Scientific and Industrial Research, P. O. Box 395, Pretoria, 0001. Tel.: +27 12 841 2868, fax: +27 12 841 3011, sluka@csir.co.za

Abstract

MOTHEO Indigenous Knowledge Systems (IKS) Project was developed from the concern African indigenous knowledge is gradually losing its status and also running the risk of being eroded. Custodians of indigenous knowledge, mainly elderly women and traditional healers do not have a system of recording this valuable knowledge. Due to the erosion of traditional mechanisms through which indigenous knowledge was transmitted from generation to generation, most of the younger generation, captured by western influence and formal education do not embrace indigenous knowledge and perceive it as backward and inferior. This state of affairs has to be reversed if the current drive to promote, develop and protect IKS

in South Africa has to succeed. It is important to create the awareness among young people that IKS is a 'science' and that what makes it different from western science is the social, economic, political and cultural context.

Text

Context

There is a greater realization now in South Africa and other African countries, that development is to a large extent context-bound and that knowledge systems other than the dominant Western knowledge systems should occupy their rightful place in development theory and practice. However, there is still a lingering impression that IKSs are not on par with Western knowledge systems and this perception is contributing towards the erosion of indigenous knowledge. This false impression is also perpetuated by the capturing of the 'newly modernised groups' and in particular young people by western influence and formal education which does not incorporate concepts of IKS.

What this project would like to achieve is to create the awareness of the young people that traditional knowledge like the so-called modern science, is a 'science' in its own right. What makes traditional knowledge different from modern science is that it is a product of culture informed by social, economic and political context in which it is applied.

South Africa therefore needs to develop a corpus of academics and scientists who can contribute to both the gradual transformation of scientific ethos, ethics and practice as well as towards the development of a strong system of protocols for development and protection of indigenous knowledge systems (Odora Hoppers, 2002).

It is against this background that the process of engaging learners in IKS dialogue and in documenting and recording scientific processes and other valuable uses of indigenous knowledge was initiated. The project is officially.

Objectives

Primary objective: To de-stigmatize IKS by creating the awareness of learners of its scientific and socio-economic value and the role it can play in sustainable socio-economic development.

Secondary objectives are: To popularize indigenous knowledge systems and their related science and technology amongst schools and in communities.

To identify IK systems still practiced and biodiversity in the area as well as associated contemporary threats.

To create a database for storage and protection of gathered information as well as acknowledgement of the source.

To establish Community-Based IKS Study Groups in participating schools.

To facilitate the development and presentation of an IKS bridging course to empower and strengthen the capacity of knowledge holders and other interest groups.

Project Design

Target Groups: The project targeted Grade 11 learners from selected 10 high schools in the North West Province.

Project Approach: Learners were given an assignment using a well structure questionnaire to interview known custodians of IKS in their local villages for the purpose of collecting information that will create their awareness of the scientific and socio-economic value of indigenous knowledge. The challenge for learners was also to determine the

commercialization potential of some of the indigenous resources identified. This exercise exposed learners to the S&T areas where IKS can be incorporated, such as pharmacology, biotechnology, etc.
An example is presented on the following table:

Indigenous Herbs

Types of Herbs	What they are used for		Types of Ailments used for	Any Myths?
	Medicinal	Nutritional		

Indigenous Skills/technologies used for preservation and processing of Herbs

Methods e.g. drying	Description of the process	Relationship or linkages to modern S&T	Weaknesses and Strengths	Any Myths?

Indigenous methods of conservation

Methods of Conservation	Are these methods still used/relevant	Strengths	Weaknesses	Opportunities

Scientific and economic value

Opportunities for Propagation	Opportunities for Value-Adding

Achievements
The project succeeded to generate interest among participating learners and teachers in indigenous knowledge. Awareness of the scientific and socio-economic value of this knowledge was created. It was also an effective strategy to start a dialogue between the youth and custodians of indigenous knowledge and also to link science and society. The project is now replicated to other 30 schools in the North West Province.

Conclusion
This project will promote the following areas of transformation:
Equity and redress of historic imbalances: This project will empower learners and communities to protect IKS by ensuring that it is not used without their approval and that commercialization strategies developed will promote equitable sharing of benefits.
Nation Building: A nation without culture is like a tree without roots – dead. This project will promote the preservation and conservation of IKS by restoring its status and removing the stigma attached to it, particularly among the youth.

Skills Transfer: Participating groups will be trained to capture and document indigenous knowledge. Various skills will be transferred to participants – from the theory of propagation of plants and herbs to the technologies of production, processing and packaging of new products.
Creation of partnerships and opportunities for disadvantaged communities: Disadvantaged communities will form partnerships with community schools, academic institutions, government and science and technology institutions.

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SCIENTISTS@WORK: BRINGING YOUNGSTERS IN A BIOTECH LAB

Sooike Stoops and Ann Van Gysel

VIB, The Flanders Interuniversity Institute of Biotechnology, Rijvisschestraat 120, 9052 Ghent, Belgium. Tel.: +32 9 244 66 11, fax: +32 9 244 66 10, sooike.stoops@vib.be, ann.vangysel@vib.be

Abstract

Many teachers of 16-18 year olds plan experiments in life sciences with their pupils, but they only have limited means. scientists@work offers them the possibility of working with a scientific team in a laboratory.
In accordance with techniques that teachers identified, VIB selected projects. Classes choose one project. The hosting scientist provides information, pupils can also ask other European scientists questions. By recording the results the group enters the competition. Finally ten finalists present their project.
868 students from 54 schools participated in this first edition. The enthusiasm of schools and scientists shows that this project answers to unfulfilled needs.

Key words: school competition, life sciences, laboratory, experiments, hands on.

Text

Context

In accordance with the curriculum, many teachers in the 2nd and 3rd grade secondary school (14-18 years old) are planning, together with their pupils, to carry out a scientific experiment in life sciences. With scientists@work, VIB offers them the possibility of doing this together with a real academic or industrial scientific team.

Objective
The unique thing about this project is that it builds a bridge between education and research, demands a clearly defined input, enables different teachers to work together and stimulates creativity. VIB aims to acquaint unbiased young people with the life of a scientist, and hopes that this would stimulate them to opt for science-oriented studies.

Methods
All information teachers need to work out a project with their class is provided on www.scientistsatwork.be; this Dutch-language website, together with contact through email, leads them through the competition. In accordance with the techniques that teachers have identified, VIB gathered –for the first edition– 41 scientific projects in academic and industrial biotech laboratories with a broad variation in topics and techniques used. This puts teachers in the possibility to choose the most suitable project. The enumeration on the website of the foreseen techniques and some keywords per project makes this choice easier. Another important aspect is the geological distribution of the projects; it should be possible to find a project very nearby the school, which circumvents some possible logistic difficulties.
Teachers choose one project and conduct with their pupils experiments in the lab of the hosting scientist. This project-guide provides information about the lab, the research and supervises the experiments. He is not the only source of information. Pupils can also ask questions to other European scientists in the field by email. This collaboration with EFB (European Federation of Biotechnology) allows them to place their work in a broader context, which is important for the awareness of the pupils. This tool is also available for visitors of the scientists@work-website who don't take part in the competition.

A project and a competition
Each project is coached by a scientist who receives the group two afternoons (14.00 - 16.30 hrs) in his lab. He provides the pupils with information about the lab, the research and together they will perform experiments or a part of them combined with a demonstration. They are to record their results and findings in a concluding essay, which must comply with a number of criteria:

1. The work must comprise an introduction, materials and methods, results, conclusions, summary, references and presentation of the group:
Introduction: location of the test, how the test fits in with the guide's research, what that research is, interactions with scientists from abroad, etc.
Materials and methods: how the test was carried out:
- Results: what test was carried out and its results
- Conclusions: what can be concluded from the test
- References: references to articles or sources that were used in this work
  Summary: max. 1 to 2 pages
- Presentation of group: who took part and who did what (attach group photo).

2. The use of figures and illustrations is free.
3. Language: Dutch.
VIB puts the summaries of the essays together to publish them in a booklet.
Provided the concluding essay is entered in time, the group takes automatically part in the scientists@work competition.

An independent jury selects 10 finalists from the essays that have been sent in. The most important criterion for being selected is the production of a final essay with strong content. Those selected are given an opportunity at the final happening in Ghent to present their project to the general public by means of a poster and a verbal presentation of 7 minutes per team with room for questions of the jury. This jury selects the three winners, who receive a prize.

Results

The success rate of this first year's edition is enormous. 868 students from 54 schools participated and have chosen one of the 41 projects. 37 scientists from universities, colleges and companies guide the 79 teams. 51 class groups handed in their final assay and on 21 April, 10 laureates presented their work in Ghent. During this final happening The Ghent University auditorium was bubbling over with energy and enthusiasm! 10 classes gave it their best and presented their scientists@work project with brio!
The winner of scientists@work2003-2004 is 'De Heilige Familie' from Sint Niklaas with their project on telomeres: 'Who gets the short end of the stick?'.
Teacher: Cor Vandevelde Team: 12 students from 6th (senior year) sciences-mathematics, Latin-mathematics and Latin-sciences Hosting scientist: Sofie Bekaert, Ghent University, Agriculture Dept., Ghent.

Conclusions

scientists@work offers students and teachers the possibility to get in touch with scientists working in a biotech lab. The enthusiasm of both parties shows that this project answers to unfulfilled needs in both the educational and scientific community.

PROMOTING SCIENCE IN DEVELOPING COUNTRIES – A YOUNG SCIENTISTS' INITIATIVE IN MOZAMBIQUE AND ANGOLA

Margarida Trindade,[1] Ana Godinho Coutinho[1,2] and Mónica Bettencourt-Dias[1,3]

[1]Association Science for Development, Portugal. www.sciencefordevelopment.org, mtrindade@sciencefordevelopment.org

[2] Instituto Gulbenkian de Ciência, Apartado 14, 2781-901 Oeiras, Portugal. Tel.: +351 214407936, fax: +351 214407970, acoutin@igc.gulbenkian.pt

[3] Department of Genetics, University of Cambridge, Downing Site, CB2 3EH- Cambridge, UK; Tel.: +44 1223 766701, fax: +44 1223 333992, mbcd2@cam.ac.uk

Abstract

Science for Development is a grass-root association of young Portuguese and African researchers, working voluntarily to promote internationalisation of scientific activity and the application of science and technology in the developing world. Activities target researchers, through technical workshops aimed at specific local demands, and junior graduates, through discussion-based courses aimed at promoting the scientific activity. We believe that the structure and mode of action of Science for Development represents an alternative to address the needs of science development in poorer countries. Today, initiatives such as this face several challenges: which tools can be developed to broaden our audience in the developing world and engage more people with science? How can the impact of activities be evaluated? How can we ensure their long-term effects?

Key words: grass roots organization; science; sustainable development.

Text

Context

It is increasingly recognized that science and technology are critically important for global sustainable development, and that developing countries can no longer be excluded from this trend. Developing countries have a huge potential in terms of natural resources, traditional knowledge and human potential. It is building on this knowledge and resources potential that a sustainable social and economic development can be ever achieved. Promoting science and technology in the developing world is now a stated objective of UNESCO[1] and, recently, two reports delivered to United Nations Secretary-General Kofi Annan make a strong appeal that developing nations should build up their scientific institutions.[2,3] As Dr. Mohamed Hassan, president of the Third World Academy of Sciences, puts it, "science alone cannot save Africa, but Africa without science cannot be saved".[4] It is therefore urgent to strengthen skilled research communities, and make them capable of translating scientific knowledge into technological solutions for social and economical problems.

While governments and international bodies publicly recognize that research should no longer be a luxury of richer countries, it is much less common that structures emerging from civil society attempt to address the same issues. In 2001, a group of Portuguese PhD life science students and Mozambican researchers created the not-for-profit organization Science for Development. This organization aims to support the development of strong and independent thinking scientific communities, able to act responsibly and propose well-adapted solutions to achieve sustainable development. Science for Development acts by promoting scientific careers and improving networks amongst scientific communities, in particular in countries that face language barriers in accessing scientific knowledge (such as in Portuguese speaking countries). All members of the organization have many years of experience in different fields of scientific research and are geographically distributed in five different countries of Europe, Africa and the United States of America and consequently, a broad range of scientific contacts which reflect on the quality of the activities organised.

Programme

Science for Development implements four types of activities:

1. Courses aimed at discussing the scientific activity and the application of science in developing countries. These courses use discussion and problem solving activities to alert university students from different Life Science branches (Medicine, Veterinary Sciences, Agriculture, etc) to the applications of Life Sciences and Biotechnology as ways to solve economical and social problems in developing countries. They provide tools to help to follow a career in science and to access scientific information across the world.
2. Public debates on scientific issues and the impact of science in society with the participation of the general public, governmental entities and NGOs.
3. Advanced technical workshops aimed at responding to specific local demands. These workshops bring together international specialists in a chosen topic, local researchers, and policy makers, and provide an environment for knowledge sharing and the generation of adapted recommendations for the problem under study.
4. An exchange programme that allows short-term training of young scientists and technicians in methodologies not available in their home countries. These are aimed to further increase international cooperation between research institutions.

In all activities Science for Development takes care to ensure that the approach is to stimulate critical thinking and independence, which breaks away from the scholastic attitude common in universities. This aims to develop problem-solving skills, necessary in scientific and technological research. Additionally, all activities aim to promote links between different scientific communities and institutions.

Challenges

Science for Development is now on its third year of activity. Two courses aimed at promoting the scientific activity, a public debate and an advanced workshop on veterinary research tools and approaches have taken place in Mozambique, with encouraging results. We are now extending our activities to Angola, a country recently coming out of a devastating civil war. However, this does not come without difficulties. Despite based on voluntary work and run on a project-basis funding (thus, quite cost-effective), longer-term funding strategies need to be put in place to ensure the durability of the project. Science for Development has been supported in the past by international charities, such as the Calouste Gulbenkian Foundation in Portugal and the Gatsby Foundation in the UK, by the universities and by the Ministries for Science in Portugal and in Mozambique.

Science for Development faces other challenges common to organisations involved in the promotion of science and public engagement with science, such as: Which tools can be developed to broaden our audience in the developing world and engage more young people with science? How can the impact of those tools and activities be evaluated? We are developing a website to be a resource of information and a tool for discussion and networking. This site will also have a pack of practical information on how to access scientific information through the Web, how to get funding, how to write Curricula and motivation letters as we have found this information to be very useful to the participants of our workshops. Evaluation of our activities has been based on summative questionnaires. So far, we have not performed an extensive evaluation of the impact of activities, but in the future we plan to use the website and mailing lists to establish a follow up evaluation process. In addition, we are trying to develop other forms of evaluation.

Science for Development represents an alternative created by young scientists to address the needs of science development in poorer countries. We think this is a model worth of attention and hope to motivate other young scientists to engage in these types of activities.

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WAKING-UP FOR SCIENCE OR KEEPING THE CONVERTS AWAKE?

Inês P. Mascarenhas
Calouste Gulbenkian Foundation

Abstract
There are no important societal issues at present that do not involve science or its applications. It is essential thus that we redouble our efforts in understanding the interaction between science and society. The social impact of science is directly connected to the utility of the technological solutions generated from its basic principles.
It is the duty of science to seek the dialogue with all the other true forms of knowledge in the broad communicational network that gives meaning and coherence to life.
In order to contribute to the enlargement of scientific culture in Portugal, the Calouste Gulbenkian Foundation promoted a study of the different types of public, or target publics, interested in varied science practices. The outcome of the study is the unfolding of several specific ways of relating to and circulating scientific knowledge.
Encouraging an open attitude towards nature and the environment and attracting young people to science is, for sure, a continuing need in terms of scientific culture. The experience of the series of open lectures aimed at high school student audiences "Despertar para a Ciência" is presented, as a mechanism to introduce the younger generations to the delight of discovering and the enjoyment of understanding.

Parallel session 7

PCST as a performance: looking for new audiences

SCIENCE ON STAGE!

Susana Alonso Argul and Laura Barrufet Miró
RE-CREA ACCIONS CULTURALS. Tordera 60 baixos 08012 Barcelona.
Phone: +34 93 459 45 80, fax: +34 93 457 25 12, re-crea@re-crea.info

Abstract
Reflection on the notion of science often used to be either an unpleasant, boring or very demanding task, but nowadays this has changed for the better. Evermore resources are available to bring it closer to an ever-increasing public. Our activities involve theatre as the main vehicle in the transmission of scientific concepts, in what one might call the "staging of science". These staged science-related situations are devised to create a direct and live contact with scientific processes so that museum visitors acquire scientific knowledge implicitly through their identification with the stage character or characters.

Key words: theatre, science, emotion.

Text

Science enters our daily lives through the means of communication, our leisure time, our habits of consumption and so on. Our work centres on the transmission of science in leisure time situations, using the arts. We transmit scientific concepts by drawing on the emotions that art provokes, and by means of theatrical characters and/or situations this access to science is enhanced. We therefore work with educational and instructive resources which foreground the senses and feelings, such as music, theatre, dance, taste and even smell. Our objectives would not be met, however, without the prime target of providing the visitor with a pleasurable and memorable approximation to science.

TIC Teatro Interactivo Científico (Interactive Scientific Workshop) and L'Aquàrium de Barcelona (Barcelona Aquarium)

The TIC Interactive Science Theatre is especially designed for the 3 to 10-year age group. The main goal of the activity is to immerse children into the world of science, enabling them to understand simple scientific processes without apparent effort.

So as to achieve this objective the visit was divided into two stages: the first consists of a visit to the aquaria which focuses on a series of practical demonstrations, with or without the use of gadgets, turning it into a playful and entertaining experience; and the second consists of a theatre play with the sea as its theme, which aims to consolidate the learning process.

Here, theatre is used as the instructive device that, drawing on its inherent playfulness, becomes the vehicle towards the learning of scientific concepts related to the sea. It is through their experience with different characters and plots that youngsters are provided with an easy understanding of the mechanisms that rule nature.

Image 1 "1910, un paseo por la fábrica" ("1910, a stroll through a factory"). Museu de la Ciència i la Tècnica de Catalunya (The Catalan Museum of Science and Technique)

In this particular case Technology is our focus of attention: the process of the transformation of sheep wool to fabric inside a textile factory in turn-of-the-20th-century Catalonia. The activity is designed for an adult public, but also adapted for children from 6 to 18 years.

Our proposal recreates this specific moment in Catalan history through the experiences of a group of characters –a male and female factory hand, a sales representative and the factory owner. The visit incorporates the visitors as new factory workers, and by means of various theatrical skits not only do they come to understand the technological process underlying textile production but also the social tissue that forms part of the labour history of early-industrial Catalonia.

This activity explores scientific concepts and the intimate relationship between science and society at large, as exemplified in history, economy and all sorts of social situations.

The aim of this exhibition was to show the importance of chemistry in our daily lives, its applications and its history. Due to the successful museum exhibition policy and the

demand for this kind of exhibitions, it attracted a significant number of visitors from an educational and general background.
It was specifically designed with instructive activities as an integral part, which complemented it by enabling dealing with those aspects of chemistry less easily integrated into a conventional exhibition, such as experiments, historical data and anecdotes. Moreover, the difficulty of some of the scientific concepts on display required the design of a series of accompanying explanatory activities that would be adaptable to any kind of public.

Image 2 "Todo es Química / All is Chemistry". Itinerant Exhibition, Museu de la Ciència i la Tècnica de Catalunya (The Catalan Museum of Science and Technique)

The methodology used to achieve the goals above was the incorporation of chemistry workshops as theatrical skits where chemistry was directly linked to our daily live into the staging of historical encounters between chemists of great historical importance, such as Mendeleev and Mme. Curie.

Image 3

Conclusion

When scientific concepts come to us through several senses simultaneously, they tend to leave a much stronger and broader imprint on our memories than in a strictly cognoscitive way. Leaving conceptual achievements apart, we firmly believe that intense moments of magic, amusement, solidarity and union are extremely valuable to the senses and feelings, stimulating ongoing visits to any science museum and boosting the museum visitor's will to appreciate, take care of and protect the natural environment. Therefore, when trying to make science accessible to the larger public, one should always rigorously focus on their needs, interests and individual realities, as this will boost their curiosity for unknown aspects of science. As science forms an integral part of our daily lives, we only need to establish the bridge that allows us to understand and appreciate it fully.

SCIENCE AND THEATRE: A MULTIFACETED RELATIONSHIP BETWEEN PEDAGOGICAL PURPOSE AND ARTISTIC EXPRESSION

Silvana Barbacci

ICS, Innovations in the Communication of Science SISSA-ISAS (International School for Advanced Studies, via Beirut 2-4, 34014 Trieste, Italy. Phone: +39 040 378 74 62, fax: +39 040 378 75 28, silvana.barbacci@technet.it

Abstract

This paper offers an analysis of the relationship between science and theatre. Such a connection can be twofold: either theatre is used primarily as a means for conveying scientific concepts and ideas, or it borrows its contents from science while maintaining its own features as an artistic expression. I will focus on the second form of «scientific theatre», i.e. when theatre preserves its artistic and aesthetic characteristics, thus enhancing the scientific imagination for the public.

Key words: science theatre, science communication, artistic expression.

Text

Introduction

It is quite a evidence that, in the last few years, science has been winning more and more space on the stage. Even if the results are not always the best, this facts stimulate a reflection on the possible contact points between science and theatre. Since we deal with a problematic relationship, it would seem difficult to build a structured theory. Rather, thinking of ways in which the pair "science-theatre" might be analyzed would seem more appropriate.[1]

Starting from the assumption that theatre is, first of all, an encounter between the audience and the actors,[2] I would propose the following classification for performances combining science and theatre:

1. Theatre as a set of performing techniques to support didactics.
2. Theatre deriving from the "scientific conferences" tradition.
3. Theatre posing ethical questions on the responsibility of science and scientists towards the society.
4. Theatre pointing to existential reflection.
5. Theatre staging either biographies of scientists or episodes from the history of science.
6. Theatre using certain sciences (such as neurobiology, anthropology, anatomy, cognitive sciences) as a support for the artistic creation.

There is quite a marked difference between theatre used merely to communicate science (1 and 2), and theatre maintaining its characteristic of an artistic expression, drawing elements from the scientific universe to create drama (3 to 6).
Going through the proposed classification, I can summarize the following:

Theatre with pedagogical purpose
When theatre is used as a means of supporting didactics, the performing elements (the acting area, lights, sound, images, the "dramatic vocabulary" of movement, the body and verbal language), help to lower the barriers between an inexperienced public and scientific contents through the main strengths of theatre: emotional and sensory communication.[3] Thus, the pedagogical activity is reconciled with the entertainment, the aim being to excite curiosity towards the scientific world. This practice is often applied in the museums or scientific institutions.[4]
In the same context can be placed some performances deriving from the tradition of the "scientific conferences",[5] which started in the XVII Century, coinciding with the origin of the first scientific Academies, and widely spread for the next two centuries, mostly emphasizing the facet of the "marvellous" in science and being warmly appreciated by the audience. The roots of the contemporary "science shows", frequently put on in the science centres,[6] may be found in this tradition.

Theatre drawing up motif of inspiration from science
A different scenario comes when dramatic creation is inspired by science without any specific purpose of communicating its contents.
Within this framework, I propose the following classification: plays dealing with ethical issues generated by the scientific discoveries; plays portraying episodes of famous scientists' lives; theatrical activities drawing on scientific ideas to support the creation of dramas.
Referring to the first class, the greatest example is "Galileo's life" by Bertolt Brecht. Its first revision, after the atomic bomb was dropped, was strongly centred on the responsibility of scientists towards the humanity. This theme was amply debated in the German circles, and many plays, during the 50's and the 60's, were addressed to it.[7] Most of them are not staged anymore, but worth mentioning are "The physicist" by F. Dürrenmatt and "On the matter of Julius R. Oppenheimer", by H. Kipphardt. Another theme posing ethical problems is pertaining to the creation of artificial beings similar to humans[8] (artificial intelligence and cloning are clearly evoked). In this sense RUR Rossum's Universal Robots by K. Èapek (1920) is an example.
Another class is the portrayals, mainly based on a psychological introspection and historical reconstruction of facts (e.g. Copenhagen by Michael Frayn).
In the third class all the activities that take inspiration from some sciences (such as neurophysiology, psychology, cognitive sciences, anthropology, anatomy) to improve the actor's technique[9] are included. Peter Brook, whose research is close to that area, created two performances where the "brain's sciences" are the nucleus of the drama: "Je suis un phénomène" and "L'homme qui…".

Conclusions
Having briefly summarized different facets on how theatre relates to science, I would emphasize my interest, from the point of view of a theoretical reflection on science communication, in the second form of "scientific theatre", i.e. when theatre maintaining

its artistic and aesthetic characteristics enhances an image of science as a human activity, an integral part of a culture in general.

Notes

[1] For more details see: Silvana Barbacci (2001): *Un caledoscopio magico: la scienza a teatro*, Dissertation of Master in Science Communication, Trieste: Sissa-Isas.

[2] See also: Peter Brook (1968): *The empty space*, London: Mc Gibbon &Kee, London.

[3] Among others, *L'Oracle de Delphi* on Dirac's scientific adventure, by the "Mimescope", staged for the first time at Cern, Genève (1999), is a nice exemple that effectively applies body's techniques, musics and images.

[4] Catherine Hughes (1998): *Museum Theatre: Communicating with visitors through drama*, Porthsmouth: Heineman.

[5] See also: Daniel Raichvarg (1993): *Science et Spectacle. Figures d'une rencontre,* Nice: Z'Editions.

[6] The *Klara Soppteater* in Stockholm gives contemporary examples, which can be linked to that tradition., having produced many plays where a scientist is on the stage with the actors.

[7] See also M.A. Orthofer, *The scientist on the stage: a survey*, in *Interdisciplinary science reviews*, v. 27, n. 3, Autumn 2002, Maney, London.

[8] Silvana Barbacci, *From the Golem to Artificial Intelligence: science in the theatre*, Jekyll. comm n.3, September 2002, http://jekyll.comm.sissa.it/articoli/art03_04_eng.htm

[9] See Eugenio Barba, Nicola Savaese, *The secret art of the performer*, 1990, Centre for Performance Research, Cardiff, UK, and Jean Marie Pradier, *Ethnoscenology*, http://www.artweb.univ-paris8.fr/theatre/ethnoscenology/ethnoscenology.htm

USE OF COMEDY TO TRIGGER DISCUSSION OF HOT SCIENCE TOPICS

Frank Burnet and Ben Johnson

The Graphic Science Unit, Faculty of Applied Sciences, The University of the West of England, Coldharbour Lane, Bristol, UK, BS16 1QY. Tel.: +44 11 73283756, fax: +44 11 73283919, Frank.Burnet@uwe.ac.uk, Ben.Johnson@uwe.ac.uk

Abstract

Science communicators in the UK are making increasing use of drama to promote engagement with issues raised by science and technology for society. This project used a comedy sketch based on a reality TV show to promote discussion amongst 16-19 year olds of the issues raised for them by advances in genetic screening. The results showed that the event succeeded in raising awareness of key issues but also raised questions about how to ensure that discussion is effectively facilitated and the most effective means of disseminating the project.

Key Words: Comedy, Genetics, Discussion.

Text

Context

The science communication community in the UK has been urged to move from one way communication to two way dialogue models, and project funders like the Wellcome Trust and the Research Councils now expect that projects submitted to them be designed to promote public engagement with science and technology, rather than simply understanding of it.

A consequence of this shift in emphasis has been an upsurge in the use of drama by

science communicators since it is seen as having considerable potential to trigger responses from an audience. Also scripts can include explanatory elements as well as sections designed to provoke discussion.
Ground breaking work in this area was produced by Y Touring who, in 1996, were commissioned by the Wellcome Trust to create plays aimed at young adults that used hard hitting methods to generate debate. Amongst the issues chosen were stem cell therapy [*Learning to love the grey*], genetic selection [*The Gift*] and mental illness [*Cracked*]. The approach was to commission a script from a professional playwright and have it performed by a group of five professional young actors. An innovation was that the play which ran for about 40 minutes was followed by a facilitated discussion during which the actors remained in character and the audience was drawn in to expressing opinions on key issues raised by the drama.
This approach proved very effective in stimulating discussion but was vulnerable to the criticism that it was top down, and did not allow young people to devise and perform plays that raised issues of greatest importance to them. This latter approach was the starting point for *Science Centrestage* once again the Wellcome Trust in 2001/2002 in which the science and drama teachers within secondary schools across the UK were encouraged to work with their students to devise dramas scripted and acted by them.[1]
Both these initiatives were evaluated, although not all the evaluations have been placed in the public domain.
An independent evaluation carried out on "Cracked" concluded:
"The play had a demonstrable and significant impact on student attitudes to mental health. The index scores for students who have seen the play are 28% higher for an index based on knowledge and understanding of mental illness".[2]

Objective
To build on previous initiatives by devising a low cost, easy to mount and disseminate event that used a comedy sketch to promote debate about how individual's genetic information should be used.

Method
The Graphic Science Unit devised a performance that used elements of theatre and television to draw the target audiences into engagement with the issues raised by advances in gene technology. The event called "Meet the Mighty Gene Machine" was originally devised for Czech Science Week with funding from the British Council and was first performed in Czech at the Czech Academy of Sciences in November 2003. The event began with a 12 minute comic mini-drama set in the future when a reality TV show has been based on live disclosure of individuals' genetic profiles and their implications. It then became an opportunity for the audience to discuss their attitudes to the use of their own genetic information in a number of contexts including, diagnosis of disease susceptibility, solving crimes and buying insurance. This discussion was facilitated by the performers one of whom invented the machine and the other who has just been embarrassed by its disclosures on his own TV show.

Results
In Prague, the event was targeted at 16-19 year olds and the discussion, which was prompted by questions posed by the facilitators, continued for over 30 minutes at every performance. Subsequent evaluation using questionnaires showed that reactions of the

target audience were positive with 62% of the participants reporting that the event had stimulated them to think abut the issues raised by the human genome project and genetic screening. A full evaluation is available from http://www.uwe.ac.uk/fas/graphicscience/projects/evalgene_machine.htm. However, some of the scientists who attended the event felt that it should have focused more on explaining the science behind the technology.

Conclusions

Comedy can be used as a way of drawing young adults into discussing issues raised by science and technology within society and the stimulus piece of theatre can be short and simple to stage and perform. Discussion following the stimulus is extended by the use of two facilitators, who mix with the audience, and use a series of prompt questions to initiate discussion. Further issues that now need to be addressed are who are the ideal performers in such an event and how to construct an effective dissemination strategy.

Notes

[1] The Wellcome Trust (2002, September) Retrieved May 5,2004 from http://www.wellcome.ac.uk/en/scs/home.html

[2] Evaluation Associates (2001, June) Retrieved May 6 2004 from http://www.evaluation.co.uk/library/c&c/cracked.htm

1905-2005: A CELEBRATION OF ALBERT EINSTEIN'S "ANNUS MIRABILIS"

Xavier Calvó[1] and Núria Pérez[2]

[1]Col·legi Sagrada Família-Horta (Barcelona). arjuna03@terra.es

[2]Observatori de la Comunicació Científica (OCC). Universitat Pompeu Fabra (Barcelona), nuriap.perez@upf.edu

Abstract

Teaching science should be considered as science communication and the History of Science as a right tool for it. History of Science allows us to interpret, to identify and to know which events are responsible for the main accepted theories, the obstacles that troubled their appearance and development or which facts contributed to them. History also permits the identification of the concepts which permitted the transformation of a science, the construction of a new theory or the use of new methods and new conceptual instruments and the social context in which their development took place. Using the History of Science in the Secondary School may allow both, the educators to communicate science contextualizing the scientific issues, and the pupils to understand that science is not "one man's work" and that the production of scientific knowledge is inserted in a social dynamics.

Key words: History of Science, Communication, Education.

Text

Science is an inseparable part of nowadays culture. Today, the vision of the world of men and women is, in great measure, conditioned by scientific knowledge and their technological applications. But, in the other hand, the image of science has been simplified and distorted because their historical and philosophical aspects had not been under consideration. Science has never been so obscure, but, at the same time, had never appealed such a great public interest. In past times, science was only one more piece in

human culture, with no direct implications in everyday life. Today, science is present in the social life and has become a collective enterprise that moves great amounts of funding. It is important to stress the social function of science communication, so to say, the need to transmit this knowledge, the processes and the technologies available to reach it. In this frame, success depends, in great measure, on the abilities of the science communicator to settle bridges between pre-established knowledge and audiences' expectations, to elaborate discourses which allow to adequate the context to every new situation, for example, the teaching of science, considered as a form of scientific communication.
Following a previous educational experience on the celebration of Watson & Crick's Double Helix Model, we present a new attempt to communicate science at secondary School level using Einstein's relativity papers celebration in 2005, emphasizing the historical and the scientific context. Within the context of a scientific meeting, and considering that our audience knows the basic features of twentieth century Physics at a very basic level, our aim is to situate Einstein's publications in the frame of the first two decades of the 20th Century, between Max Planck's hypothesis and Niels Bohr's model of the atom. On the other hand, and related to the social context, we must not forget Einstein as a social icon, a public image that, sometimes, hides the scientist, but shows a scientific communicator and a committed man.
We justify this celebration for two reasons. The first one, trying to contextualize some scientific facts which are in our educational programs. The second one, our previous experience on DNA, which was well accepted by our pupils and also in the first meeting on History of Science and Teaching, celebrated in Barcelona during November, 2003.

Material

1. "Einstein seen as scientific communicator", by Xavier Roqué, published in *Quark*, 26.
2. Book review from "Einstein 1905: un año milagroso", published by one the authors in *Quark*, 31.
3. Einstein's paper "My Theory", from *The Times*, 28 November 1919, Spanish version.
4. Einstein's letter to Sigmund Freud, "Por qué la guerra", 1932, published in Spanish by Editorial Minúscula.
5. Einstein's letters to Franklin D. Roosevelt.

These materials should be delivered to our audience one week before the meeting.
Programme:

00.00: Presentation of the activity.
00.10: The 1905 papers: a scientific communication perspective.
00.25: Albert Einstein: a man and his time.
00.40: Any other business.
00.50: "coffee end".

Evaluation of the experience:
A brief questionnaire will be presented to our audience in order to evaluate:

1. The whole experience from 0 to 10.
2. Possibilities to extend this kind of activity to other teaching areas.
3. Suggestions about future experiences.

Conclusions
Before the delivery of this paper to the PCST organization, one of the authors essayed it with pupils at the secondary School level, with little knowledge of physics and history of science. The aim of this trial was to evaluate their possibilities and the convenience of the

materials. We must point out the special difficulties in understanding the issues related to relativity. But, on the other hand, the historical approach was well understood.

Acknowledgments
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SCIENCE CONSULTANTS, FICTIONAL FILMS, AND THE "WAR GAMES EFFECT"

David A. Kirby

Center for Teaching, Learning, and Writing, Duke University, Durham, NC 27708-0025, USA.
Tel.: 919 660 7091, dkirby@duke.edu

Abstract
Scientists often consult on Hollywood films because they believe that fictional films will heighten awareness of their research areas. Fictional films are very persuasive promotional tools because scientists and filmmakers create representations with the purpose of convincing audiences that these images accurately reflect the "natural world." In addition, these representations are embedded in a narrative framework designed to encourage this belief and further the impression that the scientific scenarios are plausible. Fictional film's ability to create images of "scientific possibilities," both positive and negative, convinces scientists that "realistic" depictions will enhance funding opportunities and promote research agendas.

Key words: Film, Scientific Promotion, Representation.

Text

Many scholars have demonstrated that scientific popularization often functions as a promotional activity. Scientists who consult on fictional films are engaged in a mode of popularization that has a unique capacity as propaganda. By helping craft scientific images in high profile Hollywood films, scientific organizations and individual science consultants are able to focus the public's attention on a particular scientific issue or area. Many consultants perceive the intensely popular medium of Hollywood films as a great way to promote their science and draw the public eye to their research. By helping to construct more "realistic" depictions scientists increase the rhetorical power of a film's message.
It is fictional film's ability to create an image of "scientific possibilities" in the audience's mind that leads scientists to believe that "realistic" depiction can lead to higher funding levels. In a previous article (Kirby, 2003), I explore how film acts as a "virtual witnessing technology." Fictional cinema is particularly useful as a virtual witnessing technology

because scientific representations in film are embedded in a narrative framework designed to highlight the representation's "reality" and to make opaque its construction. Joel Black (2001) highlights fictional film's ability to make people believe they have witnessed "reality," saying that it is film's nature to "make things explicit – to reveal or display the world in an evidentiary sense that is beyond the capability of traditional representational or art media" (8, italics in original). Film, then, can work as a powerful virtual witnessing technology because of this evidentiary element.

Often, consultants will proclaim that the film on which they are working highlights an issue that requires more funding. Near-Earth-Objects (NEOs) permeated the scientific and cultural climate in 1997, the year two asteroid/comet impact films, Deep Impact (1998) and Armageddon (1998), went into production. These films provided an opportunity for science consultants, all of whom had a stake in the NEO debate, to promote the hypothetical dangers of NEOs. Joshua Colwell, for example, believed that his consulting work on Deep Impact would help inform the public about the dangers of comet impacts, "The fact that the movie made an effort to portray all this realistically helps convey this message to the public and raise awareness of a real issue" (quoted in Bradley, 2001). Colwell believed that realistic film depictions of disaster scenarios would raise public awareness and could provide a means for preventing these disasters. Joel Black refers to this belief as the "War Games effect" after the 1983 film. Black claims that filmmakers are "playing (or banking) on the notion that by presenting these doomsday scenarios in a fictional form, they are preventing them from happening (24, italics in original)." Like Colwell, many consultants see their role as enhancing the War Games effect. They believe that the more realistically a subject is visualized in a fictional world, the more motivated the public will be to fund scientific research in order to prevent the event from occurring in the real world. Consultants working on the disaster film Twister (1995) stress the importance of creating realistic scenarios in heightening public awareness about the dangers of tornados. From the scientists' perspective, the only way to avert this danger, of course, is to learn more about tornados and that requires more research support for meteorologists and storm chasers. For Deep Impact this promotional strategy worked as the publicity surrounding these two films, and their impact on public opinion, played a major role in the development of a U.S. NEO agency (for example see Anonymous, 1998).

While the concept behind the War Games effect is to create highly plausible depictions of disasters in order to arouse fear in the audience, scientists can also create realistic filmic images of "scientific possibilities" with the intention of stimulating desire in audiences to see these events become realities. Consultants on Contact (1997), for example, believed that realistic depictions of the SETI program promoted positive visions about the search for extraterrestrials. Consultants felt that if this vision could excite the public about SETI they would be more willing to fund this controversial endeavor. I refer to film's ability to inspire as the Destination Moon effect after the 1950 film whose authentic depictions convinced people that space travel was a real possibility and not just the cartoonish fantasies seen in Buck Rogers. NASA, for example, is well aware of the Destination Moon effect and views fictional consulting on films such as Apollo 13 (1995), Mission to Mars (2000) and Space Cowboys (2000) as an excellent vehicle to promote its agency's mission and scientific projects. Although the War Games effect is about creating anxiety and the Destination Moon effect is about creating desire, they are actually two sides of the same coin. The realistic presentation of scientific scenarios within a cinematic framework can convince the public of the validity of scientific ideas and foster public excitement about research agendas.

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S & T COMMUNICATION THROUGH PUPPETRY - A CASE STUDY (INDIA)

Brinder Kumar Tyagi[1] and Anuj Sinha[2]

[1] National Council For Science and Technology Communication, Department of Science and Technology, Govt. of India, New Mehrauli Road, New Delhi-10016. Tel.: +91 11 26866675, fax: +91 11 26960207, bktyagi2@rediffmail.com, bktyagi@mailcity.com

[2] National Council For Science and Technology Communication, Department of Science and Technology, Govt. of India, New Mehrauli Road, New Delhi-10016. Tel.: +91 11 26866675, fax: +91 11 26960207, cpranuj@yahoo.com

Abstract

The social milieu of India is such that the folk dances, folk songs and folk dramas are part and parcel of our live. It has also been observed that it is possible to accelerate the pace of science communication if folk media are employed effectively in regional languages. A nation wide programme was conceived and implemented by National Council For Science & Technology Communication (NCSTC), Govt. of India, on "Science & Technology Communication Through Puppetry".

The paper highlights and analyzes the efforts undertaken by NCSTC in the past decade with special reference to script writing and other experiments.

Key words: Science Communication, Science Popularization.

Text

India's manifold diversity-cultural, social, religious, linguistic and regional is unparallel in the world. In addition, nearly 70% of population are rural and about one third are still living below poverty and not literate. The reach of mass media, except radio, is still limited. These ground realities present a formidable challenge to a science communicator. In such a scenario, any centrally planned strategy employing modern means of communications does not stand much chances of success. Any strategy to be effective should be "participatory and in the local language through the familiar channels of communication".

The first major effort on the above premise was "Bharat Jan Vigyan Jatha (1987), a massive S&T communication programme, which established the efficacy of the folk arts as a powerful mode of science communication.

Puppetry, being a traditional mean of entertainment, confined generally to semi-urban areas and villages. A characteristic of this medium is its flexibility to suit regional variations and prevailing mood of the audience. It can involve the audience in active dialogue. Illiterates and neo-literate groups can be addressed by a puppet show. It is a cost effective medium and is being used by NCSTC to communicate science.

The efforts undertaken can be divided into phases-pre and post 1996. Analysis of pre-

1996 efforts revealed that all forms of puppets may not be employed and science communicators can also accomplish the task of puppet making and developing scripts. However, some issues, do call for attention were, namely:

- Scriptwriters must be expert in the subject and format of the medium to produce interesting scripts.
- Communicators must accompany every team of traditional puppeteers.
- Traditional puppeteers require training and familiarization with the scientific issues and facts

NCSTC'S Intervention

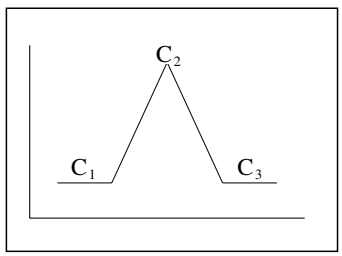
Since 1996 a much-focused programme "S&T Communication through Puppetry" is being implemented throughout the country. A 7-day training module (content and methodology wise) has been standardized with three distinguished feature as:

- Development of puppetry as interactive medium.
- Development of script on scientific themes, and
- Using this medium in combination with other techniques of communications.

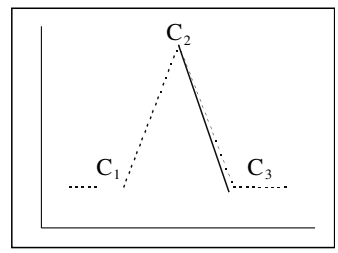
In each workshop the participants are provided with all necessary inputs to show their best creativity with the help of audio-visual aids, lectures and necessary background material for increasing the understanding of puppet as a medium for science communication.

Script Writing Technique

- The basic purpose of a script is to communicate science and scientific methods. The script should be target specific and aimed at bringing science close to people by taking examples from the everyday life to the extent possible.
- The basic framework around which the script is woven must necessarily follow the scientific method and should bring out through dialogues or the situations relevant to the theme the basic elements of scientific methods.
- Scripts can be divided into two categories, (i) that emphasize the scientific method and the scientific values, and (ii) that familiarize the audience with a new scientific information/ discovery/technology etc.
- A puppet drama is like any science drama having three main features viz; (a) ability to crate curiosity in the beginning, (b) satisfy the curiosity at the end; and (c) ability to express the up and downs of emotions through the dialogues. The difference between a script for puppet and other drama can be represented graphically as follows:



The Curiosity graph in street Drama indicates the time and scope available to script writer (C_1, C_2, C_3)



The Curiosity graph in Puppet Drama indicates the time and scope available to script writer (C_2, C_3 only)

In Graphs, C1 is building point of curiosity and C2 is the peak of the curiosity and C3 is the end of the curiosity.
(The puppet scripts, which were written on the above pattern, have proved to be very crispy and effective in catching the attention of the audience in the beginning of the play itself.)

Integration of Puppetry with other Media to improve effectiveness

- Integration of human characters for acts and movements not possible through puppets.
- Use of other visual aids in puppetry to assure accuracy of diagrams.
- Theme Exhibition and Puppet Shows.
- Puppets in Classroom to initiate Discussion.

Findings of National Convention on Puppetry (May 28-June 1 2002): About 1600 trained resource persons with scientific background

- The medium has been used more for spreading the scientific messages on subjects like pollutions, Health & Hygiene and anti-superstitions.
- The tool of puppetry has proved to be quite handy and helpful for science communication.
- The agencies with their formal networks have quite effectively passed on the skill to other communicators.

Looking Ahead

NCSTC is now standardizing the methodologies and approaches in usage of various performing arts for science communication. An attempt is being made to standardize the training modules in terms of contents, reach, selection of participants and resource material. Tools are being developed to assess the impact of various folk Medias used for science communication.

Notes

The first author of the paper is a trained puppeteer and has done many new experiments with this medium to make it more effective for science communication. The paper is based on the experiences of the various national/ state level workshops and field performances.

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CHILDREN 3D WORKSHOP: NEW TECHNOLOGIES AND ICONOGRAPHY LANGUAGE IN THE CREATIVITY PROCESS

Ofelia Ortega[1], Thomas Muller[2] and Louis-François Fléri[3]

[1] 3D Workshop Pegagogical group, Centre de Création en Realité Virtuel. Llull, 334-338, 08019 Barcelona. Spain. Tel: +34-677-37-24-16, ofeof@yahoo.es

[2] Educational Software, Interactive Lighting and Art Software research groups. Institut Image. Ecole Nationale Supérieure d'Arts et Métiers. 2, rue Thomas Dumorey – BP 123, 71321 Chalon sur Saône –cedex,

France. Tel.: +33 (0)3 85 90 98 77, fax: +33 (0)3 85 90 98 61, thomas.muller@ai.cluny.ensam.fr
[3] 3D Workshop Pegagogical group's director, Centre de Création en Realité Virtuel. 110, rue Vielle du Temple. Paris. France. Tel.: +33 (0) 6 08 60 80 06, lffca@club-internet.fr

Abstract
The Centre de Création en Realité Virtuel (CCRV) and Institut Image propose the application of new technologies to the development of a children's workshop based on the work of graphic artist Warja Lavater. The goal of this project is to develop a learning tool based on iconographic language supported with computers which would allow children to create and tell stories as a group. Researching the development of an application for an intuitive learning tool adapted for children is a key part of the project. In general, we highlight the potential of this activity as a learning tool suitable for children's knowledge development.

Key words: children, creativity, new technologies.

Text

Context

The 3D workshop emerges from the combined efforts of the CCRV and Institut Image. Both institutions work together in premises where art and new technologies go hand in hand. CCRV provides the concept of interactive art while the Institut Image provides technical and human means. The 3D workshop, aside from having a creative and technological approach, opens up an educational dimension that represents an introduction of interactive art to children of early ages. The founder of this project, Louis Fléri, launched the 3D workshop with the help of the institutions mentioned above. His new challenge consisted in developing a software to create and recreate fairy tales trough Warja Lavater's iconographic language adapted to children.
This project was made possible by the collaborative work of qualified professionals from different fields, among them there are artists, teachers, pedagogues and computer engineers. The project was supported by the European Union and the local authorities of Burgundy, France.

The graphic universe of Warja Lavater

In the early sixties, at the Museum of Modern Art (MOMA) of New York, Lavater launched a book-object consisting of folded pages like an accordion, where The Little Red Riding Hood tale was narrated in an alternative way: with colour images and without words. The colour images were not figurative drawings but symbols. In this case little red riding hood was represented by a red circle and the wolf by a black circle.
"Imageries" is the name given to a series of Perrault's fairy tales using iconographic language, where the artist's goal is "to make written language into images and images into written language".
In 1965, Warja Lavater presented her first book at the Georges Pompidou Children's Workshop (Paris, France) and in 1994, the artist herself helped with the audio-visual adaptation and the production of synthesis images. The same year, the film was awarded the first Prize Pixel INA Art category at Imagina Festival.

Technical-pedagogical dialogue

Dialogue between educational objectives and technical tools is the base which supports the development of this project. From a pedagogical point of view, the goal is to stimulate a different approach into traditional fairy tales, where the reader interprets the story

conditioned by his/her social and cultural background and in accordance with his/her knowledge development.
Another objective of the workshop is to make it easier for children to develop group work creativity, as well as narrative and listening skills through the use of advanced technologies. In a certain way this initiative tries to put children in touch with new technologies.
The computer screen doesn't stimulate cooperative work, it encapsulates individuals into a virtual world. Children go through a learning process by using computer interfaces, keyboard and mouse. Softwares are full of abstract metaphors that are difficult to understand for the very young ones. These facts are confronted with its learning objectives.
In order to overcome the obstacles of using new technologies, we created, in the first place, an adapted ergonomic design to work in teams (tactile screens set on table surfaces not needing the use of keyboard and mouse). On the other hand, the workshop developed an info-graphic software without artificial devices (cut, paste, etc.) by which interaction is guided intuitively, "pointing a circle on the screen, giving it colour, making it bigger, moving it and changing page".
To make the most of the software, it was set up in two different working places. On one hand, low tables with tactile screens called "Magic Palettes" and, on the other hand, a wide working surface called "Magic Table", were children could climb and make their compositions with images using an e-pen.

The 3D workshop

Three schools were chosen to try out the project with a total of 45 students from four to eight years of age. Later, during the Nicephore Days (an image, art and new technologies festival), we opened the experience for all publics, from 0 to 99 years old.
The 3D workshop was divided into three phases:
1. Projection of video "Imageries". An introduction of Warja Lavater iconographic language and traditional fairy tales.
2. Working with the Magic Palettes
   - Making up tale's characters using images, making up or recreation of fairy tales and info-graphic making of stories in small groups (4 or 5 children).
   - Fairy tale teller. Projection and narration of stories with all groups together and with parents in the open sessions.
3. Making of an accordion-like book with images made by the children at home or in the school.
4. Playing with Magic Table. An open area to show how the software worked.

The feed back among students, schoolteachers and the 3D workshop team members was vital for the pedagogical and technical adaptation of the project and to open the workshop to other publics.

Conclusions

Through the experience, we realised the potential of the activity as a pedagogical tool adequate to learning processes of reading and writing skills, narrating fictional or real facts, creative expression and artistic language. Additionally, we would like to emphasise the utility of the activity the makes new technologies accessible from an early to late age in an intuitive way.
The 3D workshop allows working in teams with different fields at the same time, such as language, literature, art expression, math, new technologies and education of values. It's also possible to work with groups of different ages mixed together because each child has

his/her own role. With no doubt, this is a useful tool for the development of children's knowledge. To conclude, it has to be mentioned that this experience opens up many challenging questions for the research of psychopedagogy.

SCIENCE AS PERFORMANCE: A PROACTIVE STRATEGY TO COMMUNICATE AND EDUCATE THROUGH THEATER, MUSIC AND DANCE

Brian Schwartz,[1] Adrienne Klein[2] and Linda Merman[3]

The Graduate Center of the City University of New York. 365 Fifth Avenue, Room 8309. New York, NY 10016, USA.

[1]Phone: (212) 817-7521, fax: (212) 817-1629, bschwartz@gc.cuny.edu

[2]Phone: (212) 817-7522, fax: (212) 817-1629; aklein@gc.cuny.edu

[3]Phone: (212) 362-7666, fax: (212) 817-1629; lmerman@jhha.org

Abstract

Science as Performance is designed to communicate science to the general public. We present the concept of a *Center on Science and the Arts* consisting of public performances, program dissemination, and outreach to schools, professional societies and laboratories. We put forward a strategy for exporting productions to other venues, spreading public engagement in science issues. As an example of international outreach, two of the authors (BS+LM) are producing a musical play, based on the acclaimed novel *Einstein's Dreams* by Alan Lightman, which will have its European premiere in Lisbon next year.

Key Words: Science, Performing Arts, Theater, Science and the Arts

Text

Context

It is a challenge to convey to the public the exciting developments in science, technology, engineering and mathematics (STEM). (In what follows we use the word science to represent all the STEM disciplines.) Theater, music, dance, the literary and the visual arts can convey the joys and controversies of science. Over the past few years there have been major successes in communicating science to the public through the arts. This is especially evident in theater and film with such recent plays as *Copenhagen* and the Oscar winning film *A Beautiful Mind.*[1,2]

The performance series *Science and the Arts* has been developed and tested at the Graduate Center of the City University of New York (CUNY) in mid-Manhattan for more than three years.[3] The response to the series has shown that the arts can make the sciences accessible, relevant, and exciting to diverse audiences in ways that provide both scientific content and significant artistic and entertainment values.

Objectives

The overall objective is to disseminate widely the concept of *Science as Performance,* by using three strategies:

1. Presenting high-quality performances in our *Science and the Arts* series.
2. Helping other institutions develop their own *Science and the Arts* series.
3. Presenting performances at the meetings of science societies, and as part of the educational outreach programs of national and private laboratories.

Methods

The *Science and the Arts* series at the Graduate Center has been an incubator for the development of programming. The authors have identified performers who use science content in their work and others who wish to develop such work. This has been accomplished by attending many art and theatre events; a task made possible because we are located in New York City, the cultural center of the U.S. After presenting an event on our stage, we judge its suitability for performance at other venues. We have often supplemented performances with discussions with the audience about the science ideas conveyed in the script.

A strategy for replicating the *Science and the Arts* program on another campus is to make use of the talents of faculty and staff in the science and the arts departments, and the infrastructure of performance and meeting spaces at the institution. We are researching those institutions which will be good candidates for collaboration, with promising talent, facilities, and a philosophy that encourages interdisciplinary thought.

Currently, many US government agencies such as the National Science Foundation, the Department of Energy, the Department of Education, and the National Aeronautics and Space Administration support educational programs for public school teachers and students. We work with the developers of these programs to bring to their projects appropriate performances
in *Science and the Arts*.

In an example of international outreach, Brian Schwartz and Linda Merman are producing a musical play based on physicist Alan Lightman's book *Einstein's Dreams*,[4,5] which is scheduled to have its European premiere in Lisbon in January 2005.

Results to Date

The authors have collected a wealth of professional contacts and documentary materials. For example, the authors have a listing with annotations (and a personal library) of over 100 science-related plays including dramas, histories, biographies, comedies and musicals.[6,7] In addition, over the years we have developed working relationships with actors, playwrights, dancers, choreographers, musicians, composers, artists and scientists who work at the intersection of science and the arts. In the conference presentation we will illustrate many of our collaborations in theater, dance, music and art.

The presentation of *Science and the Arts* programming at the professional meetings of teachers and scientists has proven to be a particularly popular strategy. A successful symposium on *Copenhagen*[8] and the *Science and the Arts* programs at the Graduate Center have been well covered by the national print and electronic media.[9,10]

Conclusions

We observe that there is a non-professional public with a strong interest in all aspects of science. We attempt to satisfy this interest with quality performances that impart some information about science and the lives of scientists. Our productions are well attended and we are drawing the attention of other institutions that would like to replicate our success. In time, we will package many of the science/arts series productions so that they may be duplicated. We hope to expand our project into a *Center on Science and the Arts,* including residencies and opportunities for artists to develop new work in dialogue with scientists. To this end, the *Science and the Arts* program is currently establishing a Board of Advisors.

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A CREATIVE APPROACH TO SCIENCE COMMUNICATION AND EDUCATION

Steve Mesure
The CREATIVE SCIENCE Consultancy

Abstract
A Creative Approach to Science Communication and Education: (How Science Theatre And Creativity Has Influenced A Variety Of Projects In Science Education And Engagement.)
Steve Mesure has been writing creative science communication and developing a variety of techniques and applications for 17 years. Recent work, which emphasises the importance of encouraging the presenter to become more creative, can be applied equally to science education and public communication.
The emergence of creative science engagement can be seen through the use of science theatre and theatrical techniques. The presentation will cover the development of Floating Point Science Theatre over the last 16 years, how it continues to promote and teach science to over 1½ million children and 7,000 schools. Steve will then look at some of the other new creative applications of science theatre which have arisen from this work and a range of other, more recent initiatives that focus on developing creativity in science education and public awareness.
He will look at the benefits of using the visual arts, (physical theatre in particular), story telling, characterisation, emotions, crossing disciplines and above all, creativity. Exploitation of these intelligences can make science accessible to those who were turned off by it, and be inspirational to many who haven't seen it's opportunities.
Specifically Steve will talk about the pilot 'Creative Science Teaching Lab' and its outcomes, and some forum theatre work arising from a project at the University of Liverpool.
The success of these projects suggests that science communication as a whole can benefit from creative thinking.

Parallel session 8

The role of books and literature in public communication of science

SCIENCE, BOOKS AND SOCIETY

Michel Claessens

Head, Information and Communication, Directorate-General for Research, European Commission, 200 rue de la Loi, B-1049 Brussels, Belgium. Tel.: +32-2-295-9971, fax: +32-2-295-8220, michel.claessens@cec.eu.int

Abstract

The presentation will outline the European Commission's views on the role of books and literature in the context of the science and society issues. In 2001 the European Commission took an important initiative to stimulate a change in the relationship between science and society, as to reflect the new issues, new fields and new questions that accompany recent scientific and technological developments. Against this background, the publication strategy of the European Commission and concrete examples will be presented.

Key words: Science and society, books.

Text

In December 2001 the European Commission proposed and decided to implement a "Science and Society Action Plan". The Commission document set out a new strategy to make science more accessible to European citizens, and 38 actions have been identified as to achieve this objective. The activities described in the Action Plan are now conducted in close cooperation with all the Member States, and –beyond Europe– with third countries and international organisations. Numerous players are involved: local and regional public authorities, the general public, civil society, industry, etc.

The Commission acts here as a catalyst. It was made clear from the outset that significant results can be expected only if Member States themselves make an all-out effort in a joint, coordinated approach with the Commission.

At the dawn of the 21st century, as the economic integration of an enlarging European Union becomes a tangible reality, our society is faced with the challenge of finding its proper place in a world shaken by economic and political turbulence. Examples abound to show that knowledge, in particular science, technology and innovation, are indispensable to meet this challenge.
However, there are indications that the immense potential of our achievements is out of step with European citizens' current needs and aspirations, such as peace, jobs, security and sustainable development of the planet.
The 2001 and 2003 Eurobarometer Surveys (two opinion polls *Europeans, science and technology* were conducted at the Commission's request in the fifteen Member States between 10 May and 15 June 2001, and in the ten new Member States plus Romania, Bulgaria and Turkey in November 2002) of European attitudes to science gives a mixed picture, ranging from confidence and hope to lack of interest in scientific activities or even fears regarding some of their impacts.
80 % of Europeans believe that science will one day conquer diseases such as cancer or AIDS, and scientists enjoy a high level of public confidence, to the extent that 72% of the respondents said they would like politicians more frequently to use expert advice in making their choices. Despite these expectations and the climate of confidence, the same survey also shows that Europe's citizens do not always have a very positive perception of science and technology, and that science is remote for some sections of the population.

Industrial hazards and ethical issues are widely highlighted in the media, raising questions and reinforcing the public's desire for progress to be more closely monitored. Some people feel that science and technology are changing their lives too quickly. Although progress has been made, too many stereotypes still keep women out of science and deprive it of the diversity sorely needed for a more harmonious contribution to political, social and economic life.
Young people, moreover, no longer find studying science and scientific careers sufficiently attractive. Together with demographic trends, this potentially affects the labour market where industry has difficulties in recruiting the engineers and scientists needed. Europe would therefore gain by assembling in a Community framework the efforts deployed in the Member States to improve the European public's ability to assess the scientific and technological issues of the day, and to motivate them to become more involved in science.
Against this background, the Commission's action plan presents 38 actions designed to:

- Promote scientific and education culture in Europe.
- Bring science policies closer to citizens.
- Put responsible science at the heart of policy making.

The proposed action plan marked the beginning of a long process, the objective of which is to change the relationship between science and society. Some of the activities are very long term –e.g. in the field of education– while others, such as conferences, are ad hoc.
The European Commission has also set out an ambitious strategy to accompany the implementation of the Action Plan through information and communication activities. A new "Science and society" Directorate has been created within its Directorate-General for Research, now consisting of 6 Units: Strategy and policy, Scientific advise and governance, Ethics and science, Women and science, Information and communication, Education and science.

The European Commission is also committed to help EU-funded projects better communicate and disseminate their research results. It draws in particular the attention of participants in FP6-funded projects on the fact that they can no longer ignore the 'public communication' dimension of their activity and that they are also in an excellent position to improve the image of science and technology among a broad public. Exposing non-specialists to the results of research work helps to improve their understanding of scientific and technological developments and stimulate public debate on important issues, which not only meets a very real social need but also contributes to the success of RTD policy. Last but not least, publications (hard copies and electronic) have an important role to play. The European Commission's Research Directorate-General (DG) publishes about 500 publications per year, with a total print-run of over 2.5 million copies. The presentation will outline the Research DG's publication strategy in this respect and give examples of publications:

- Promoting scientific awareness of the public about European research and science and society issues.
- Stimulating public debate about scientific issues.
- Contributing to science and society issues (e.g. Eurobarometer surveys).

NEW WAYS OF COMMUNICATION IN POPULAR SCIENCE MAGAZINES

Amelia Die

Lezama, 14. 28034 Madrid. Tels.: 91 728 91 21, 616 33 94 85

Quo magazine has already celebrated its 100th issue introducing a very special way of making scientific divulgation, with a personal view about communicating science differently from the traditional path. When it came to the market in 1995 there was no precedent in the Spanish media. Divulgation magazines had a classical layout presenting topics and developing them. They did not take advantage of new computing capabilities

applied to magazine edition, such as illustration and images modification applications. They coming out of *Quo* magazine represented a new point of view for many other graphic magazines in Spain, not only for those dedicated to divulgation; and this new point of view made them change their criteria because of its success.
Although *Quo* dealt with many the same topics than others in the market, the way it treated them had an innovative planning. The main topic for issue Nr 1 was instinct behaviours in human beings. Nevertheless, the study was completely original, since the headline was: "The animal inside us". It was explained graphically by a man face with a magnifying glass making its eye bigger. Into the lens one could see the eye of a wild feline. It must be taken into consideration that it was technically a milestone for the time being, that image modifying programs were at their starting point then and that both the idea and its making out were really amazing.
This is only an example of the turning of the screw that *Quo* was supposed to be given from the very beginning, which endowed it with an uncommon personality that is still mantaining through its seven years of existence.
Precisely, this singular case is specially significant because of this dialog, whose headline is: "Scientific Knowledge and Cultural Diversity". As I see it, cultural diversity means not only the acceptance of more or less "exotic" cultural traces to the eyes of the Western world, but the singular way we manage all issues related to them. I assume here The word "culture" in another broader meaning than is usually accepted. Through science is already known that cultural traces of an species could become genetic as time goes by, thanks to evolution. With the necessary careful consideration, different points of view can lead to its incorporation to daily practise of communication on science, even to cause a "cultural swing". This has been the big goal of *Quo*.
Which are the basis of this diversity? Apart from the graphic advances and he new point of view dealing with classical scientific divulgation topics.
Quo has its own developing characteristics. In detail, they are:

- The playful side of news, which had never been used in written scientific divulgation, i.e.: topic: Pollution caused by the *Prestige*, delst with in "Pastimes" section of the magazine, which headline was: "This is not a game". We proposed home experiments, guess what games, etc., to make comprehensible the consequences of pollution due to hydrocarbon. Another example: we show a series of images: "We Explore the Rarest Planet". In the first six pages amazing images of vulcanology, gravity, temperature can be seen... Which planet are we in? Is a question for the reader to be answered: The Earth.
- Interactivity. Communication among *Quo* and its readers can be called, at least, as surprising. Usually, no less than three contests are proposed in every issue of our magazine, all related to science. There is a whole section (called "Quonnected") made in a big part by readers who send their questions and quizzes, their solutions to every proposal and challenge. The response has been amazing: readers have sent papyroflexia objects, a home-made plane, a raw egg by mail, a boat made out of clay and ears made out of almost anything (to celebrate the anniversary of Van Gogh). The answer is massive: readers invade the redaction of *Quo* with their inventions and proposals.
- Sense of humor and irony. This is a really important aspect of *Quo*.
  Scientific divulgation is usually considered a boring and erudite matter. Just the opposite for a lot of topics, we think at *Quo*. A recently published article (May 2004)

is about ants. Instead of treating the matter in a traditional way, we called it: "The Working Class", illustrated with an image of an ant with a red helmet. Information about ant-hill organization appears like a hierarchic organigram: enterprise, activity, staff... The product manager is the queen, whose personal particulars can be seen, her productivity ratio, her salary, the duration of her contract, etc.
Therefore, you can explain a very serious scientific topic on a humorous basis.

- Seriousness in contents. Quo has been awarded whith the recognition of such prestigious prizes as Boehringer, Casa de las Ciencias de A Coruña and Oncology Association. Rigour is that assured in the magazine. *Quo* reporters are specialised in every branch of science they write of, which has lead to be considered as a very prestigious magazine. *Quo* attends congresses and discussion forums about science and divulgation and it gives its peculiar vision in courses about scientific press.
- Thanks to all that, one can conclude by saying that *Quo* has become a reference in Spanish scientific divulgation and an example of "cultural diversity" on topic treatment.

H.G. WELLS' SCIENCE FICTION AND SCIENCE COMMUNICATION

Mª Dolores González Rodríguez

Departamento de Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca, Campus Miguel de Unamuno, Edificio F.E.S., 527, 37007 Salamanca. Tel.: 923 294640, ext. 3417, mdgr@usal.es

Abstract

The aim of this communication is to expound connections between science fiction literature and popularization of science through H. G. Wells' storytelling, a good example of vulgarization of Science installed in our popular culture. His short fiction stories display strategies of scientific representation, use of jargon, a variety of scientists' depictions, etc. Reliable scientific information is mixed up with pseudoscientific contents and explanations, extrapolations, and so on. Wellsian literary purposes aimed to think over science social consequences. Wells' objective was to explore beyond boundaries of his time scientific knowledge, halfway between blind enthusiasm and gloomy portraits of science and technology.

Key words: science fiction, popularisation.

Text

Context: Wells is considered one of the founders of science fiction. The readers' demand for scientific information, mass media and a literary formula –between adventures and detective story– were essential for the success and spreading of these popular romances. Scientific degree in Biology, teacher of that subject and admirer of Charles Lyell and Thomas Huxley, Wells wanted to honor them in his literary work, as well as focus this on science. Furthermore, his involvement on social and politics affairs is reflected on the plots of his stories. Nonetheless, he was influenced by social Darwinism, and used this theory to criticize Victorian English Society.
Objective: The objective has been to analyze how is represented science in Wellsian stories and which strategies and elements are recognized as popularization ones. On the one hand, Science is mainly portrayed by the use of technical vocabulary and explanations based on scientific elements or extrapolations. On the other hand, Wells foresaw early Philosophy of Technology: social and political reflections about science and

technology are depicted through speculative narrations and dystopia formulas. He aimed to make the reader aware of the pervasive consequences and social misuse of science and technology.
Methods: The method has been the analysis of Wells's selection of plays, approaching from the philosophy of science and technology (scientific and technological culture), and studies of popularization and perception of science.
Results: Reading some Wells' works is remarkable the knowledge he had about subjects as biology, chemistry or physics. He seemed to be more concern with depicting negative aspects of Science (misleading objectives, ambitions, bad behaviour of scientists, potential risks, threats to the society and human beings). A polarization of attitudes towards science is frequent in science fiction, however Wells cannot be considered ingenuous.
As a man educated on science, Wells managed to introduce a commendable representation of scientific activity such as researching tasks, social and political handicaps, moral objections, *ethos* of the scientific community, accurate use of scientific concepts, use of reliable scientific sources. On the other hand, he revealed misleading scientific practices, specially through the scientists depictions.
According to Haynes (1994), there are seven stereotypes of scientists, some of them are represented by Wells: the mad, inhuman –Dr. Moreau–, noble and altruist –Ponderevo–, adventurer –the Time Traveller–, helpless –Griffin. These are not fixed archetypes: characters' evolution illustrates complex context of science, i.e. Ponderevo's story and bourgeois economical ambition.
Conclusions: Wells combined fiction, scientific fashion theories and non-scientific elements in a successful literary formula seemingly credible. He was careful about the image of science in his stories, but speculative ideas are often presented as scientific arguments.
Nowadays there are popular images of scientists based on Wellsian characters and their behaviour. Many Wellsian professionals of science depict a pessimistic view of science and technology. Each story shatter the confidence on science, but on the other hand, eventually there is no substitute for rationalism and scientific method: superstition, magic, economical pressures or religion among others, are defeated in Wellsian stories (Skal, 1998).
Wells' concern is with the social, political, human and biological aspects of scientific and technological development. Controversial issues, such as eugenics, animals' experimentation, working conditions, natural selection applied to society, scientist's ethics, and so on, are thematized in Wellsian romances. Wells thinks over possible pervasive consequences of science, but his apparently negative vision is not a plain pessimistic one. He always felt confident about science and, far away from a blind enthusiasm, his dystopias and gloomy portraits of the future were metaphorically pieces of advice, just in order to involving reader in the commitment of a control over science and technology (Elias, 1998).
To sum up, Wellsian scientific romances are an excellent instrument for spreading scientific culture, and for arousing curiosity and interest for science. There lurk some risks for a proper communication of science. Although the popular images and stereotypes this genre have created, it offers sources for improving scientific culture, not only by the specific contents but also by the reader's criticism and comparison with real scientific ideas (i.e. pointing out the groundless ideas or extrapolations). Furthermore, science fiction is a popular way of communicating ideas about science and technology –a popular philosophy– and how they affect society and human beings.

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READING AND SCIENCE PROGRAM: STORYTELLING WITH THE OSWALDO CRUZ FOUNDATION'S RESEARCHES

Carla Gruzman[1] and Adriana Assumpção[2]

[1] Centro de Educação em Ciências do Museu da Vida/COC /FIOCRUZ Tel.: 55 21 38652186. R. Marquesa de Santos 53/605, Laranjeiras Rio de Janeiro - RJ, Brasil, CEP: 22221080, carlag@coc.fiocruz.br

[2] Centro de Educação em Ciências do Museu da Vida/COC /FIOCRUZ Tel.: 55 21 38652130 . R. Açapuva 196/202, Higienópolis Rio de Janeiro - RJ, Brasil, CEP: 21050 730, assumpcao@coc.fiocruz.br

Abstract

This work discusses the participation of researchers in the Reading and Science Program in the Museum of Life. Integrating part of the Oswaldo Cruz Foundation (Fiocruz), in Rio de Janeiro, the museum has as its aim to inform and educate people in science, health and technology in a playful and interactive way. The Program proposition of work is based on the articulation between literature for children and young people and science departing from themes related to health and environment, which are contemplated by the institution. Our study is based on interviews which were conducted with researchers, on the questions that arise during the debate with the visiting audience and on observations made by the team. From the accomplished analysis, we searched for comprehending how this program can contribute to the popularization of science.

Key words: Literature, Popularization, Science Museums.

Text

The Reading and Science Program proposition starts from the initiative of the Education in Science Center at the Museum of Life interested in sensitizing and founding the professional team in the museum for the development of activities which are aimed at the promotion of reading. The guiding principle of the activities is related to the possibility of articulating literature, science and daily life departing from themes that are more closely related to our institution's general contents –science, health and technology.

In this work, we will discuss the reading practices and its interface with the educational field and scientific diffusion for, then, presenting an exploratory study on the participation of Fiocruz's researchers in the monthly event *Storytellers in the Museum of Life.* We tried to comprehend the researcher's perceptions and attribution of meanings in relation to the proposition of articulation between literature for children and young people and science.

The monthly event counts on a group of storytellers that approach the approached theme; the contribution of a researcher who brings the account of his daily work; followed by a moment of debate with the participation of all the people who are present. The public on weekends is really diverse.

The close link between reading and social participation was reaffirmed by the educator Paulo Freire in the Brazilian Third Reading Congress, held in 1981. According to him, reading is a knowledge process and a creating act. Thus, promoting reading is being able to share with the other not only the aesthetic and affective aspects of the taste for reading, but also acting in an active way in the development of cognitive aspects which are related to knowledge, allowing the development of criticism and analysis ability.

Currently, in the educational field, the concern with reading and the reader's education has been expressed through studies which approach the knowledge involved in the daily act of teaching and learning, the multiple languages that permeate the reading practices and the different dimensions that act in the diffusion of literature and the education of its audience, among others (Lajolo, 2002; Paiva, 2003; Soares, 2003).

In our investigations we discussed aspects like: What is the profile of the researcher who participates in the storytellers event? Which are this researcher's expectations in relation to this proposition? Which resources does he use in his narrative? How does the researcher evaluates his own participation in the activity?

Our study was based in the qualitative approach. As research subjects, we identified those Fiocruz's researchers who participated in the monthly events in the period from 2001 to 2002. Thus, from the seventeen professionals who were invited, we interviewed thirteen researchers using a semi-structured interview script as a research tool.

Based on the interview analysis, we observed that the moment of presentation to the audience generates great expectations in the researcher. At first, some of them planned a lecture, but after some preparatory meetings with the team, they decided for a more informal presentation. Most of the researchers used different kinds of languages in their communication with the audience. Thus, other resources were incorporated to the verbal narrative: images –slides, OHP transparencies, photographs, video snippets; sounds– sounds and music; text –explanatory leaflets, books, primers; specimen samples– samples of insect, periwinkle and medicinal plants collections; reference objects –indigenous, childish and recyclable objects; and even the use of dramatization of different situations and special clothing.

In relation to the subjects, we make evident that even those who perform their work taking into account the production and circulation of knowledge, affirm that scientific diffusion is still in its beginning. As to the museum's role, they highlight the aspects of education and science and health diffusion as part of their mission, besides the importance of including nearby communities in the discussions. Most of the interviewers claimed ignoring other activities involving storytellers and scientific diffusion. We observe that although many interviewers expressed their concern about the dismythication of science, the academic language was present in their communication, which made the audience's comprehension difficult. The subjects considered the fact of talking to a heterogeneous audience as a challenge, but it was also a rich experience as it favored the dialogue with visitors, enlarging the population's access to scientific information.

Our study has showed that the researchers who participated in the Reading and Science Program comprehend the museum's role as an important social space for scientific diffusion practices. In this context, the proposed activity enables the visitors to relate science aspects with their daily life, also collaborating with the democratization of

scientific knowledge. This work has also signaled that the enlargement of the identified themes can be really positive, as we could embrace themes which are suggested by the visitors themselves. We also believe that this activity can be developed with the school audience.

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WHY THERE ARE NO PROFESSIONAL POPULAR SCIENCE BOOK AUTHORS IN CHINA

Lui Lam,[1] Li Daguang[2] and Yang Xujiy[3]

[1] Physics Department, San Jose State University, San Jose, CA 95192-0106, USA, and China Research Institute for Science Popularization, China Association for Science and Technology, Beijing, China. lui2002lam@yahoo.com

[2] China Research Institute for Science Popularization, China Association for Science and Technology, P.O. Box 8113, No. 86, Xue Yuan Nan Lu, HaiDian District, Beijing 100081, China. ldaguang@vip.sina.com

[3] Science Times, No. 3, Nan Yi Tiou Yue, ZhongGuanCun, Beijing 100080, China. yangxujiy@vip.sina.com

Abstract

There are no full-time professional popular science book authors in China. To investigate the reasons behind this anomaly, we interviewed several authors and publishers in China. Remedies are proposed. A way out is to increase dramatically the sale of popular science books through their use in the teaching of science in high schools and the universities. The findings and lessons are also relevant to other parts of the world.

Key words: popular science books, teaching science courses, China.

Text

Introduction

Popular science (PS) books have a long history in existence (Gregory and Miller, 1998). They are a neglected tool in the science education of students and ordinary citizens (Lam, 2001). PS books are unique among the science media.

1. They are available in every bookstore in every town, unlike the technical science books which are available in special book stores in a university town.
2. Many of the PS books are written by the pioneers themselves, Nobel laureates, or very gifted science writers who could be journalists or other scientists.
3. These books are affordable to almost everybody (about 20 yuans in China, and 15 dollars for a paperback in USA).
4. These books are the places to learn how research was actually done and discovery were made in very recent times.
5. These books, at least in the USA and for the majority of them, contain no equations and are easy and very entertaining to read.

   To ensure the continuous appearance of new and good PS books, a large number of competent authors are called for.

Popular science book authors in china

China is a country of 1.3 billion in population. Yet, there is not a single *full-time* professional PS book author in this vast country. This is in contrast to the case in literature, because China does have professional writers who can support themselves by publishing novels. And this is not due to lack of support from the Chinese government. In fact, the Chinese government recognizes science and technology as an important pillar in raising the living standard of its population and the economic well being of the country as a whole. Two years ago, China passed the laws that protect and encourage scien ce population at every level of government (Popular Science Press 2002).

In the years from 1949 to about 25 years ago, before the market economy was introduced every writer in China was government employed. The government at that time saw the need to support full-time novelists, but not full-time PS book writers. Obviously in China (and everywhere else in the world) PS books are not deemed to be equally important as literary books.

These days, when market economy is in place, and self-employed literary writers do exist, we still see no full-time PS book authors in China, self employed or government employed. Why?

To find out we interviewed a number of PS book authors and publishers in China. We are told that:

1 Science popularization is considered lower in status compared to science research or teaching.
2. Work in science popularization is not counted in job evaluations in many places.
3. Lack of systematic and large-scale government effort or plan to train PS professionals.
4. Insufficient income to support free-lance full-time PS writers.

While points 1 and 2 are definitely true in almost every other country, some countries are doing something to tackle point 3, while point 4 is not true at least in the USA.

Point 4 is particularly interesting. With such a large population in China, how can this happen? These days, an average PS book in China sells less than 5,000 copies. (There are exceptions. For example, *The Complete Book of Raising Pigs* did sell 3 million copies.)

What can be done

To address point 4 in China, here are some recommendations.

1. The government could extend the new policy of supporting literary book projects to PS books, too. That is, prospective authors can apply for a grant to write a particular PS book.
2. In every science funding agency, for example, the Chinese National Natural Science Foundation, a new division of funding should be set up to support PS activities, including book writing.
3. In major research institutes, such as those in the Chinese Academy of Sciences, one-year visiting positions for prospective writers could be established, enabling them to observe the research in action, learn about major research findings, and discuss with the experts and perhaps even collaborate with them to write PS books.
4. Most importantly, to guarantee that PS books will be sold in large quantities in the immediate future, all science teachers in high schools and universities should incorporate the use of PS books in their classes. It is done by offering the students extra credit if they buy a PS book, read it and write a brief report. This is a sure way to excite the students in science and to enlarge their knowledge base. (For more details, see Lam 2001.)

5. Since natural science forms the basis of all social sciences (Lam 2002, Wilson 1998), and science and literature are equally important in shaping modern lives, the time has come to include several PS books –such as James Watson's *The Double Helix*– into the list of required readings in the general education of every student in every university.

For points 1-3, the prospective authors may come from any source, such as from magazines and newspapers. Naturally, points 4 and 5 are equally applicable to other countries.

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FACT VIA FICTION: STORIES THAT COMMUNICATE SCIENCE

Aquiles Negrete

Tecnológico de Monterrey, Calle del Puente 222, Col. Ejidos de Huipulco 14380, Tlalpan, México D.F. México. Tel.: 52555483, fax: 52555483, pspan@bath.ac.uk, aqny@yahoo.co.uk

Abstract

In this research I propose that narratives represent an alternative means to communicate scientific ideas to society. In a previous study (presented in Cape Town, South Africa 2002 PCST-7), I obtained information about the effect of factual and narrative formats on people's memory and learning. In order to achieve a better understanding of the differences between these two kinds of written information, it was necessary to extend the study both in sample size and in time scale. In this paper I report the results of a follow-up study. The results suggest that, for science communication concerns, both text forms can be considered equally effective in conveying scientific knowledge.

Key words: Science, Communication and Narratives.

Text

Introduction

A fundamental task for science communication is to produce materials that are not only understood by the general public, but also remembered in the long-term as a part of the learning process. There is evidence from memory studies suggesting that narratives represent a good recall device and a learning aid (Sternberg, 2003).

Here I will suggest that literature is an alternative and effective media to teach science as Gough (1993), Appelbaum (1995) and Weaver (1999) propose. In a broader sense, those narratives represent an important means for science communication to transmit and recreate information in an accurate, memorable and enjoyable way.

In a previous study, I obtained information about the effect of factual and narrative formats on people's memory and learning (two measures in time), as well as about the

way people organise information when retelling stories (Negrete, 2002 and Negrete, 2003). In order to achieve a better understanding of the differences between factual and narrative formats, it was necessary to extend the study both in sample size and in time scale. In this paper I report the results of a follow up study that I carried out with a larger sample and a third measure in time.

Objectives

To evaluate the ability of fictional narratives (short stories) in communicating scientific ideas. To investigate the extent to which people can understand, apply and remember scientific knowledge included in a short story in comparison to traditional factual texts.

Methods

Two stories with scientific content (Nitrogen by Primo Levi, and The Crabs Take Over The Island by Anatoly Dnieprov) were adapted (1500 words each) to enable the participants to read them and complete two questionnaires about them in an hour session. The study included a contrast between factual and narrative scientific information and compared the extent to which the information was remembered at three different times (immediately after reading, two weeks and a month later). A group of 52 undergraduate students participated in the test.

In the creation of this study, four forms of question were included: multiple choice (identify), straightforward and open-ended questions (remember), questions to recount the stories or the lists of facts (retell), and questions where the participant was expected to produce a solution for a particular problem mentioned in a hypothetical situation (contextualise). A combination of measurements of explicit and implicit memory provided a learning measure and therefore an estimator of science communication success.

In order to perform a comparison between factual and narrative information, I extracted from each story a list of all the scientific facts mentioned. In this way all the scientific information included in it was transformed to individual sentences that mention these facts in a plain textbook style and isolated from the story (the extreme opposite of narrative form). Questionnaires were applied to assess the scientific information remember and understood. A statistical test was carried out to compare the performance of the two groups (rm-ANOVA).

Results and Discussion

Particularly relevant for this study was that the interaction between Time (session 1,2 and 3) and Text Form (narrative and factual) was significant ($f = 5.67$; $p<0.002$). The effect of Time is different depending on the Text Form. T1 and T3 in the narrative group are not statistically different to T3 in the factual group. T2 in the narrative group is not statistically different from T2 in the factual group and that T2 and T3 in factual group are not statistically different. This indicated that performance on T1 for the factual group was better than in the narrative group but in T2 and T3 there were no statistical differences in performance between groups (fig. 1).

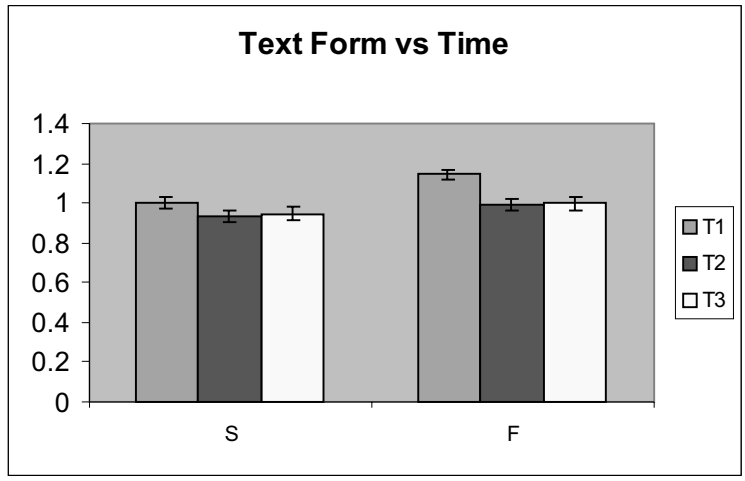

Figure 1 Differences in performance between narrative (S) and factual (F) groups over time (T1, T2 and T3). Different letters indicate significant differences (HSD $p<0.05$).

This study suggested that, independently of the memory task, factual information is better remembered immediately after a reading compared to narrative one. However, as time goes by, there is no statistical difference in the amount of scientific information retained. Consequently, it is possible to conclude that, in the long term, both text forms are equally effective in conveying scientific knowledge.

The results also suggest that factual information deteriorates at a faster rate than the narrative format. It is plausible that differences are due to the fact that narrative information provides numerous aids for storing and retrieving information from memory. It therefore prevails longer than information that does not include mnemonic devices.

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FRANKENSTEIN BY MARY SHELLEY: SCIENCE, ITS MYTHS AND ITS MONSTERS

Luiz Teixeira[1] *and Lucia Rocque*[2]

[1]Casa de Oswaldo Cruz – Fiocruz. Marquesa de Santos 53/605 Laranjeiras, Rio de Janeiro, RJ, Brasil, 22221080. teixeira@fiocruz.br

[2]Instituto Oswaldo Cruz – Fiocruz e Departamento Letras Anglo-germânicas UERJ luroque@ioc.fiocruz.br. Smith de Vasconcelos 38/4, Cosme Velho, Rio de Janeiro, RJ, Brasil 222241-160

Abstract

We discuss the trajectory of public acceptance of the novel Frankenstein. We centred ourselves in the mythic stature reached by the creature and in its role in the popularization of the work. We start from the idea that the novel's great success was due to the public interest in the monster, and the fact that the work turns to the recreation of life, aspect that historically arises strong interest by equalizing men and gods. We also observe that the Frankenstein creature produces interest by the fact that it brings up questions about the individual, his individuality and relations with the other.

Key words: Scientific Diffusion, Science Fiction.

Text

The fact that techno-scientific development has continuously generated hopes and apprehensions in eastern societies is not new. From the 19th century on, this process has made many futurist predictions become part of the daily life of great population contingents. In this context, it emerged the literary genre that later became acknowledged as science fiction. After all, according to Isaac Asimov's definition, science fiction is the line of literature that deals with men's answers to the changes that occurred in the level of science and technology" (Asimov, 1984: 146).

Inaugurating science fiction as a literary style, Frankenstein brought to public keen criticism to the pretension of knowledge without frontiers or ethic limitations, violently questioning men's excessive ambition –value which is more and more encouraged by the ascending bourgeois society. Although the work is characterized as a rejection to these values, such criticism shows itself as addressed to a determined kind of knowledge and to a way of its practices organization: it is at the same time a lampoon against the elicit manipulation of nature, and a criticism to the fact that the science of that time was an exclusive prerogative of the masculine sphere (Rocque e Teixeira, 2001).

All this critical potential existent in Frankenstein, has not become old over the course of time.

On the contrary, it has gained body as the work was reinvented in other media –mainly by the cinema– with the simplification of the original story, which little by little would be transformed into a horror tale that has as its protagonist a monstrous creature. Today, the quick development of biological sciences, especially genetics, makes the human mind surmise more the possibility of one day science having total power to recreate life in a laboratory. In this context, the Frankenstein myth shows itself even stronger.

The valorization of Shelley's work should also be seen by the strength of the being she created through Victor's hands. The creature seems to have own life, excelling himself in front of the rest of the novel. It is related to the monster category itself, whose existence, real or imaginary, invites us to reflect on human's limitations, or in a last analysis, on our own conception of subjectivity.

In the context of decay of the Cartesian singular reason and ascension of multiple and fragmentary subjectivity, monsters become the source of great interest while their

existence addresses to the particularity of our subjectivity statute. This way, they lead us to think the question of alterity, because when certainties about the centralization of the individual vanish, more and more the other –the different one– has its social place rethought. Such aspect goes beyond the limits of academic reflection, touching the general public. The other's place, or condition, and its human or monstrous classification are in the heart of the super valorization of the character created by Victor Frankenstein. As it is the representation of the different, the abominable, and also the socially unacceptable, the monster allows the formation of an identity, and the creation of a collection of signs that distinguish what is wanted as human from the monstrous and from a group of norms that indicate what is acceptable or abject (Cohen, 2000). In our case, Shelley and Victor's monster brings within himself another fear, thus in front of his creator's human identity he demands his own identity, independently, his reason of existing –which can be seen in the fact that he asks his creator to create a partner for him as well.

Claiming for their rights, the monsters show themselves as even more threatening, as they leave in the air the fact that the differences between human and monstrous are arbitrary and fluid, related to moments and spaces. After all, monsters are a cultural creation totally related to our way of seeing ourselves and the other, and there resides much of our attraction to these figures.

Incited to write Frankenstein by a competition with a group of friends about who could write the best ghost story, Mary Shelley may have never dreamt about being capable of writing a story which over the course of time would achieve such notoriety. It is as if the monster had obtained more than the acknowledgement he demanded from his creator. Sprung up almost two hundred years ago, he continues to inhabit the anguish and dreams of our pos-modern world, incorporating controversies over the ethic limits of science and knowledge in a general way, making us continuously rethink the relation of these limits with the complex questions of alterity and tolerance and the responsibility of the whole society in these imperative questions.

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Parallel session 9

Theoretical framework evolution around PCST

SCIENCE POPULARIZATION AS A STUDY SUBJECT

Martín Bonfil Olivera

Dirección General de Divulgación de la Ciencia, Universidad Nacional Autónoma de México. Edificio Universum, tercer piso, Circuito Cultural, Ciudad Universitaria, Coyoacán 04510, México DF, México. Tel.: (55) 55 53 04 04, mbonfil@servidor.unam.mx

Abstract

A brief discussion of the definition, goals and models about science popularization is presented, followed by a view of the types of studies about this discipline done in Mexico. Three main purposes for science popularization are proposed that can guide research and allow to maintain the diverse modalities of science popularization, while managing to go beyond the deficit model.

Key words: Science Popularization, Research, Mexico, Models.

Text

Definitions

The term "science popularization" alludes to a set of activities, disciplines and approaches that seek to communicate science to a wide voluntary audience. No definition is commonly accepted by all science popularizers, because their practices are usually carried out in a practical way, without a proper theory to sustain it. (A definition that has gained good acceptance in Mexico has been presented by A. Sánchez Mora.)[1] This situation has resulted in each different group or individual trying to develop its own theoretical framework to plan, evaluate and analyze their activities.

Goals

Such reflection has been the seed of what could be called "research on science popularization".[2] In Mexico, although there has been a long and strong tradition of

science popularization, such studies have been rather scarce and seldom published.[3] In this context, it is important to define more precisely the diverse approaches that can be adopted according to the particular goals pursued, since each one implies its own criteria for assessing quality and determining what is evaluated. Briefly, it could be said that the range of important and valid goals for science popularization is very broad: entertaining, informing, teaching, arising new scientific vocations, challenging pseudoscience, democratizing scientific knowledge, spreading scientific culture...[4]

Models

Lewenstein[5] has proposed four models of public communication of science and technology. It is clear that in Mexico, as in many other countries, the "deficit" model is prevailing, with the "context" model slowly gaining recognition. More social-oriented models such as the "lay-expertise" and the "public participation" models need to be encouraged. Some of the diverse goals for public science communication mentioned above are more aptly satisfied by some models than others. Thus, all four of Lowenstein's models can be useful in certain circumstances, and none has necessarily to be discarded in favor of the others.

Science communication studies in Mexico

Examples of research on science popularization that have been to a modest degree conducted in Mexico are historical studies,[6] analyses of scientific and science communication discourses,[7-10] approaches to the relationship between science and literature[11] or science and art in general,[12] museum studies[13,14] as well as philosophical or methodological reflections.[15]

A strategy for science communication

In setting goals for science communication studies, it is important to distinguish between "applied" studies, which seek to improve the practice, planning, evaluation and development of popularization activities and products, and "basic" studies, which view science popularization itself as their subject and analyze it in ways not directly applicable to the practice. Both types of studies will be necessary if science communication is to go beyond the deficit model without limiting public science communication to what is "useful" or "necessary" for pragmatic purposes.

I propose three main purposes for science communication, that broadly encompass the diverse goals mentioned above: 1) public appreciation of science (including aesthetic appreciation of science and a view of science as a valid form of entertainment), 2) public understanding of science (including scientific knowledge and knowledge about what science is and how it is done), and 3) social responsibility about science (in the STS sense, coherent with the lay-expertise and public participation models).

Conclusion

I suggest that, in view of the diversity of modalities and goals for public science communication in countries like Mexico, it would be useful to adopt a broad strategy (possibly a national one) that encourages all diverse modalities around the three goals proposed: social appreciation, understanding and responsibility about science and technology. Thus it would be possible to meet important social demands that have received little attention from science communicators, without at the same time giving away the ideal, long sustained in Mexican science popularization, of a broad scientific culture in the aesthetic sense.

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CONCEPTUAL SPACE: A NEW UNDERSTANDING OF POPULAR SCIENCE

Peter Broks

School of Cultural Studies, Faculty of Humanities Languages and Social Science, University of the West of England, St Matthias Campus, Fishponds, Bristol, United Kingdom. Tel: +44-117 32 84335, peter.broks@uwe.ac.uk

Abstract

This paper suggests a new model for understanding how the meanings of scientific knowledge are challenged and negotiated. It suggests that we treat ideas not as things but as spaces to be shared and explored. Like urban space "conceptual space" is the result of design, history and use. Spaces/ideas are not always used as intended. Popular science aims to open up this conceptual environment but to open up spaces means to lose control over them. The challenge for scientists is not just whether they are able to do this but whether they are willing.

Key words: model, negotiated meanings.

Text

Old models

Popular science is now at a critical phase in its history. The marketing exercise that often passes for science communication is looking increasingly irrelevant - a vision of modernity in a post-modern world. Likewise, the models employed to understand the popularisation of science are now generally acknowledged to be inadequate - a linear

model of communication, a deficit model of understanding and (commonly) a presentation of science as an unproblematic collection of facts. Most work within this standard view concentrates on the "effectiveness" of media with the public as empty vessels needing to be filled with the "right" answers and scientific "literacy" a measure of how full those vessels are.

This might be called the first generation model of popular science. A second generation has tried to go beyond a simplistic transmissive model to give a more complex account of science communication. For example, Hilgartner uses the metaphor of a stream to show a spectrum of contexts for popularization (Hilgartner, 1990) and Lewenstein uses the analogy of a web in his account of cold fusion to show a whole network of interconnections (Lewenstein, 1995). Often this rejection of a transmissive model comes with a call for a "dialogue" between science and the public.

Accepting this need to consider the context for communication I want to suggest a third generation model based on contextualized interactivity, a cultural approach which sees popular science not as an accumulation of information but as a struggle over meanings.

Conceptual Space

My previous work has argued that popular science is best seen as a "forum" where what is popular meets what is scientific. I now want to develop this spatial imagery further with the idea of "conceptual space" as a new model for understanding how the meanings of scientific knowledge are challenged and negotiated

I want to shift from thinking about ideas as objects that get passed from person to person and to start thinking about them as spaces. I believe this shift in imagery is applicable to ideas in general but is especially important for our understanding of science in particular. We are already familiar with spatial imagery. Academics "locate" their work within a particular subject "area" and "orientate" themselves with respect to other researchers in the "field". There are disciplinary "boundaries" and "frontiers" of knowledge. We are also familiar with non-physical spaces where things happen and people interact (e.g. in cyberspace).

However, I think there is something new that arises if we take this metaphor seriously: firstly, if we consider an analogy with urban space, and secondly if we apply these ideas to our understanding of popular science.

Analogy with urban space

Urban space is the product of design, history and use. More particularly we should note that:

1. Space can be created and closed down. The more open and accessible a space the greater the variety of use and the less control there is over it.
2. We interact with space. Urban space shapes what we do and how we do it; equally, space may be used in ways other than intended

Similarly, conceptual space is the result of design, history and use. As urban space shapes what we do and how we live, so conceptual space shapes what we think and how we think it. In both cases we interact with the space and transform it for ourselves as it, in turn, transforms us. We can draw out the analogy further:

- to close down a space restricts what we can do there (e.g. prevent us asking certain questions),
- use is not always as intended (e.g. variety of Darwinisms, popular appropriations of chaos theory),

- people keep revisiting the same places/ideas or avoid other places/ideas (i.e. prefer not to think about....),
- some places/ideas are functional and only visited when needed (e.g. science?),
- some places/ideas are more permanent than others.

Conceptual space and popular science

By reframing our understanding of science in public, conceptual space also suggests a way forward to go beyond the simplicities of science communication. There is no simple boundary between science and the public, nor any simple line of communication between them. Instead we can see the open spaces where not everything is done or thought for rational or rationalized ends, and restricted spaces, fenced off and policed, where only the persevering few are able to venture.

Thus, our new concern should be with access to spaces; with freedom of movement; with helping people to navigate and showing them different routes; with opening up the conceptual environment. However, the desire to make science more public may conflict with an equally strong desire on the part of scientists to control the meanings of what is made public. To open up conceptual spaces means to lose control over them. The challenge for scientists is not just whether they are able to do this but whether they are willing.

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BELIEFS THAT DIFFERENTIATE, IDEAS THAT JOIN: PARALLELING DISCOVERY AND COMMUNICATION TO MODEL PCST

Andrea Cerroni

Department of Sociology and Social Research - University of Milan-Bicocca, via Bicocca degli Arcimboldi 8, 20126 Milano, Italy. Tel.: (+39) 02 6448 7566, fax: (+39) 02 6448 756, andrea.cerroni@unimib.it

Abstract

Traditional PCST models are insufficient to understand and intervene onto science public perception. It is advanced a socio-cognitive theoretical framework, articulating knowledge in beliefs and ideas.

While we produce ideas thematizing beliefs through open critics and public communication, we live within hidden, involuntary local beliefs. Beliefs are responsible for differentiating local points of view; scientific ideas are designed to be shared in widening horizon. It is suggested a communicative basis for science, neither universal nor particular, but relativistically embodied, that enables a participation model.

Key words: beliefs, ideas, relativistic knowledge.

Text

Usual models for PCST –deficit, contextual and lay expertise (Lewenstein, 2003)– are openly judged unfit to understand public perception. However, widely demanded participative models are still pretty unexplored. Suggestions come distinguishing knowledges and paralleling discovery and communication.

Distinguishing knowledge: beliefs and ideas

A useful distinction inside knowledge goes back to Ortega y Gasset (1934).

Beliefs are hidden, involuntary local knowledge, similar to habitus (Bourdieu, 2001). This is locally socialized knowledge where we live within. This is personal knowledge (Polanyi, 1958) we receive while having experience in our socialized, daily life. So, great part of such knowledge is not, properly speaking, personal: indeed, it is here before we are born and we leave it pretty unchanged, as it is just taken for granted. It is also the ground of our reasoning, the scientific one, too; and that's the reason why we feel it is our "personal" knowledge.

Ideas are arguments openly stated that, following Hacking (1999), we discuss, accept, share, state, work out, clarify, contest through a voluntary reasoning starting from a thematization of some beliefs. So, idea-type knowledge is dialogical, and lives of public communication.

So, we accept ideas but we do not accept beliefs, as we receive them (Cohen, 1992).

Highly different are the communication ways of the two kinds of knowledge: ideas travel publicly through irradiation across minds; beliefs travel through implicit, imitative cultural contagion (Sperber, 1996).

Ideas are driven towards coherent and complete corpuses (theories), but such a goal is strictly unreachable (after Goedel).

Beliefs are responsible for fundamental attitudes, as we can see with biotechnology public perception (e.g. Cerroni, 2003), and they are arranged in unstructured clusters, with some beliefs more stable then the others. To be more specific, such clusters are not structured by subject's reasoning, but are structured by the actual experience, socially structured by subjects' objective life, indeed.

Paralleling discovery and understanding: a realistic science of science

While studying scientific discoveries, we have to go over the positivistic dichotomy of contexts: discovery is not a cognitive process entirely different from public understanding.

Scientific revolutions are characterized by conceptual breakdown driven by heuristic reasoning based on beliefs, as it for common reasoning while producing conceptual innovations (e.g. Cerroni, 2002). Therefore, a parallel can be elaborated for public communication, in order to model heuristic reasoning of public perception. As a result, we can take advantage of science of science both to analyse and to intervene into public perception.

Beliefs guide the framing process of new concepts, and the cognitive processes of discovery should be openly presented to public in order to both stimulate analogous reasoning and to reduce the distance between science and daily life. As discovery is not matter of "genius", but of socio-cognitive job, so is for public perception. Apart from technical difficulties, the biggest ones, as science history shows are of the same nature. Scientist and his public make the same cognitive effort in the common background knowledge.

Relativity beyond relativism: science to join, communication to participate

If scientific knowledge is not fully different from the lay one, but an idea-type knowledge built on common beliefs and aimed at reflexivity (Bourdieu, 2001), we de-mythize and we enhance the social image of science to the public. Science, indeed, has the social mission to unveil common beliefs, transforming them in ideas and putting their content under

public judgment, to improve knowledge in front of evolving experience and more general contexts.
If beliefs are responsible for differentiating local points of view (Elias' involvement), ideas –especially scientific ones– are designed to be shared in widening horizon (detachment), subjected to onus probandi through open confrontation. However, also if scientific knowledge is based on beliefs, the image of science has not to be reduced to socialconstructivism or socialrelativism of the current Sociology of Scientific Knowledge. It is suggested that communication is science basis as it this a paramount common-action, neither universal nor particular, but general relativistically embodied in objective structure of historical-specific human experience (cfr. Bourdieu, 2001). And this is less emotively involved and more rationally detached knowledge to be participated by variety of subjects. Communicating this –scientific– view of science, we could enhance actual participation in such a participative type of knowledge as scientific knowledge actually is, avoiding both fatal risks of knowledge-based society: technophoby and technocracy.

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SCIENCE COMMUNICATION AND SOCIAL PARTICIPATION TO COMMUNICATE SCIENCE FROM THE SOCIOCULTURAL APPROACH

María de los Ángeles Erazo Pesantez

Facultad de Ciencias Sociales. Edificio FES. Despacho 306. Campus Miguel de Unamuno. Universidad de Salamanca. C.P. 37007, Salamanca, Tel.: 645343772, mariadelosangeleserazo@yahoo.es

Abstract

The super-specialization and complexity of science has generated an exclusive vocabulary of techniques and terminologies that is difficult for many to understand. This situation has created a great breech in communication between scientists and the general public. The PCST provides one of the most suitable channels through which to unite these two parties. But this process must take into account the cultural characteristics of participating actors –their values, beliefs, traditions, habits, phobias, symbols and knowledge– to ensure that scientific and technological decision-making is more transparent and is open to the general public. This work proposes to study the PCST from a sociocultural approach.

Key words: communication, cultural diversity, scientific knowledge.

Text

The Need for a Cultural Model of PCST

The term culture is multidiscursive[1] and its definition has motivated many studies. Anthropologist Leslie White(1989)[2] supposes that science is not just part of the culture, but that could even determine the culture.

In this study, culture is understood as a system which, although having emerged from a biological origin, it changes and develops with biological principles and from its own laws that cannot be explained solely using a biological reductionist analysis. [...] Culture acts like fast mutant. It sends new variations to the order of natural selection and it changes the epigenetic rules through succession of generations and the new information obtained in each offspring.[3]

Science and technology have a social obligation, for this reason it's necessary that the general public understands its procedures, results and effects. The general public must assume a civic conscience[4] and participate in the decision making with respect to those subjects.

The majority of projects designed to communicate science to the public follow models of an asymmetrical type, like those of deficit or diffusion.[5] They are limited models which analyse communication as a process with a unidirectional path (moving from the scientific to the public). Not only do they assume that the transmitted information is neutral, they also ignore the cultural characteristics of the actors. These are the main reasons why communication between scientists and the general public is problematic.

For this reason it is necessary that the Public Communication of Science and Technology (PCST) recognizes the cultural characteristics of its actors, as suggested by Brian Wynne (1996). In his analysis about risk communication, they recognized that in the interaction between science and the public the tacit cultural dimension has an important influence. That is, the tacit dimension conforms –in great manner– the states of (in)communication and distrust. According to Wynne (1996), these states recognize that the cultural dimension of science is loaded of significance. This contrasts with the traditional image that is had of science, like a neutral knowledge about an immutable reality.

If we accepted that dialogue will have to be cultural, then the traditional unidirectional model of the communication will have to be reformulated from a sociocultural perspective, to become a more complete model. This model should take into account the connections between forms of organization of the society (the politics-cultural), socio-economic mediations and the discursive practices of science and its divulgation.

Although scientific investigations dream of achieving international (global) projection, they must acknowledge (local) cultures before communicating with the general public. Pierre Fayard (2002) summarises this point, "If science is global, its measurement, to be efficient, ought to be developed locally. *Think global, act local*.[6]

To communicate is to dialogue, is to relate a fact to the cause that produces it and with the effect that it generates. In this study the PCST is understood as a sociocultural practice that operates within a given society, with defined cultural political orientations and with an adequate discursive management for specific publics.

The Characteristics of the PCST

The PCST is involved with all types of extension activities and scientific knowledge updates. It can be undertaken within non-formal education,[7] with support of the mass media and in spaces opened for dialogue over scientific-technological issues.

There is no consensus on who is the most suitable person to communicate science publicly. A solution is the joint work between scientists and journalists. But this cooperation is insufficient without the contribution of other professionals, educators and the family.
Just as music requires interpreters to be appreciated, science needs professionals who can interpret scientific studies for the public. Maurice Goldsmith compares a public communicator of science with an art critic, to who he calls scientific critic. To this professional, Goldsmith suggests him a multidisciplinary formation that integrates courses of general science, of history and philosophy of science and technology, of art and of communication psychology.

Conclusions

It is necessary to restore the balance between knowing how to do science-technological, and the knowing how to do it humanely. This balance must guide decision-making with respect to science and technology.
In order that science and technology support the formation of a civil conscience –and comply with their social obligations– it is necessary to develop PCST studies from a socio-cultural perspective. This analysis should incorporate the following in the communication process: institutionalization, mediations, and social agents who to take part in this communication process.
It agrees: 1) to surpass the split between human and exact sciences, 2) to value and to reinforce the contribution of social sciences to the study of the PCST and 3) to promote interdisciplinary analyses about. Only open dialogue will overcome the obstacles to greater communication between scientists and the general public, which ultimately, could obtain the ideal that Stephen Hawking summarizes below:
"If we discovered a complete theory of the Universe, it would have to be understood, with time, in its basic principles by all; not only by a few scientists. Then everybody: philosophers, scientists and common people could take part in a discussion about why the Universe and ourselves exist. If we found the answer to this, it would be the final triumph of human reason."[8]

Notes

[1] This could refer to nationalism, fashion, anthropology, literary criticism, vitiviniculture, marxism, feminism, the cultural studies and even common sense.
[2] Leslie A. White conceived culture as a global system, sustained by three subsystems: ideological, social and scientific. This last one is attributed a basic role in the fight for the survival of species and it is considered determinant in the construction of culture.
[3] Cfr. Enrique Pallares (2000), p. 24.
[4] From PUS (Public Understanding of Science) to PEST (Public Engagement with Science and Technology), in *Science*, vol. 298, 4th October 2002, p. 49.
[5] B.C. Lewenstein (2003): "Models of Public Communication of Science and Technology", in *http://communityrisks.cornell.edu/BackgroundMaterials/Lewenstein2003.pdf*
[6] Cfr. Pierre Fayard, (2002), p. 238.
[7] Non-formal education is understood as a complement to formal or institutionalized education. It's difficult to have the didactic contents updated with respect to scientific and technological advances; so, in as much as those reforms are applied, non-formal education could empower those who wish to contribute to the public understanding of science and the technology, through the PCST.
[8] Fragment of documentary *A Brief History of Time*, Inc., UK, 1991; Anglia Television Ltd./Gordon Freeman Production, UK, 1992; Globus Comunicación, S.A., Madrid, 1993.

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DIMENSIONS OF SCIENCE COMMUNICATION

Ann Van der Auweraert

Department of Science Communication, University of Antwerp, Groenenborgerlaan 171, 2020 Antwerpen, Belgium. Tel.: 0032 32653484, ann.vanderauweraert@ua.ac.be

Abstract

Science communication has received considerable attention over the past few years. A number of related terms such as public understanding of science, public awareness of science, public engagement of science and public participation appear in several reports and journal articles. This article analyses these different articulations of science communication and describes a possible framework for science communication.

Key words: science communication, theoretical framework.

Text

Introduction

In a survey of the literature we have found that the term science communication has been used in several different ways, from monologue to dialogue. This evolution could be the result of tree important shifts in the way of thinking about the communication process between scientists and the public: 1) the introduction of an active receiver, 2) process communication and 3) public participation.

Monologue

In the traditional way of thinking, science communication is the dissemination of scientific results to a generally passive and monolithic public, usually through the formal education system, or through the mass media. In this diffusion model the communication process goes in one-direction, from a sender to a passive receiver. (Logan Robert A., 2001) The aim of the communication is the 'understanding of science' by citizens, in the hope that there will be a greater support for science, and especially for the great amount of money that goes to science (Lewenstein B.V., 1992). A lot of effort is put into the raising of

increasing the scientific literacy of the public, and we see the creation of several 'public understanding of science' programmes (PUS), based on the concept of this 'deficit model'. See for example: (Paisley William J., 1998; Laugksch Rudiger C., 2000; Wynne Brian, 1991).

Shift 1: The active receiver

In the diffusion model, citizens were generally viewed as empty minds to be filled. But in the communication sciences, they have for a long time recognized that the receiver is an active partner in the process. The transmission of knowledge from sender to receiver is more complex than thought. For example, there are several different audiences, with their own experiences, knowledge, wishes and needs. So, if the sender wants his message get across, then he has to look closely at his audience. One of the consequences for instance is avoiding jargon. The greater attention for the pubic also means more creativity in the 'packing' of the message. A variety of events arise with the audience in mind. The 'public awareness of science' (PAS) is the aim, not only the pubic understanding of science. See for example: (Stocklmayer Susan, Gore Michael, & Bryant Chris, 2001; Wynne Brian, 1991;Laugksch Rudiger C., 2000; Clark Fiona & Illman Deborah L., 2001).

The conclusion is a shift from one-way towards a two-way communication process. There is more interaction between sender and receiver, and the receiver is more attentive to his audience. As the public understanding of science is supply driven, the pubic awareness of science is more demand-driven.

Shift 2: knowledge as a social construct

As in public understanding of science, the public awareness of science tells stories about the results of scientific research. This transmission of knowledge is certainly suitable for basic science. But what if there is a lot of uncertainty or if there are ethical implications? In social sciences they have found that knowledge isn't a product, but in fact, the result of a very intensive and continuous interaction process. Communication is then a mutual process between scientific experts and lay-experts. Communication is a transaction process. See for example: (Bucchi Massimiano, 1998; Wynne Brian, 1991; Gibbons Michael, 1996). In terms of science communication, it means a shift from product to process communication.

Shift 3: open participation

Within the transaction model, there is a tendency to open participation activities, were scientists and lay people are equal partners in the communication process. The driving forces are the improvement of the relationship between scientists and their public, and the knowledge that science isn't the only source of knowledge. In fact it's one part of our understanding of the world and has to find its way between other knowledge's (experiences, intuition, philosophic, ethical). Other properties of this kind of communication are openness and transparency. See for example: (Gibson Ian, 2000; Barbagallo Fiona, 2002; King Suzanne, 2002).

While a real dialogue between equal partners is the ultimate goal, there are other participation forms where the actors in the communication process are less equal, and where the scientist still plays a dominant role in the agenda setting. For instance, this is the case in the 'Pubic engagement of science ' events, like citizen juries or panels. The aim is to consult the public for decision-making. It's still supply driven. It's a communication process between experts and non-experts, two-sided. In contrast, the real dialogue is a multi-direction way of communication. There is no fixed sender or receiver,

or there is no expert or layperson, both are senders and receiver at the same time, and partners in dialogue. The communication process is bottom-up, in contrast to the original content of science communication that is top-down oriented (The Wellcome Trust, 2001).

Conclusion: a framework for science communication

As mentioned at the beginning, there are several ways to look at the concept of science communication: understanding, awareness, engagement and participation. These differences could be characterised in a scheme with two axes: product versus process, and close versus open communication.

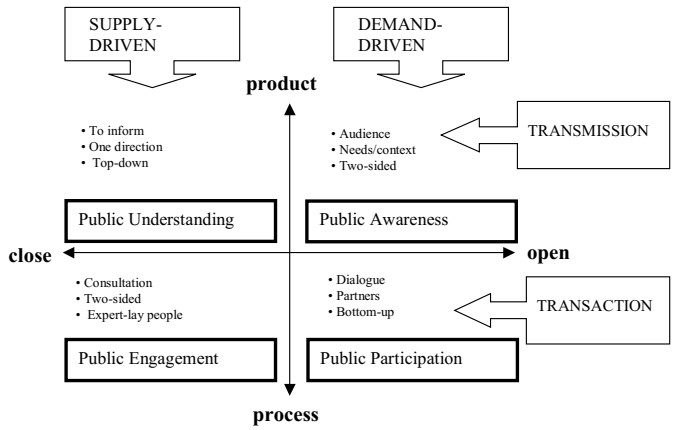

Figure Different Interaction-modes for science communication

All these four approaches of science communication are important to build a sustainable relationship between science and society!

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WHEN SCIENCE COMMUNICATION SETS THE AGENDA FOR CITIZENSHIP

Cidoval Morais de Sousa
UNITAU / UNIVAP / UNICAMP

Abstract
The proposal of this paper is to offer elements for the construction of a discussing agenda concerning a particular dimension of Public Communication of Science (PCS), which we here call a citizen agenda. The constructivistic inspired literature targets two attitudes related with the communication of sciences: one strongly concerned with the proposital content, discoveries, new theories, feeder of the Mertonian rewarding system; the other, that can be resumed by the idea that communicative elocutions are words´ acts, produce actions, have an elocutionary force that does not depend on its propositional content. This, according to some authors, allows to understand communication as an sphere of the own right social activity, inside which messages are not preserved or transferred, but, yes, formed and constructed. We share the assumption that communication penetrates science research and that it is so relevant to it as for the questions related to the publication of its results. For constructivistic authors, the PCS have four dimensions: the literature (written material); the biographical (emphasis on the scientist); the collective (characteristic of the large research networks); and that devoted to the lay public. In this paper we add one more – the citizenship dimension, that has as its major concern the construction of a new pact, which allows to reduce the gap that separates the common citizen from the sciences, giving him the means to form opinions on S&T practices and policies which affect his day-to-day life, so that he can also participate with more knowledge and responsibility. In this context, we foresee science communication as a tool for the construction of citizenship.

SCIENTIFIC POPULARIZATION: A POSSIBLE INSTRUMENT OF LITERACY IN SCIENCE

Marta Ferreira Abdala Mendes
Casa de Oswaldo Cruz-Fiocruz, Brasil

Abstract
The current changes that it suffers the world, of character techno-scientific, organizational, political etc. they have been putting us a challenge: to develop the learning capacity and understanding of the relationships of the which we are subject, so that we can have a larger participation front to the processes decisives. Due to the moment in what did notice the impacts of the science in the society and vice-versa, done so much in discoveries believe as brilliant - how the Genoma Human Project - and in controversial cases, the clone and foods *transgênicos*, which will the validity, the functionality be or even the possibility to propose a debate on that science is that?
As several other subjects that permeate the scientific activity, the scientific popularization is made present while instrument of cultural development and of widespread and updated access to the knowledge. What was purified, reduced, enlarged, and, therefore, known by the scientists is what will be selected, spread and formalized seeking the formal education, the no-formal education and the society in general.
Then, as it is alphabetized in science, the citizen that is out of the school? For different means the citizen has access the science, larger part of this access feels starting from the means of mass information: television, newspapers, popular scientific magazines, ... Inside of this universe of means of scientific popularization I detach the scientific magazines that it has as objective takes the science to the widest public. However, how does the scientific knowledge arrive to the public? Do these vehicles mythicize the science, promoting simplistic conceptions on the science and its content? Or do they take into account this knowledge while a product of a certain specific culture for values, language, etc. promoting a more critical and democratic understanding of the science?

Parallel session 10

Science communicator, is it a good profession?

THE DISTORTED VIEW ON SCIENCE. ON THE WEAKNESS OF JOURNALISM AND THE STRENGTH OF PUBLIC RELATIONS

Winfried Goepfert

Freie Universitaet Berlin, Institut fuer Publizistik/Wissenschaftsjournalismus, Malteserstr. 74-100, D-12249 Berlin. Tel.: +49 30 838 70300, goepfert@zedat.fu-berlin.de

Abstract

Science and technology are presently facing an acceptance crisis. One strategy to counter the lack of acceptance consists in strengthening public relations. The efforts of scientific institutions to boost their PR work meets with a period of weakness on the side of journalism. The number of published units is decreasing, competition between publishing houses is diminishing. Editorial departments are being reduced, journalistic spheres of competence outsourced, specialized editorial departments are shut down. On the other hand we are confronted with a growing number of PR workers. Public relations to a growing extent copies journalistic methods and exerts influence on journalists. Regarding the coverage of science in particular, one can state that the evaluation criteria of scientists leave their mark on the coverage of science journalism. This paper gathers some indicators for these general tendencies. Especially the illegitimate methods of taking influence shall be scrutinized and discussed.

Key words: Science journalism, public relations, science coverage.

Text

For a long time science was perceived as something positive and presented favorably in the media. In the mid-seventies perception and media coverage became more critical (Kepplinger, 1989; Bauer *et al.,* 1995). Certain practices were no longer accepted by the population. Science and technology had gotten into an acceptance crisis. Scientists and researchers felt compelled to justify their work and campaign for more public support. But this strengthening of public relations occurs in a quite peculiar situation, one might

call it the weak phase of journalism. This weakness of journalism as a phenomenon is true for journalism as a whole and for science journalism in particular: Editorial staff is being reduced, spheres of competence are being outsourced, and PR products replace journalistic products without being sufficiently identified as PR.
In communication science, the relationship between journalism and public relations has recently been conceptualized by the determination hypothesis: "The more influence public relations gain, the less influence can be attributed to journalism and vice versa" (Baerns, 1991: 17). In public communication, journalism and public relations have to fulfil different purposes. Journalists construct 'true realities' on the basis of constitutional preconditions and Public Relations create 'desirable realities' for the sake of the customer. Both, journalism and PR, have to play different roles. Nevertheless, recent developments seem to counterpoise this functionally important distinction between both communication systems.
Present statistics give proof of the decreasing number of published units and the resulting decrease of competing publishing houses. Traditional newspapers are threatened by advertising papers and free-of-charge newspapers. In 1980, the advertising papers already reached 700 titles, in 1998, their number amounted to 1,300 titles with an edition of 85 million copies (Rager, 1999).
Editorial staff and journalistic spheres of competence are being outsourced. At the *Westdeutsche Allgemeine Zeitung*, specialized editorial departments were closed down and replaced by centralized editorial offices delivering theme pages like "health", "automobile", or "computer" to all regional newspapers (Röper, 1997: 54).
The following tendencies may stand as proof for the growing influence of public relations:

- The number of PR workers grows dynamically.
- Public relations increasingly copies journalistic working methods.
- Public relations increasingly uses journalistic personnel.
- Concerning science journalism: Evaluation criteria of the scientific community influence media coverage.

The following figures show the development of personnel working in public relations: At the time being Germany has an estimated 60,000 journalists and 30,000 PR specialists. The number of PR workers is growing dynamically and is supposed to be reaching 50,000 in 2005.
Press information and PR kits are increasingly often presented in a journalistically useful style, so they can be directly integrated into the print system or broadcasting schedule without any further processing. In an analysis specifically dealing with science coverage Barbara Baerns comes up with the result: Two thirds of the science coverage of news agencies are based on information from public relations (Baerns, 1990: 47). One might consider this a precarious and somehow imbalanced proportion. Because it means that only one third of science coverage is due to independent research of journalists.
The evaluation criteria of the science community influence journalistic coverage by their publishing habits and the accompanying public relations. In a survey, Carola Pahl analyzed half a year of medical coverage on the science pages of eight nationwide daily and weekly newspapers in Germany (Pahl, 1997: 10).
The survey researched the sources of almost 1,200 articles on medical topics. 450 could be directly derived from an article in a professional scientific journal, which equals to almost 40 percent of the total coverage. Interestingly, the source was not always mentioned. Only about 80 percent of the articles referring to a specialized publication

bothered to mention their source. Most of the articles followed a simple principle by only summarizing what was said in the journal article.
Journals with a high "impact factor" get the most quotations among all journalistically processed scientific journals. The impact factor shows how often an article in a journal is quoted in other professional publications. In other words, it indicates the reputation of a journal within the scientific community.
By adhering to the publishing practice of the scientific community, journalistic coverage also copies its evaluation criteria. But the accompanying public relations also influence the media coverage. The professional journals usually issue press information, especially on articles they consider important. Additionally, these publications are highlighted in the respective journal's editorial. Analysis has shown that such highlighted articles very often become the basis of a newspaper article. Thus, press information and editorial comments substantially influence the subject selection of newspaper editors.
In the following some tendencies shall be highlighted that prove the increase in illegitimate forms of taking influence:

- Hidden sponsoring and subsidies.
- Employing and influencing journalistic personnel.
- No transparency in usage of PR material.
- PR in pseudo-journalistic shape.

Public as well as privately owned television and broadcasting stations are presently outsourcing editorial planning and production processes. In most cases, the most inexpensive bids are accepted, that quite often cannot even cover the production costs. Knowingly or unknowingly, both sides take into account that the producers will have to look for other funds to finance the project. As a consequence, radio or TV broadcasts are being sponsored by third parties, either by coverage in favor of a certain product or by seemingly accidental name dropping or demonstrations of a product. Sponsors often aren't even mentioned by name, but they influence the choice of topics and the tendency of coverage. W. Göpfert (1990) and Busche (1998) have discussed plenty of examples. This mixing of journalism with PR is by no means a new phenomenon, it has happened before. But never before has this tendency been accelerating like it is today.
A recent example may demonstrate to what extend public relations for science considers the assumption of journalistic tasks as a matter of course: At the *Badische Zeitung* in Freiburg, once a week the reports on science and research were no longer written by journalists. The newspaper leaved this task to the local university. The press office of the university edits the paper's science page and fills it with own news and articles. The credits on the science page mention the press office as an "editorial". However journalistic science coverage still exists but it is in parts being replaced by public relations. There are other examples: The weekly science page of the *Vancouver Sun*, for instance, is created by the local H.R. Macmillan Space Centre. The page is layouted like a regular newspaper page, and bears the centre's logo at the bottom.

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THE RISE OF SCIENCE JOURNALISM IN DENMARK

Kristian Hvidtfelt Nielsen[1] and Henry Nielsen[2]

[1]History of Science Department. University of Aarhus, Ny Munkegade, building 521, DK-8000 Aarhus C, Denmark. Tel: +45-8942 3506, Fax: +45-8942 3510, ivhkhn@ivh.au.dk

[2]History of Science Department. University of Aarhus, Ny Munkegade, building 521, DK-8000 Aarhus C, Denmark. Tel: +45-8942 3513, Fax: +45-8942 3510, ivhhn@ivh.au.dk

Abstract

In the context of a large-scale national project on the history of Danish science, we conduct a historical investigation into the rise of science journalism in Denmark, 1938-1951. In particular, seeing science journalism as cultural boundary-work (Gieryn 1999), we study the work and lives of the two first professional science journalists in Denmark, Børge Michelsen and Niels Blædel. We situate their work in a context of scientific and public culture and try to take into account their different journalistic experiences.

Key words: Science journalism, history, Denmark.

Text

Context

While Danish journalists have been reporting science since the 19th century, the professional science journalist is a recent feature of Danish history. Professional science journalists face a threefold problem of mediation. First of all, they have to know enough about science to gather and translate information about very difficult and intricate fields of expertise; secondly, they have to be very conscious not to take the hierarchical structures of scientific expertise for granted and to relate scientific topics to other fields of human experience; thirdly, they have to draw science into more general discussions of public interest. The first part of the problem is technical for the most part and a cornerstone in science journalism's professional code. The two latter parts of the mediation problem relate to the social and epistemic boundaries between science and society.

Science journalism may be seen as cultural boundary-work described by sociologist of science Thomas F. Gieryn (1999). Science journalists demarcate science as a culturally

discrete and identifiable activity. Yet, at the same time, they also break down existing boundaries between science and society by creating a new cultural space for the interpretation and understanding of science, namely science as public news.

Objective

Our objective is to situate the work of the first, professional science journalists in the context of contemporary changes in Danish scientific and public culture. Looking at the ways in which the first "real" science journalists in Denmark responded in different ways to their role as mediator between science and society, we want to demonstrate that science journalism may be seen attempts to create a historically specific and cultural space for science.

Methods

Our study is a qualitative, historical investigation. It is carried out in relation to the on-going, five-year project on the history of Danish science, organized by the History of Science Department, University of Aarhus.[1] We study the articles of the two first science journalists in Denmark and try to situate them in the wider context of the contemporary history of science and social history. Also, we aim to look at the journalistic experiences of the two journalists in mention and to make it significant for their science journalism.

Results

We find that the first two science journalists in Denmark, Børge Michelsen and Niels Blædel, focused their journalistic efforts on: 1) science (and, particularly, science carried out in Denmark) as an exemplary, noteworthy, and valuable activity, and 2) the lack of government support financial and the consequent job-related difficulties of younger scientist (see e.g. the collection of articles in Michelsen 1941, and Blædel 1949). In their science journalism, science was culturally demarcated as being something different from, yet on a par with other culturally and nationally important activities such as literature and the arts. This has to be understood in the context of WWII, which put Danish nationality under pressure, and thus created a need to promote the efforts of Danish citizens, including Danish scientists.

At the same time as aligning science, literature, and the arts, Michelsen and Blædel depicted science as an important part of the political economy of Denmark. Science, in their view, gave rise to technical advances and therefore had to be supported. Their endeavors trying to increase public support for science were in concordance with similar undertakings by several scientists and a few politicians at the time.

What separated the science journalism of Michelsen from that of Blædel was Michelsen's occupation with the daily work of scientists (Michelsen, 1941). Before taking up science as a journalistic specialty, Michelsen wrote about the everyday life of different trades, and, so, seeing science as yet another trade must have seemed naturally to Michelsen. Blædel's starting-point was different in that he came to science journalism without much journalistic experience. He concentrated his articles about the results of science, and not its daily routines.

Conclusions

From our studies of the rise of science journalism in Denmark, we conclude that it is, indeed, fruitful to see science journalism as cultural boundary-work that demarcates science from other cultural activities. We conclude that the rise of science journalism in

Denmark is contextually situated, i.e., it is in part a reflection of and response to contemporary developments in scientific as well as public life. Finally, we also conclude that science journalism reflect the individual background of the journalist involved.

Notes

[1] The principal objective of this project is to write a four-volume work in Danish on science in Denmark from the Middle Ages until recent times situating science in the context of national and international history. The two last volumes include chapters on the popularization of science. We aim to cover the topic broadly by looking at many different kinds of science popularization, including science journalism.

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SCIENTIFIC JOURNALISM AND CITIZENSHIP RIGHTS

Alice Mitika Koshiyama (PhD)

Journalism and Citizenship Group, School of Journalism, University of São Paulo (Universidade de São Paulo – USP), Street Lucio Martins Rodrigues, no. 443/A, CEP 05508-900, phone (55-11)3091-4117/4087. São Paulo, State of São Paulo, Brazil, alicemit@usp.br

Abstract

Journalism is a gender of knowledge, a way to understand the world and to make the life better. We study this knowledge like as professional work for improve the citizenship rights (see C. Abramo).
When the scientific journalist works to improve the population health, he has to make choices. He is a citizen (see T. Marshall), he has values (see A. Heller), knows how to be journalist. His knowledge has to be specific and his ethical values it can be the opposite of others knowledge, for example the medical. In this way, journalist work for human's health rights, he must know what is the science and its economic values in the capitalism.

Key words: journalism, citizen participation, health and medicine.

Text

Context

Journalism is a way of making new concepts of life. Many scientific journalists works only for business, but it could be different. The press has a hard mission to improve the best knowledge. And also the press has a mission to improve a new ethics and new values for the health for all people.

Objective

It must build a new concept of scientific journalism, an independent journalism with specific rules and special knowledge. How we can do it in scientific journalism?

Methods

This is a interdisciplinary research with history (cf. A. Heller), ethics and journalism (cf. C. Abramo) and citizenship (cf. Marshall). History is a construction of values (cf. Heller). The citizenship rights are values, but it is a work in progress, during more than two

hundred years (cf. Marshall, Bobbio, Gentilli, Hirschmann). We see this situation in some cases studies about citizenship and scientific journalism (cf. M.O. Bocchini; M. Siqueira). The historical and cultural background is a way to study brazilian press and its news about hormonal therapy for women.
Results: The alternative texts what were written against the majority press, were critical about hormonal therapy for women. (cf. site Observatorio da Imprensa).The majority of critical news and articles about hormonal therapy were written by feminists: doctors, like Fátima de Oliveira (cf. REPOSIÇÃO HORMONAL - A imolação de mulheres na busca da eterna juventude (HORMONAL THERAPY – the women sacrifice for eternal youth); or presswomen at a non governmental organization, SOF – Sempreviva Organização Feminista (cf. Mulher e Saúde (Women and Health), March,2002, no. 28).

Conclusions

Journalism depends on historical and cultural conditions. Some conditions are: an ethical basis of citizenship and knowledge about science and journalism. We can say an independent scientific journalism is possible.

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MAXIMISING SOCIAL PARTICIPATION IN SCIENCE COMMUNICATION: SOME LESSONS FROM ANTHROPOLOGY AND PSYCHOLOGY

Rod Lamberts

The Centre for the Public Awareness of Science. Frank Fenner Building (42). The Australian National University, Canberra ACT Australia 0200. Tel.: +61 2 612 50747, Fax: +61 2 612 58991, Rod.Lamberts@anu.edu.au

Abstract

This paper begins with the premise that science communicators –though a diverse breed– are all facilitators of social/public participation in science. Given this, four short examples are presented deriving from the author's prior experience in anthropology and psychology. The examples are summarised as; culture clash, notions of rationality, relativism and culture change. Using these, the importance of social awareness to science communication theory and practice is highlighted. It is argued that science communication without recognition of, and responsiveness to, social context is science evangelism.

Key words: facilitation, context, culture.

Text

As a practice and a discipline, science communication is extremely diverse. Underlying this diversity however, is at least one, central theme: our role as facilitators of social/ public participation in science. To fulfil this role effectively, we need to be equipped to recognize and respond to the demands that varying social contexts may make upon us. In this paper, I present four examples from anthropology and psychology, each aimed at enhancing the science communicator's awareness of social context, and therefore their capacity to facilitate societal science participation.

Culture clash

A useful way to highlight social context is via cross-cultural comparisons, remembering that "culture" refers to more than just differences in ethnicity. First, an example of a culture clash within one ethnic group from a conference held in Australia, sponsored by the Forum for European-Australian Science and Technology Cooperation (FEAST).
This science/technology research-focussed forum ("Networking for Excellence") featured researchers, bureaucrats and practising scientists, and focussed on economic-related science issues. The *clash* occurred at the beginning of the plenary session "Science and Social Responsibility". As this session began, over half the attendees left – a dramatic example of cultural difference unrelated to ethnicity. The message to science communicators? Many involved with science have no interest in the social contexts in which science exists.

Notions of Rationality

Taking a traditional view of culture and applying it to science communication is also enlightening when considering awareness of social contexts. James Frazer, author of the classic anthropological work *The Golden Bough,* proffered two laws anthropologists could use when rationalising the logic behind *primitive* magic. These are the laws of similarity, and of contagion.[1]
The first law describes how like produces like, as happens with voodoo dolls. A voodoo doll looks like a magic practitioner's intended victim because they assume that anything inflicted upon this likeness will accordingly happen to their victim.

The second law, *contagion*, suggests that objects which have been in contact remain connected after separation. Hence some Australian Aboriginal groups ensuring others cannot find their nail clippings as these could be used to inflict harm *remotely*.
Interestingly, similar *misperceptions* –from the vantage of science– occur in science-literate societies, too. Notions of contagion are demonstrated by people who believe that choosing the same lottery numbers each week enhance their chances of winning. Implicitly they believe that the balls drawn from the lottery machine this week affect, or infect, those drawn in subsequent weeks.
The law of similarity can be seen in the still poorly-evidenced belief that watching violent movies *makes* people violent, or that subliminal advertising *makes* people buy things they don't want. A half-century old anthropological theory is relevant to the work of science communication today.

Relativism

From here, I want to consider cultural relativism: the idea that cultural practise is best understood from within the culture that adheres to it. Adopting this position can be productive, as anthropologists found when interpreting magical beliefs outlined above. So too, the science communicator may appreciate the position of, for example, a community of loggers unsympathetic to views of environmental scientists whose research they communicate. Appreciating the loggers' "anti-environment" stance relativistically may reveal a "pro-survival" stance when viewed from within the loggers' culture. But relativism can only go so far.
A clinical psychologist I knew spoke of working in Thailand with villagers who routinely sold their daughters into urban prostitution so their families could survive. For a time, she tried to remain relativistic, understanding this practice in context. In the end though, her moral sensibilities no longer allowed her even tacit complicity in such practices. She broke down from the stress of trying to resolve her personal beliefs with her professional duties. Her message? Recognize and maintain your own moral standards. Without these, we operate without grounding, swinging from belief to belief as the immediate social environment dictates. This is particularly relevant to science communicators working in areas involving ethically charged research and practice, such as reproductive technologies, bioprospecting and the environmental science.

Culture change

My last point, using an example combining anthropology and psychology/psychiatry, is this: social contexts, and more broadly cultures, change. They are neither static nor preservable. This example comes from the history of the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM), the *bible* of psychiatric diagnosis. The DSM-I, first published in 1952 , has been substantively revised thrice (DSM-II, DSM-III and DSM-1V). To demonstrate how (scientific) culture changes, I will consider DSM-II. Published in 1968, it included homosexuality as a mental illness. In 1973, well before the next formal revision (DSM-III, 1980), the American Psychiatric Association voted to remove homosexuality from the DSM-II. This change, brought about not *by* science, but *in* science, was influenced by contemporary changes in society/ culture. Social acceptance of homosexuality had changed, and psychiatry and psychology were moved to change too.
This example highlights that scientific culture changes, and does so in relation to the social context of the society in which it exists. It shows how social context, culture, and

the psychiatric sciences are inextricably entwined, suggesting again that awareness of social contexts is a highly desirable trait for a science communicator.

Conclusion

Culture clashes, concepts of rationality, cultural relativism and culture change - all are examples of the diverse interaction of social context and understanding. Considering the science communicator as facilitator of social participation in science, the relevance of these examples is clear: science communication will be enhanced by socially aware practice. Without this, it is little more than science evangelism.

THE SCIENCE COMMUNICATION PROFESSIONAL IN AUSTRALIA

Jenni Metcalfe[1] and Toss Gascoigne[2]

[1]Director, Econnect Communication Pty Ltd, PO Box 734, South Brisbane BC, 4101 Australia. Tel: +61 7 3846 7111, Fax: +61 7 3846 7144, jenni@econnect.com.au

[2] Executive Director, Council for Humanities and Social Sciences, PO Box 8157, ANU, ACT 2601 Australia. Tel: +61 2 6249 1995, fax: +61 2 6247 4335, director@chass.org.au

Abstract

The Australian Science Communicators (ASC) was formed in February 1994 in response to a demand by professionals working around Australia for an organisation that would help them to network and share ideas. Since this time science communication has become a recognised profession in Australia. This paper reports the results of a survey of science communicators and explores the questions: who are science communicators, what do they do, what influences them, and how do they see their career path.

Key words: science communicator, Australian Science Communicators, science communication.

Text

Context

The Australian Science Communicators (ASC) was formed in February 1994 in response to the demand of professionals around Australia for a forum for networking and sharing ideas. At the time it was a revelation. There was so much enthusiasm for the idea that 375 individuals across Australia agreed to become founder members.

At the time, science communication was an isolated profession. Every science organization, every division of CSIRO had one science communicator, but they had no organised way of talking to their colleagues.

There was no opportunity to share experiences or exchange ideas. Tertiary courses in science communication were at an embryonic stage. Publishing articles on science communication was a fanciful idea, and attending international meetings to discuss professional issues was almost unknown.

That was a decade ago. Now there are 465 members in ASC and science communication is a recognised profession in Australia, probably more so than in any other developed country.

Method

During May this year, a web-based survey was promoted to those on the ASC email list, to which both members and non-members can subscribe. The aim of the survey was to get a snapshot of science communication in Australia today.

Results
The web-based survey received 142 responses, with 101 (71%) of these responses being from ASC members. The majority of ASC members (56%) had been members for less than three years. The majority of respondents (77%) called themselves science communicators consistently or sometimes.

Who are science communicators?
The top five professions reported by respondents were:

- Public relations/media officer/communication officer for a science-related organisation (36%).
- Scientist doing science communication (20%).
- Freelance writer or editor (16%).
- Consultant (15%).
- Journalist (13%).
- Science communicators tend to be female (61%) and between the ages of 26 and 35 (38%).

While the majority of science communicators (49%) were in full-time employment, a significant number (45%) reported part-time work as a science communicator. These results were reflected in their earnings with the majority (34%) earning between A$40-60,00 a year, but a significant proportion (27%) earning less than A$20,000 a year.
The vast majority of respondents (79%) had a science degree of some sort, but a significant proportion (32%) had also had formal training in science communication. The majority (54%) also thought that science communicators should hold a science degree, but a significant proportion also (42%) disagreed with this.
The majority agreed or strongly agreed (57%) that science communication was now a respected profession in Australia. They also agreed (71%) that science communication was a different profession to public relations.

What do science communicators do?
The five most common tasks reported by survey respondents were:

- Writing (94%).
- Editing (80%).
- Web development (70%).
- Partner/client/stakeholder liaison (61%).
- Event management (56%).

The least common tasks reported were:

- Political liaison/lobbying (20%).
- Communication research (23%).
- Audio-visual production (30%).
- Scientific research (30%).
- Exhibition design and management (41%).

Science communicators are most likely to interact with scientists (96%), the general community (88%), research managers (71%) and journalists (70%). They are least likely to interact with politicians (36%).
When asked to define science communication, almost all survey respondents defined it in terms of making science more meaningful to the public, whether this was through translating complex concepts or by creating a dialogue.

What influences science communicators
The biggest influence for getting people involved in science communication is an interest in science (92% said consistently or sometimes) and/or a background in science (83% said consistently or sometimes). However, training in science communication also appears to be important (49% said consistently or sometimes).
The most common occupations prior to becoming a science communicator were students (31%) followed by scientists (23%).
When science communicators were asked about what they enjoyed most about science communication, the most common responses were about:

- Translating science into laymen's language for the general public.
- Meeting interesting people, including interacting with researchers.
- Finding out about stimulating ideas and new scientific advances.
- The varied nature of the job of a science communicator, which often involved a great deal of creativity.
- Seeing the general public, including children, gain enjoyment from science

When communicators were asked what they found most frustrating about working as a science communicator, they highlighted the lack:

- of willingness by scientists to communicate,
- resources, especially funding,
- value put on science communication, especially by organisational managers,
- appreciation by media representatives for the needs of science (for accuracy etc.),
- recognition for science communication.

When respondents working in organisations were asked about their status within that organisation, the majority (56%) rated it as low, while a third (31%) rated it as high.
Most ASC members found value (77% high or medium) from being a member of ASC through branch meetings, the e-list, networking and professional development.

How do science communicators see their careers developing?
The majority of respondents (51%) plan to continue working as a science communicator until retirement. Respondents were split in their opinions about whether there were many employment opportunities in Australia (54%) or not (42%). However, only a quarter of respondents agreed there was a good career path for communicators in Australia. The majority (49%) disagreed with this statement.

What have been the key changes in the past decade?
When survey respondents were asked about the key changes over the past 10 years to science communication they highlighted the rise in the numbers of science communicators and the increased recognition and respect for the profession. They also mentioned the increase in tertiary science communication courses available and shift in

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PCST network: an added value for science communication training?

A NEW CONCEPT OF SCIENCE JOURNALISM ON DEBATE

Germana Barata,[1] Carlos Vogt,[2] Rafael Evangelista[3] and Simone Pallone[4]

[1] Laboratory of Advanced Studies in Journalism (Labjor). State University of Campinas (Unicamp). Reitoria V, 3º Piso. Cidade Universitária Zeferino Vaz. 13083-970, Campinas-SP, Brazil. Tel.: +55 19 3289 3120, Fax: +55-19-3788-7857, germana@unicamp.br

[2] Labjor.Unicamp. vogt@fapesp.br

[3] Labjor.Unicamp. rae@unicamp.br

[4] Labjor.Unicamp. spallone@unicamp.br

Abstract

Science communication not only informs but contributes for making the society aware of and active contributors on the science practice. Therefore, it is necessary that the media considers science as a broader concept that emerged in, influence and is influenced by society. Yet, it still prevails the concept of science as the discoveries, developments and results that are free and independent of social values. What the Brazilian electronic magazine *ComCiência* has practiced is to bring the humanities, history, education, science policy and culture as major elements in its content as a way to broad up the science concept.

Key words: science journalism, interdisciplinary.

Text

Science and *Nature* magazines, the most important science journals in the world, publish discoveries, developments and results of science based on empirical data and theories, all of which are supposed to be free and independent of social values as the concept of science is accepted. Lacey (1998), however, has showed that social values as part of human nature do play an important role and are essencial for the scientific activity. That indicates that science is not imune to outside influences and rarely neutral and independent.

As S&T permeates our daily lives and increasingly deals with ethics, safety and environmental issues, they can't be well understood without considering the social values and the background that provides the conditions for them to be developed. Therefore, human resources, education, investments, science policy, market, culture, and others are part of this making process. Likewise, humanities, education and philosophy experts contribute enormously to contest, comprehend, challenge and improve the science tasks on society.

Although Dijck (2003) has argued that the two cultures (humanities versus natural science) identified by Snow in 1959 has long been dissolved it seems that science communication still keeps them apart. One barely recognizes the voice of agents that differ from or oppose to experts on science news sections. On the contrary, the news is used to picture science as the concept showed in journals like *Nature*, which tend to consider it as the ultimate truth, since the data has been peer reviewed and anchored to undoubted figures.

In Brazil, science communication has deleveloped significantly since the last decade, which can be partially attributed to the Genome Project, which placed Brazil in the world scenery of science, but also to GMOs, cloning, global warming and others. Therefore, journalists have improved their knowledge and the public got more interested in understanding those subjects. As a result, the country now has at least four important printed science communication magazines.

Yet, what can be verified is that the science news frequently focus on results and conclusions made by scientists in order to improve life quality. No doubt that kind of information is also important, but the public should also get to know the difficulties, interests, impacts, controversies and the long-term process that permeate science and technology. After all, the aims of science communication are not only to inform but also to make the public aware of and active contributors on the science practice, which makes it necessary to consider science as a broader concept. Consequently, subjects like health, climate change, ecology and economy - that directly impacts society and though are often in the spotlight - should be presented as interdisciplinary and multicultural issues that contain political, economical, social, cultural and scientific interests. Other issues as indigenous people, poverty, famine, landless workers movement, arts, politics, education and globalization, that are hardly ever read at science news sections, also concern and involve science and its relationship with society, development and culture.

That is what *ComCiência* (www.comciencia.br) has practiced since 2000 as an electronic Brazilian magazine published by the Laboratory of Advacement Studies in Journalism of Unicamp and the Brazilian Society for the Advancement of Science. Created to be a lab for students of the MSc in Science Journalism of Labjor, the magazine is composed by: report of the month and daily science news. The first one includes interviews, book reviews, articles written by experts and reports written by science writers all of which exploring the same subject but by different spectrum. The second one, written by science writers, contributes for raising aspects or issues that did not appear on the great media, which brings the humanities, history, education, science policy and culture as playing a major role in its content as it has been concluded through the analyses of news published in 2003.

As a comparison, the science news published at three other eletronic science communication magazines have been analyzed for three months (from October to December of 2003). *Ciência Hoje* (www.uol.com.br/cienciahoje), *Scientific American Brasil* (www.sciam.com.br) and *Newscientist* (www.newscientist.com) were selected for

being traditional printed science communication publications in Brazil (the first one) and worldwide (the last two) that have an eletronic version.
Ciência Hoje has practiced a multicultural science communication frequently providing to its readers reports that deals with education, politics, economy, science communication, philosophy, antropology, religion, sociology, history among the traditional fields directly linked to physics, biology, chemistry and medicine. While *Scientific American* and the *Newscientist* bring topics that mainly describe science as experiments, results and conclusions, without dealing with social influences, therefore the humanities, phylosophy and culture, for instance, are not present.
Although the comparison indicates that a multicultural science communication has been practiced among the magazines selected it shows that a broader debate must be motivated in order to change the concept of science that is still reproduced as a reflex of the traditional view of natural sciences.

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TRAINING SCIENTISTS TO COMMUNICATE WITH LAY AUDIENCES: SUCCESSES AND LIMITATIONS OF A SCIENCE COMMUNICATION WORKSHOP

Mónica Bettencourt-Dias [1, 4, 5] *Ana Godinho Coutinho* [2, 4, 5] *and Sofia Jorge Araújo* [3, 5]

[1]Department of Genetics, University of Cambridge, Downing Site, CB2 3EH- Cambridge, United Kingdom. Tel.: +44 1223 766701, fax: +44 1223 333992, mbcd2@cam.ac.uk

[2]Instituto Gulbenkian de Ciência, Apartado 14, 2781-901 Oeiras, Portugal. Tel.: +351 21 4407936, fax: +351 21 4407970, acoutin@igc.gulbenkian.pt

[3]Institut de Biologia Molecular de Barcelona, Parc Cientific de Barcelona, Spain. Tel.: +34 93 4034968, fax: +34 93 4037109, sarbmc@ibmb.csic.es

[4] Associação Ciência para o Desenvolvimento, Portugal, www.sciencefordevelopment.org

[5] Associação Viver a Ciência, Portugal, www.comunicar-ciencia.org

Abstract

In recent years it has become widely accepted that scientists should discuss their work with different communities. Yet, in most countries science communication is not part of the formal education of researchers. We organized a pioneering workshop in Portugal to train scientists to communicate with lay audiences. Evaluation shows that participants feel more confident and are more pro-active in communicating, suggesting that a low budget activity can improve the participation of scientists. However, as we will discuss there is scope for improvement, raising the challenge to the PCST network to play an important role in setting goals and promoting exchange of practices.

Key words: scientists; workshop; communication-skills.

Text

Context

It is becoming increasingly more accepted that the scientific community has a duty to discuss the implications of their work with society and to play a role in making knowledge and technologies meaningful to different communities. Yet, science

communication (SC) is still not part of the formal education of researchers. Scientists are trained to do research and discuss it with their peers and students and only those expertises play a part in career advancement. Many researchers feel they need training in communicating with lay audiences. In recent years several strategies have been developed, such as media training workshops, brochures with communication guidelines and media fellowships.

Many countries lagging behind in public awareness of S&T have made little effort in training scientists to communicate. That is the case of Portugal, characterized as a country with low knowledge and interest levels in EU surveys (Eurobarometer 55.2). In those countries, because there is less institutional participation and smaller budgets for science communication, it becomes more important to learn from the experience of other countries and adapt it to their own reality. While some strategies followed in other countries may be very expensive or may take a long time to produce results, skills training workshops are very attractive as they are generally not time-consuming; they can cover a variety of different topics and skills, and they do not need to be very costly. A short workshop can have some of the best trainers and strongly motivated participants from different parts of the country.

Objectives

Our long-term aims were to train scientists to communicate effectively with the media and the public, and to motivate researchers to participate and organise science communication activities. With those aims in mind we organised a workshop to: develop skills, discuss SC contents with a view to changing attitudes, and finally to promote collaborations between people interested in SC.

Methods

We organised a 3-day workshop, Comunicar Ciência ("Comunicating Science"), at the Gulbenkian Institute of Science in Portugal. 17 scientists, from different parts of the country and 10 journalists and SC experts from Portugal and the UK participated in this workshop. The workshop comprised a mixture of "hands-on" exercises and discussions aimed at the development of skills (e.g. writing a press release; being interviewed; popularising science via websites; being proactive with the media; organising an event for the public and dealing with questions from the public) and a discussion of topics with the view to providing tools and changing attitudes (e.g. science vs. media; different models of SC). Interaction between participants and trainers was promoted in many sessions and many trainers suggested forms of getting SC information. Three components were evaluated through questionnaires during and after the workshop: the workshop as an activity, whether the aims set for the workshop had been achieved, and the impact of the workshop on its participants. Different questionnaires were used because of the need to measure changes in attitude, acquisition of skills and impact of the workshop: questionnaires were given at the beginning and end of the workshop and after three months (follow-up evaluation).

Results

The workshop and its outcomes

Through evaluation of the workshop we have found that a key to its success are the "hands-on" sessions and discussions and the encouragement of contacts. Improving communication skills was the major motivation for participants to attend the workshop. At

the end of the workshop both participants and trainers felt there had been an improvement in skills. The majority changed their attitude towards the media, such as being "more understanding" or having "more respect for the work of journalists". Additionally, participants may have genuinely shifted from a scholastic perception of communicating science to a more "engaging with science" mood. During the workshop they proposed four projects all of which tried to promote engagement with science. At the beginning of the workshop the major motivation to communicate was to improve lay audiences´ knowledge on scientific contents and processes of science; the evaluation of the workshop gives us no indication as to a change in this unidirectional form of communication.

The impact of the workshop

Summative and follow-up evaluation shows that scientists feel more confident in their communication skills and are more proactive towards the media and towards the organisation of activities. In fact, participants are now trying to organise three out of four projects that were born from one activity in the workshop. Continued contact with the participants will tell us more about its future impact. We think that more workshops similar to this one should be an important part of a strategy to improve the participation of researchers in SC and to improve the relationship between scientists and journalists.

Conclusions, challenges and the role of the PCST network in science communication training

This work shows that, in line with the trend in the rest of Europe, there is a favourable environment to promote SC in Portugal. Candidates from several different institutes, different fields of research and different stages in their career applied for the workshop. With some reservations regarding our sampling, this work has shown that researchers in Portugal need training in skills for communicating with lay audiences, and workshops like the one described here are a good strategy to address that problem. Additionally these workshops may promote the start of new initiatives and recruitment of other researchers to these activities. A workshop like this one only costs around •6000.

There are challenges for broad scope workshops like this one: how to better promote dialogue between scientists and the public? How to cover other "lay" audiences, such as policy makers and funding bodies? How to cover other topics, such as risk assessment? How to better measure the impact of these workshops, for example how to assess changes in attitude? How can the tools developed in these workshops be re-used through different media to reach scientists that do not attend these workshops? As different people in different countries try different science communication training experiments it will be important to promote the discussion and exchange of experiences, maybe through the PCST network activities.

VALUE OF INDUSTRY LINKS IN NEW SCIENCE COMMUNICATION DEGREES

Jan Dook[1] and Nancy Longnecker[2]

[1] Centre for Learning Technology, M408, The University of Western Australia, 35 Stirling Highway, Crawley, Western Australia 6009. Tel.: +61 8 6488 2597, fax: +61 8 6488 1039, Jan.Dook@uwa.edu.au

[2] Centre for Learning Technology, M408, The University of Western Australia, 35 Stirling Highway, Crawley, Western Australia 6009. Tel.: +61 8 6488 2492, fax: +61 8 6488 1039, Nancy.Longnecker@uwa.edu.au

Abstract
Science communication programs at The University of Western Australia (UWA), include a BSc (Communication Studies), Graduate Certificate, Graduate Diploma and research degrees. Strong links with both the science communication community and scientific research community are vital to the success of our program. Because of space constraints, this paper gives two examples: 1) staff external to the University who supervise student projects in a practical work setting and 2) University staff who provide subject material for a display assignment. Other collaborations not discussed in this paper include guest lectures, press release and fact sheet assignments, case studies and research projects.

Key words: communication, education, industry links.

Text

Introduction

Who is '*the industry*'? We consider it vital to link with people who work in the "industry of science", both practising research scientists and science communicators. Strong support from University administration and staff provides excellent links with internationally recognised researchers. Western Australia has a strong science communication community and many contribute to UWA's Science Communication programs, including staff from Scitech Discovery Centre, Perth Zoo, CSIRO, the Western Australian Museum, and state agencies such as Western Australian Departments of Agriculture, Conservation and Land Management, Fisheries and Health.
The philosophy of the Science Communication program at UWA is based on constructivist theory in that a learner builds on their foundations of knowledge and that personal experience is a powerful way to learn. Assessment in all of the units is assignment based. As discussed in a separate poster at this conference, we attempt to make all of the assignments in the Science Communication units authentic. Industry colleagues contribute to assignments and provide guest lectures, tutorials and project supervision. In this paper we discuss the contribution of industry people in terms of students putting their learning into context via personal experience.

External links

Students enrolled in the undergraduate degree participate in a 130-hour practicum in their final year. Each placement involves a specific project as well as general duties in the host organization. Not surprisingly, students have found the practicum experience to be valuable. Positives such as consolidating previous theoretical knowledge and learning, developing a suite of skills and allowing for a taste of potential further studies have all been identified. Having the opportunity to network and make future contacts are also seen as being significant.
One student mentioned these differences between studies and the workplace:

> *"The University has deadlines defined in advance along with assignments and expectations that are fixed... Employment involves collaboration with others (especially government) for a shared product. Deadlines change, new projects/ deadlines arise overnight and you impact on other people. I feel this understanding is often lacking in some graduates and so professional placement is useful for all degrees." (student, 2004)*

From the industry point of view, hosting practicum students can be difficult. Substantial time is required to manage the student and ensure that they are getting a worthwhile

experience. It is therefore important that the practicum has benefits for the host agency apart from the opportunity to collaborate with the University.
The student might bring skills that are lacking in the organization or work on a task that would otherwise not be attempted. A young person can add a new dimension. One supervisor has said, *"as she is currently studying, she is also bringing contemporary thinking from her field to the E(ducation)&L(earning) Team. It is important for experienced employees to be challenged in their thinking and ways of doing things from time to time. Hosting a practicum student is one way of doing this" (supervisor, 2004).*

Internal links
A number of assignments involve working with practising research scientists at UWA. In their 'Display Assignment', students work as a team and liaise with a researcher to create a poster. In their Science Communication units, students learn the fundamental importance of simplifying complexity for communication with the general public. Practising researchers do not necessarily have that understanding. In this and other assignments, students learn the difficult tightrope act of trying to please the researcher they work with and provide a clear, concise picture of a research project(s).
Some staff express frustration by what they see as an oversimplification of their life's work:

> "*My impression is that they decided it was too hard to come to grips with the subject matter and therefore did something rather shallow." (participating academic, 2004*).

Most staff enjoy contributing to the assignments and are happy to do so again. For example, of the 11 staff who participated in the 2004 Display Assignment, ten replied to a survey. All of those were willing to participate again, eight 'anytime' and two 'occasionally'. Even staff who found the experience 'frustrating' or 'okay' as opposed to 'rewarding' were happy to participate again.
There was no correlation between staff perception of assignment end product and their willingness to participate. This may be explained partially by academic staff's acceptance of responsibility of providing learning experiences. In addition, however, we believe that academic and research staff value the experience themselves.

> "*… we as researchers can get some feedback on what students, the general public and/or other scientists may think about the presentations… ie Do they work? Do they grab people's attention?" (participating academic, 2004*).

Summary
Good industry links to education programs provide benefits to students, program coordinators and participating staff. Benefits for students include putting their learning into real-life contexts, getting glimpses into the workplace and networking with potential employers. Program coordinators maintain their awareness of current practise in research and science communication and links help define useful research projects and collaborations. Participating industry staff benefit by the work contribution that students can make. A significant benefit can also be involvement in a university program with bright and enthusiastic students given professional science communicators frequently work by themselves within their own organization.

GLOBALIZING SCIENCE COMMUNICATION TRAINING: CASE STUDY OF THE STANFORD RESEARCH COMMUNICATION PROGRAM

Carolyn Gale

Research Communication Program, Stanford University. 450 Serra Mall, Bldg 160, Stanford, CA 94305-2055, USA . Tel.: +1 (650) 724 3915, cgale@stanford.edu , http://i-rite.stanford.edu/

Abstract

This paper gives an overview of the Stanford Research Communication Program, which develops tools to help experts learn to communicate complex information to a broad audience. It also discusses collaboration efforts to expand the program internationally, and includes an overview of a study in progress that aims to deepen understanding of ways researchers can improve their written and oral explanatory communication skills across disciplines and cultures.

Key words: explanatory discourse, research communication training.

Text

Overview

The Stanford Research Communication Program (SRCP) helps researchers learn how to communicate the nature and significance of their work to lay audiences. The program also works to identify specific problems of communicating between disciplines, and between researchers from varied locations.

SRCP consists of two programs and a public outreach effort. I-RITE is a series of workshops that focus on written communication, and I-SPEAK focuses on oral content and delivery skills. These programs have been offered in online and asynchronous formats, ranging from two-day workshops to two-month courses. SRCP also has experience integrating students from universities in Sweden into Stanford's course and workshop offerings. These pilot programs allowed SRCP researchers to refine approaches to helping non-native English speakers learn to communicate complex information in English.

Since 1999, SRCP programs have established a proven curriculum, a prototype Web-based submission/annotation tool, a draft evaluation plan, and extensive experience implementing the program under a variety of conditions. Based on preliminary results, SRCP believes that there is great potential to prepare I-RITE and I-SPEAK to be fully global programs that can be open to doctoral-level researchers from anywhere in the world. In line with this aim, SRCP continues to:

- *Further develop the program's technological infrastructure* by evaluating current technologies for use in workshops and courses, developing appropriate new features, and implementing redesigned tools in a cross-cultural program.
- *Establish a systematic research and evaluation effort to* a) validate and increase program effectiveness at improving explanatory writing skills, and b) investigate means of effectively using ICT to support our program aims.

Program Rationale

While Information and Communication Technology (ICT) tools address problems of communicating at a distance, these tools are not sufficient to create a fuller interchange of research ideas. Within most fields, discussion of cutting-edge ideas is limited to highly

technical discourse particular to a disciplinary, or sub-disciplinary, research program (Wear, 1999). A first step in equipping researchers with tools for interdisciplinary communication is fostering new modes of writing and speaking that make important ideas readily accessible to a broader audience (Gopen & Swan, 1990; Rowan, 1990, 2003; Whaley, 2000).

In an ideal world, researchers would be able to give effective written or oral accounts about their work to the types of academic audiences described above. This ability to engage in explanatory communication is essential to success in professional and academic contexts (Calandra, 2002; Jaffe, 2003). Unfortunately, considerable anecdotal evidence suggests that many researchers are not adept at explanatory communication designed to deepen a nonspecialist's understanding of unfamiliar information for a broad audience (Rowan *et al.*, 2003).

International Collaboration

While there has been a collaborative relationship between Stanford and two Swedish universities (Uppsala, KTH) since 2001, it has mostly been a voluntary effort to pilot integrated Stanford/Sweden I-RITE programs. In 2003, SRCP was awarded a grant from the Wallenberg Global Learning Network (WGLN) to formalize international collaborations, and the evaluation process.

Also, SRCP has been and will be conducting I-RITE workshops at universities in Norway, Denmark, Japan, and South Africa. With these pilots, SRCP is collecting data on cultural needs in training and program deliverables, investigating localized train-the-trainer scenarios, and is planning to continue these collaborations as a stepping stone for future research studies.

Program Evaluation

A critical element in establishing I-RITE and I-SPEAK's validity is to include a rigorous research and evaluation program. In collaboration with faculty experts in explanatory communication, SRCP has created a system for (a) measuring explanatory discourse generated to help lay audiences understand a student's research and (b) measuring the extent to which this discourse helps lay audiences appreciate the value of research being described (Rowan *et al.*, 2003).

This system is currently being tested with I-RITE program participants providing pre- and post- "elevator talks" (short passages explaining a research project to nonspecialists). Quantitative measures of program outcomes will be supplemented by other indicators of program effectiveness. SRCP uses several approaches to gather information about the processes through which participants build their communication skills (analysis of implementation conditions, discourse analysis of participants' face-to-face and online interactions, pre- and post- surveys, and interviews).

Sustainability

Based on program refinement, evaluation outcomes, and research results in the upcoming year, SRCP plans to open the I-RITE/I-SPEAK programs to participants from interested research institutions worldwide. SRCP expects that funding for these participants will come from their home institutions, and foundations that promote international development in higher education.

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DEVELOPING SCIENCE WRITERS AND SCIENCE JOURNALISTS IN INDIAN LANGUAGES : A CASE STUDY

Manoj Patairiya

Director (Scientist 'F'). National Council for Science & Technology Communication (NCSTC) Technolgy Bhavan, New Mehrauli Road, New Delhi – 110016 (India). Editor Indian Journal of Science Communication (IJSC) (A Half-yearly International Research Journal on Science Communication).
Tel.: (R) +91 11 26562561, (O) +91 11 26567373, fax: +91 11 26960207, manojpatairiya@yahoo.com, mkp@alpha.nic.in

Abstract

Developmental changes emerge within specific economic, social and ideological contexts and in turn reshape thinking and working of institutions as well as individuals. Science communication using mass media can play an important role in making people aware of these developments. It requires a large number of trained science writers/ journalists especially in vernaculars. Incidentally, India has 18 well-developed regional languages. An innovative countrywide training programme has been devised and introduced to develop trained science writers/ journalists. The aim is to develop as many science writers/ journalists as possible to meet present and future challenges. This paper discusses and analyses various experiences learnt, methodologies applied, impacts achieved, and responses received, while implementing the programme.

Key words: Training, science writing/ journalism, vernacular media.

Text

Introduction

According to a study, science coverage in mass media in India is around 3%, which is abysmally low. We intend to increase it up to a level of 10-15%. It has been rather difficult to find enough science writers, especially in vernaculars, who can generate quality material in desired forms for media. We have observed that even in rural and far-flung areas, there are persons who have a natural bent of mind and talent to develop into and to write good stories, plays, poems and scripts. Yet the demand for appropriate science writers remains unfilled. To fill this gap, it is felt necessary to identify and encourage these writers and provide them some orientation and training to develop in them skills for science writing.

The Basic Idea and Concept
The basic idea and concept behind this programme is to:

a) Bring together the writer, illustrator, scientist and medium at local level and provide them some orientation and training.
b) Bring budding science writers and illustrators together with experienced and established ones for close interaction; to expose the former to intelligent and constructive criticism of their writings by the latter, as also to issues of importance to both science writers as well as their readership.
c) Expose experienced writers and illustrators in fields like arts, economics, politics, etc., to science communication.
d) Develop basic science writing, science reporting and science illustration skills through actual practice and exercises.

Objectives
The main objectives of the programme are as follows:

a) To increase science coverage in mass media.
b) To encourage reporting on scientific achievements of the country.
c) To train science writers for different media.
d) To investigate local scientific/ technical problems through science journalism to find solutions.
e) To develop skilled science writers/ journalists/ illustrators for undertaking various activities in science communication.

Methodology
Under this programme, 3-5 days' training-cum-orientation workshops of 'local writers and journalists' are organized at district level and they are exposed to various techniques of science writing and reporting. The participants are science activists and enthusiasts, whether students of science at higher level or not. The idea is to develop grass root science writers/ journalists who can eventually write on 'local issues' of scientific importance with help of 'locally available resources' for 'local level mass media'. The work plan for development of science writers is divided into three phases.

Observations and Results
A questionnaire survey of a select group of participants of this programme was conducted to obtain information on aspects like number of people writing on science and the type of writing they are engages in, etc. Some of the observations and results derived from survey are summarised here:

a) Several groups devoted to science coverage are emerging at local level.
b) Several such writers are emerging, who can effectively write for folk forms, like skits, plays, songs, fiction, stories, etc.
c) A number of popular science books are coming out including these scripts.
d) The programme enables local writers to project local scientific/ technical problems instead of imposing foreign fed information in media.
e) The local audience is able to get more indigenous S&T information relevant to their daily life through media.

f) As a sequel and follow up to these workshops, a few workshops on specialized topics are also organized.
g) The programme has been able to trigger a chain reaction at all levels to develop skilled science writers for specific needs.
h) At some places, neo science writers have formed Science Writers' Associations as part of Indian Science Writers' Association.
i) A countrywide science media network is being developed as an offshoot to this programme.
j) So far, over 200+ such workshops have been organized and over 10000 trainees were trained. Our target is to have similar activities in all 500+ districts.

Acknowledgement

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TRAINING SCIENCE COMMUNICATORS IN COLOMBIA

Ximena Serrano Gil and Lisbeth Fog Corradine

Colombian Association of Science Journalism – acpc. Carrera 7 No. 69-05 Bogotá (Colombia).
Tel.: (57) (1) 3102911, acolpc@hotmail.com

Key words: science journalism, acpc.

Text

The need Science Communicators

Human beings have created many different ways to transmit knowledge: Since philosophical discussions at Greek public squares, formal and informal educational activities, until mass communication media, and modern information and communication technologies (ICT), like virtual spaces and the cyberspace.

Currently, science popularizers are professionals with some special characteristics and lots of alternatives to perform on diverse communicative activities, as they may have been trained either in social or natural science.

Transmission and appropriation of science journalism and science concepts need a professional training process that allow students, journalists and researchers to understand

all the possible scenarios derived from scientific activities and their implications on social, economic and legal aspects. This training will result in the adequate transmission of science, which means accurate and easy to understand.
That is why it is necessary to train communicators and journalists convinced that society has the right to access to this information and therefore higher its levels of education. Those society professionals will be able to appropriate scientific knowledge, to transmit this information and build real communication channels with the citizens.
Like other countries in Latin America and around the world, Colombia does not have science communicators nor specialized journalists trained in this specialty. There is a lack of normativity by public institutions that rule the educative policies of the country. Universities do not promote the implementation of this kind of programs. Furthermore, mass media do not require journalists, specialized in this area.

ACPC trains Science Communicators

The Colombian Association of Science Journalism (ACPC) is one of the oldest in Latin America. Since the beginning this Association has promoted the training of Colombian science journalists, gaining national and international recognition. How can we train idoneous science communicators? what kind of abilities should these professionals have in order to transmit citizens the knowledge produced by researchers? How can we attract the attention of citizens in order to obtain more knowledge? These are some questions we are trying to solve by organizing activities with universities and mass media. For this purpose acpc has as one of its main lines of activities, to train science journalists.
Since 1996 its members have designed and organized seminars, conferences, workshops and courses addressed to faculty, researchers and journalism students. According to the different audiences, we design the appropriate course. For eight years we have done it permanently getting excellent results.

Conquering Spaces

Five universities with Social Communication Departments have hired members of acpc to offer science journalist courses. Since 1998 we have trained 543 science journalism courses. As a result of acpc experience at those universities since 2000 we offer some of the students the opportunity of doing an internship at our offices.
11 students have been trained at acpc. Nine of them did their internships at Noticyt, the Colombian Science and Technology news wire service, that started January 2003. One of them is working in the communication area of an important national research center, Cenipalma, and another two remain working at Noticyt.
Acpc has organized 18 courses in 14 cities, 15 universities, 5 research centers and 6 media institutions, reaching more than 3500 people from Colombia, Ecuador and Mexico. The scientific community has been receptive to our call and have proposed programs to train researches on the dissemination of their research projects.
In order to be able to do that members of the Association are permanently trained.
As a result of many years of research and preparation of academic material, we have organized several conferences on specific topics that we are constantly adapting with new events.
This is how the acpc has developed a valuable approach to democratize scientific knowledge. This was one of the reasons why the acpc won on 2002 the Award Scientific Merit under the category of Popularization of Science, given by the Colombian Association for the Advancement of Science.

PCST-8 Sessions

Science communication: historical perspectives and new trends

Proceedings

Parallel session 13

Lessons on PCST history

SCIENCE, JOURNALISTS AND MASS PRESS IN THE XXTH CENTURY

Tomeu Adrover[1] *and Gemma Revuelta*[2]

[1]University Professor of Science, Technology and Society of the University of the Balearic Islands. Collaborator of the Observatory of the Scientific Communication of the Pompeu Fabra University. Universitat de les Illes Balears, Edifici Ramon LLul, Carretera de Valldemossa km. 7.5, 07122 Palma de Mallorca, Illes Balears, tadrover@ono.com

[2]Subdirector of the Observatory of the scientific communication (OCC) of the University Pompeu Fabra. University Professor of Scientific journalism of the Pompeu Fabra University. Passeig Circumval·lació, 8, dept. 201, 08003 Barcelona. Tel.: +34 93 542 24 46, fax: + 34 93 542 23 94, gemmarevuelta@upf.edu

Abstract

We have analyzed all the information about science, medicine and technology in 23 tryings realized between 1888 and 1983 - a whole of 1212 texts - of La Vanguardia and the Diario de Barcelona (two newspapers from Barcelona). We have done a quantitative analysis, and we demonstrate that the communicative link that the journal drow up at the beginning of this century established that the analysis had more importance than the information. From 1943 the information about science has lived through a period of normalization and has begun to be a part of a communicative model of mass.

Key words: Newspapers, journalist, history.

Text

From 1888 to 1918 we can see how the majority of information is produced by the newspaper editing itself. There are mainly two different types of text. Those texts that are clearly impartial and those that have the opinion of the author in it.

In this moment in history, 57% of the texts of our sample are in impartial articles without the author's signature, 26% don't have the author's signature but are analytical, and 17% are signed by the author.

From 1918 and until 1933, the appearance of information agencies and the following modernization of the newspapers shows a change in the author's implication in scientific news. In fact, during this time the unsigned information and the information without implication of the author descends to 39%.
The first conclusion we can make about this period of time (1888-1933) is that the articles signed by the author usually have the author's interpretation and opinion in it. Some 45% of the articles are signed by the author.
In the same period of time mentioned earlier, there are two types of journalists that sign articles about science: correspondents or contributors specialized in scientific themes. In this last case the information is firmly linked to the author's interpretation and opinion. Certain specialists in the History of Communication[1] believe that the moment of modernization of the press must have been between 1902-1923. This was also the moment of the construction of a system of mass communication in Catalonia. Very important to note, is that in this period of time, the science journalists usually give their own opinion in their articles. Our hypothesis is, that the uniformity in the structure of the media didn't influence the science journalists until the period of time that is called the Big Science.[2]
From 1953 onwards, the "lateral" information about science and technology is considerably reduced. We can also see new sections in newspapers, exclusively about scientific subjects, and a new usage of language.
In the last part of our sample study (1953-1983) we found out that journalists started naming their information source. As from 1963, this becomes a constant fact. Furthermore, we observed that during the Spanish transition (1975-1982), journalists wrote less about scientific subjects. But after 1983 the science journalist becomes a mass media worker and takes part of the features of this communicative system.

Conclusions

Historical events, such as the civil war, the World War, Franco's dictatorship and the transition towards democracy, have marked the relationship between science journalism and the mass media in Catalonia. Also this relationship has been marked by the special relationship between science and mass media.
After the information vacuum between 1933-1953 the articles about science were introduced into the system of mass communication. From this moment on, the number of articles with the author's interpretation in it descend considerably, giving place to a larger amount of articles in which the author and the information are closely linked. It is in this moment that the journalistic language is applied to science.

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INJECTION DRUG USE AND CONSTRUCTIONS OF RISK

Caroline Jean Acker

Department of History.Carnegie Mellon University. 5000 Forbes Avenue. Pittsburgh PA 15206. USA.
Tel.: 412 268 6040, fax: 412 268 1019, acker@andrew.cmu.edu

Abstract

American injection drug users today use injection methods and respond to opiate overdose with methods similar to those used by physicians in the mid-nineteenth century –methods consistent with nineteenth-century medical theory. Their isolation from sources of public health knowledge has in effect left them in a nineteenth-century medical world. Ironically, this fact affords the historian better understanding of how physicians understood and responded to risks associated with injection in the past. Needle exchange programs seek to bring injection drug users into the twenty-first century.

Key words: injection drug use, history, public health.

Text

The standard insulin syringe, made of steel and plastic, is a precision engineered instrument, yet it is mass produced and disposable. It costs seven and a half American cents. The hypodermic syringe symbolizes medical technological prowess made mundane. Yet the syringe is also a charged object, as it pierces the skin. The heroin injector emerged in the twentieth century as a symbol of deviance.

The hypodermic syringe also symbolizes a clash between American drug policy and the public health imperative to control infectious disease. Laws passed in the 1970s and 1980s to prohibit possession of devices used to consume illicit drugs typically included syringes in their lists of banned items. Yet the sterile syringe affords a cheap and effective way to prevent HIV transmission among a high-risk population.

The American junkie has symbolized obduracy as he willfully practices dangerous behaviors. But needle exchange workers have found that injectors readily adopt a range of risk-reducing behaviors at the same time that they find addictions and related problems difficult to manage and either struggle with or reject a health care system that often treats them badly: with hostility; or with ignorance about managing the health consequences of drug use, or managing other disease in the presence of opiate addiction.

Thus, drug injectors and needle exchange activists, like historians of science, realize that the development and implementation of public health knowledge is complex. Developing effective public health knowledge is not just a matter of translating scientific findings into prescriptive statements; the flow of knowledge is not just from the experts to target groups. Any encountered difficulties do not just represent unreasoning resistance or ignorance.

Rather, science does not simply provide ever more accurate views of the world. In a dynamic process, we continually reshape the world to make science work in it. For example, Tomes (1998) has shown how many aspects of daily life, from hand washing to the design of furniture and clothing, were transformed in order for ordinary people to act in ways consistent with germ theory.

When their friends overdose, opiate injectors immerse the person in water, shock the soles of the feet with electric cords, or inject the person with salt or bleach. Similarly, the first generation of physicians to use hypodermic syringes to inject morphine treated overdose with cold water, electric shock, and injection of coffee, whiskey, or other substances. Similarities also appear in injection technique: William Burroughs (1977) and mid-

nineteenth-century physicians both dissolved morphine in spoons, heating the drug over a flame (Kane, 1880).

Nineteenth-century physicians identified all the risks associated with injection –overdose; contamination or spoilage of injected solution; abscesses; disease transmission; tissue damage from repeated injection. Medical management of the risks associated with the syringe itself falls into three periods. In the nineteenth century, physicians, individually and through collective means such as journal and textbook writing, developed techniques and refinements to reduce harms to the patients they injected. For the first half of the twentieth century, these risks were primarily managed through the labor and skill of nurses and through hospital systems for sterilizing and maintaining equipment. Finally, with the advent of the disposable syringe in the early 1960s, engineering and manufacture brought the risks under control.

In the nineteenth century, the medical and nonmedical were not sharply divided. From the earliest deployment of the syringe, many people injected themselves with morphine or other drugs. When the 1914 Harrison Narcotic Act banned nonmedical use of opiates, and when physicians in the 1920s defined junkies as psychological defectives and undesirable patients, opiate injectors were closed out of the medical advances that continued to improve the syringe. Thus, nonmedical injectors became increasingly isolated from the world of medical progress. Yet, like other laypeople, they absorbed the broader currents of medical advance and used this knowledge to reduce the risks they perceived. In addition, as members of what was increasingly defined as a deviant subculture, they communicated what they knew (or believed) among themselves and in this way established norms of practice that were handed down over time.

Clinical records of narcotic ward patients in Philadelphia in the 1920s reveal some of these practices. (Acker, 2002) Many addicts sterilized their needles; one wiped the skin with iodine before injecting. Addicts typically used 4-6 needles a month; since opiate addicts typically inject 4-6 times a day, this meant using a needle up to 30 times.

Nineteenth-century physicians developed methods of managing patients' addiction to morphine that also resemble later practice. One practice is described in 1880 (Kane, 1880), 1926,[1] 1951 (Burroughs), and 1990.[2] Each describes the same dose reduction tactic—replacing withdrawn drug solution with an equal volume of fluid containing no drug. Thus, the 1990 junkie bought and dissolved month's worth of heroin. Each time he withdrew a syringe-full, he replaced it with a syringe full of water. Such similarity suggests transmission of knowledge across 110 years.

Notes

[1]Records of the Philadelphia Committee for Clinical Study of Opium Addiction, Library of the College of Physicians of Philadelphia, Philadelphia, vol. 19 case 26-8.

[2]Anonymous heroin addict, personal communication.

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POPULARIZING THE HISTORY OF SCIENTIFIC EXCHANGES IN THE "PERIPHERY"

Carlos Acosta and Nicolás Cuvi

PhD students, Centre d'Estudis d'Història de les Ciències (CEHIC), Universitat Autònoma de Barcelona, Edifici Cc, 08193 Bellaterra, Barcelona, España. http://www.uab.es/cehic/, geo_acosta@hotmail.com; traba_lenguas@hotmail.com

Abstract

We present a popularization project in the history of contemporary science, that to the publication of the book Ciencia entre España e Hispanoamérica. Ecos del siglo XX (available at www.uab.es/cehic/proj/fecyt.htm). We discuss our experience as science communicators in an academic institution, paying special attention to methodological issues and to the cross-fertilization between science communication and the history of science. We also question the idea that knowledge created in peripheral regions is not relevant.

Key words: history of science communication, scientific exchanges, peripheries in science and technology.

Text

Introduction

In April 2002 we submitted to the Fundación Española para la Ciencia y la Tecnología (FECYT) a project that aimed at popularizing scientific and technological exchanges between Spain and Latinamerica in the 20th century. We wanted to make known both the history of science and the knowledge produced in purported peripheral regions to modern and contemporary science.

We did not share the idea that the history of science and peripheral knowledge were largely irrelevant, even though they are often attractive enough to science communicators. The project was carried out during the first half of 2003 by three people: a Catalan physicist and historian of science at the Universitat Autònoma de Barcelona, and two PhD students of the Programme in History of Science at the same university (a geologist from Colombia and a biologist from Equador) who had also trained as science communicators.

The sources

First we had to select our sources. Historians often distinguish primary sources (originating in the scientists to be studied, such as manuscripts or published papers) from secondary ones (the product of the work of historians). Time constraints and the availability of secondary information made us choose secondary sources for most of the 20th century, and primary ones for recent years, above all the 1990s. We drew mostly on Spanish journals and books in the History of Science, and we also got advice and information from a number of experts.

In search of a structure

We had to settle on the book's structure, and several alternatives were considered. We discarded a chronological structure –too lineal or even traditional. To discuss one knowledge area after the other would have excessively fragmented the narrative, and we feared this would also be the case of a geographical structure. We also considered priorizing the forms of exchange (letters, journals, exhibitions…), but this we found problematic too.

In the end we decided to focus on the protagonists of the exchanges, people and institutions, arranged in chronological rather than geographical order. We discussed in

separate insets additional information that did not fit this structure, such as bibliometric information, specific exchange projects or key institutions. Even so, we had to devote separate chapters to two substantial issues: the role of the Spanish language, and the exchanges prior to 1900.

Academic versus popularization interests

It is widely admitted that academics and science communicators do not write for the same people. The former address their peers, the latter the public at large. We think academics should pay more attention to lay people, and also that science communicators have much to learn from academics.

Our project built on such interaction of interests: it was carried out within an academic history of science center, by people with experience in science and science communication. Yet some tension inevitably appeared, particularly in three regards: style, reference to sources, and conclusions.

As for style, we were convinced it had to be both attractive to a wide public and rigorous. We used fictional situations such as interviews or travels. We also used analogies, metaphors, and a prose rethorical enough to sustent interest in the story, even though the academic partner had to be convinced this style was convenient. The reception accorded to the book by scientists and historians of science suggests that we managed to avoid academic technicisms.

The second problematic issue was how to refer to sources. We let historians talk by themselves, and thus made ample use of literal transcriptions. The problem was then how to give the references without burdening the text. To make the text as "clean" as possible, we placed footnotes at the end, and we also limited references to works quoted in the text, referring to the rest of our references in a complete bibliography that is available, together with the book, in Internet.

The third issue had to do with the book's conclusions. The science communicator in us was happy enough with the histories, conclusions were for him built in the text. However, the academic partner could not do without conclusions. In the end we did draw some conclusions and found that a valuable addition to the work, even though aware of their provisional status and counting with the professional historian's indulgence.

Conclusions

Science popularization tends to focus in recent findings, particularly as they regard biomedicine in advanced countries –those at the core of contemporary science. This has to do above all with the need to have an impact, but if we grant that the perception of such an impact is socially construed, we can also grant that the public's awareness and interest could be increased, if only we provided the public with more resources.

We need to broaden the scope of knowledge that gets into the media, to take into account and value knowledge from "peripheral" regions. This is unlikely to harm science communication, while leaving this knowledge aside casts a shadow over the media's agenda and raises suspicion about their interests in neocolonial policies. New technologies no longer leave the excuse that information is not readily available.

All regions produce knowledge. Instead of talking about technological backwardness, we need to let each region create each own knowledge and technology, those best suited to its environment, less dependant from other regions, most able to sustain its basic necessities. This kind of popularization can be done from the media and academic institutions. A balance must be kept, in historical matters, between the public interest on one hand and

academic rigour on the other, and this in turn demands paying close attention to style and the use of references. The historian may profit from rethorical figures, and the communicator may have to provide explicit historical conclusions. Our experience shows that a positive feedback can be established between history of science and science communication.
We also think that information should be freely available. Private handling of information damages both science and science communication. We edited our work, but we also placed it in Internet so that anyone can access it. The reader may also find there our historical conclusions (p. 116-121, at www.uab.es/cehic/proj/fecyt.htm).

JOAQUÍN GALLO: A MEXICAN POPULARIZER OF ASTRONOMY (1914-1947)

Susana Biro[1] and Gisela Mateos[2]

[1] DGDC, UNAM ,México sbiro@servidor.unam.mx

[2] CEIICH, UNAM, México ihcmateos@yahoo.com

Abstract

We present a report of work in progress of our research in the popularization done by Joaquín Gallo, astronomer and director of the National Observatory in Mexico (OAN) from 1914 to 1947. We focus on one question to guide our research: What was Gallo's motivation for his work in popularization? We find many answers. Gallo did popularization to give Mexican astronomy a wider public recognition and support. He also did it for the public, as there was a demand for information. Finally, he believed this would make Mexico a better nation.

Key words: history, popularization, astronomy.

Text

Introduction

The history of science popularization has only recently received serious attention by historians of science. For example, Shapin (1990) discusses science, the public, and the ways they have related through history. He proposes that the study of this activity should complete our panorama of science in society. Cooter and Pumphrey (1994) review previous work and suggest several ways that future research may go. Raichvarg and Jacques (1991) review the history of popularization in France asking the questions: why?, who?, for whom? and how?
The interesting results in this new area, however, come from studies of particular cases. Each casts light on one or more elements that are determinant in a certain place and time. Sheets-Pyenson (1985), for example, makes a distinction between high and low science and then compares low science in periodicals in France and England at the end of the nineteenth century. Lightman (1999) studies the narrative of British popularization in the nineteenth century and finds that natural theology was initially central to this narrative, and was later displaced by a secular discourse.
England, France and the nineteenth century are the most common subjects of this kind of study. Our case is different because it takes place in Mexico, a peripheral country, and in the twentieth century. We study a period of time beginning shortly before Gallo's start as director and ending with his departure from the Observatory. We hope to be able to find

the reasons for his popularization, as well as any changes, both qualitative and quantitative.
We have consulted two archives: the *Fondo Joaquín Gallo* contains books, notebooks and many manuscripts for booklets about astronomy. There are also parts of a book, short stories, scripts for radio programs and photographs of the many scientific expeditions that Gallo participated in. The *Fondo Observatorio Astronómico Nacional* (AHUNAM-OAN) spans from around 1870 to 1970 and contains documents of different types related to the OAN.

Gallo's Popularization

Joaquín Gallo was born in Mexico in 1882. He studied geographical engineering and began working at the OAN in 1903. He was director from 1914 until 1947. This period was dominated by instability and limitations for the observatory (Bartolucci, 2000).
From the documents consulted we find that Gallo did the following popularization activities: wrote for the press and for journals, answered letters from the public, gave public lectures and had public observations, wrote pamphlets and gave interviews.
We detect three types of documents in the AHUNAM-OAN related to Gallo's activities as popularizer. First, there are numerous internal documents related to the "open nights" which were held two times a week. These had, in his words, the purpose of "showing a little bit of the cosmos" to the general public. These sessions were interrupted once due to a cut in personnel. The public were neighbors of the OAN as well as people from all over the country.
The second kind of documents are notes to the press written by Gallo between 1919 and 1928. There are three kinds of subjects covered by these notes: news about astronomical discoveries around the world, information about astronomical phenomena observable in Mexico and informative articles about established knowledge. These are the subjects Gallo chose to communicate.
The third kind of document is also the most abundant. We have a great variety of letters from the public spanning from 1927 to 1947. These can be placed into several groups according to the subject of their questions: about the yearbook published by the OAN, related to meteorology, about popular beliefs and about amateur astronomy. In contrast with the second kind of documents, these show the subjects that the public wanted to know about.

Conclusions

In agreement with Kärnfelt's (2003) results, we find that the main reason Gallo did popularization was to promote his discipline in an effort to get more support. At the same time, he believed that communicating science to the people would result in progress for Mexico. And, finally, given the nature of his subject, part of his work was in response to an avid public.
The study of the history of popularization is necessary in order to have a complete image of science in society. For popularizers, it is an important tool for teaching and for the consolidation of the discipline.

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AN APPROACH TO THE HISTORY OF THE MAIN TRADITIONS OF SCIENCE POPULARISATION

Sergi Cortiñas Rovira

Department of Journalism and Audiovisual Communication. Universitat Pompeu Fabra, Passeig Circumval·lació, 8, dept. 201, 08003. Tel.: 93-5422440, sergi.cortinas@upf.edu

Abstract

This paper puts forward a model for the study of the popularisation of science history. The model, based on qualitative methodologies, distinguishes four schools each with their own fundamental characteristics, their authors and their seminal works. The first of these is the school born out of the Italian Renaissance, whose greatest figure was Galileo. The second school is the French one which reached its apogee in the 18th century; authors like Fontenelle, Buffon, Diderot and, already in the 19th, Flammarion comprise its best known representatives. The third school is the Germano-Prussian one. Its most important figure was Albert Einstein, a nonpareil writer and lecturer. The fourth and last school is the powerful Anglo-Saxon one. This school, the latest and most preponderant, counts populariser like Darwin, Gamow, Asimov, Sagan and Gould among its numbers.

Key words: Science popularisation, populariser.

Text

Introduction

Science popularisation has a long and distinguished history. This paper tries to separate this history into four traditions. They are, in chronological order: the Italian Renaissance, the French tradition, the Germano-Prussian and the Anglo-Saxon.[1]

The Italian Renaissance

The Italian Renaissance tradition begins with Galileo Galilei (1564-1642). Although interest in science was lively before his contribution, he is the first science populariser in a totally modern sense. In many respects he represents the delayed culmination of the ideals and forces at work during the Renaissance. One of these ideals is the liberation of language: Galileo chose to write in Italian rather than Latin. In the *Dialogue* (1632) he presents his ideas in the form of a dialogue with all the concomitant benefits of charm, lucidity and irony. This tradition allows the union of the sciences and the humanities and will become the model all other schools try to reproduce.

The French School

The Enlightenment represents the second great moment in the popularisation of science. In the French school special attention is paid to its literary aspects. Moreover, it is the first time that a completely conscious attitude is taken to science popularisation.

The fundamental texts of this tradition are *Entretiens sur la pluralité des mondes* (1686) by Fontenelle, *Histoire naturelle* (1749-1788) by Buffon, *Encyclopédie* (1751-1780) by Diderot and *Astronomie populaire* (1879) by Flammarion.

Bernard le Bovier de Fontenelle (1657-1757) was the first luminary of this tradition when he presented the astronomical discoveries of the 16th and 17th centuries in a popular text, written in an easy, flowing style. His example was followed by the Comte de Buffon (1707-1788) who directed his attention to the natural sciences (Domínguez, 2001). The next writer of importance was Denis Diderot (1713-1784). He undertook the massive task of collating and compiling all the knowledge then available in a single work. After him Nicolas Camille Flammarion (1842-1925) popularised astronomy and was read avidly in the 19th century. Although these writers are the best known, many others also deserve mention such as the Marquise of Châtelet, Voltaire, Verne, Moigno, Figuier and Tissandier. Although greatly admired throughout these two centuries their influence visibly declined during the 20th century (Raichvarg and Jacques, 1991).

The Germano-Prussian School

The Germano-Prussian school rose to prominence between the last decades of the 19th century and the Second World War.[2] Headed by physicists of the calibre of Einstein, Schrödinger, Heisenberg and Planck, it was characterised by cutting edge science by professional scientists who were also excellent popularisers. An example of this great scientific exposition was Albert Einstein (1879-1955). In his book *On the Theory of Relativity* (1917) he outlined and explained in unparalled clarity his physical ideas and some of the wider implications that could be drawn from them. Another example of the type of writing prevalent in this tradition was Schrödinger's *What is Life?* (1944) that drew public attention to the burgeoning importance of biology.

The Germano-Prussian tradition is characterised by a strong consubstantial philosophical and ethical component. It also marked the move away from the individual to the university as the centre of research and popularisation.

The Anglo-Saxon School

Despite a period of significant overlap with both the French and German traditions, this movement achieved hegemony during the 20th century, largely through the influence of the United States as a world power in scientific research (Laszlo, 1993). During the Victorian age Charles Darwin (1809-1882) was the greatest exponent of this tradition and Michael Faraday (1791-1867), author of *The Chemical History of a Candle* (1860), its greatest lecturer. Darwin's *On the Origin of Species* (1859) was probably the last scientific treatise that could be read by someone who had no previous, specialised knowledge.

The geographical centre of this tradition shifted in the 20th century to the United States. The increasing scientific dominance of the US after the First World War lead to an efflorescence of popular writing. The most important contributors were George Gamow (1904-1968), author of *One, Two, Three ... Infinity;* Isaac Asimov (1920-1992) a prolific populariser and author of science fiction; Stephen Jay Gould (1941-2002), author of *The Panda's Thumb* (1980); James Watson (1928), author of *The Double Helix* (1968) which

revealed the crudity and ambition in scientific research; and Carl Sagan (1934-1996) who captured the imagination of millions through his ground-breaking series and book 'Cosmos' (Guerrero, 1997).
This tradition is characterised by the multifarious means of popularisation used by its exponents.[3] It is also characterised by its use of English, a functional and versatile language. Just as English has become the language of science, so equally it has become the *lingua franca* of scientific dissemination (Calsamiglia, 1997). The style that has evolved to meet this need is clear, precise and down-to-earth.

Notes

[1]This paper is a summary of a part of my doctoral thesis on popularisation of science, still in course, directed by Dr. Josep Maria Casasús (UPF).
[2]Goethe was, in a sense, the main precursor of this tradition.
[3]The Anglo-Saxons have operated trough books, even the poetry, young literature, conferences and, mainly, the mass media –newspapers and magazines, radio and television programs. "Science Times", the excellent weekly section of *The New York Times*, was created in 1978 by John Noble Wilford.

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THE DYNAMIC PROCESS OF SCIENCE COMMUNICATION HISTORY IN BRAZIL

Luisa Massarani[1] and Ildeu de Castro Moreira[2]

[1]Studies Centre at the Museum of Life/Casa de Oswaldo Cruz/Fiocruz, Brazil, and SciDev.Net/Latin America (www.scidev.net). Av. Brasil, 4365, Manguinhos, Rio de Janeiro, RJ, Brazil. Tel.: +55 21 3865 2155, fax: +55 21 3865 2155, lumassa@coc.fiocruz.br

[2]Institute of Physics and the Interdisciplinary Group on Epistemology and History of Science and Technology, Federal University of Rio de Janeiro, Brazil. Instituto de Física, Bloco A, CT, Cidade Universitária, UFRJ, CEP 21945-190, Ilha do Fundão, Rio de Janeiro, Brazil. Tel.: +55 21 2275 8168, ildeu@if.ufrj.br

Abstract

We analyse the dynamic process underlying the relationships between science and public in Brazil throughout the 20th century. We compare the science communication activities at three periods of time: a) 1920s/1930s; b) post-Second World War to 1960; c) from 1980s to the present moment. With the

support of historical analysis and comparisons, we discuss some of the current challenges and dilemmas for communicating science in Brazil.

Key words: history of science communication; science communication in Brazil.

Text

Our objective is to analyse, from a historical perspective, the dynamic process underlying the relationships between science and public in Brazil. We will map out how science communication has been developed throughout the 20th century considering the main actors, themes, motivations, objectives and the viewpoints on science. We will consider three periods of time:
a) 1920s/1930s; b) post-Second World War to 1960s; c) from 1980s to the present moment. The justification for choosing these periods is based on the fact that they were marked by more intense and diversified science communication activities, in comparison to other periods of time.
In the 1920s, science communication was an important tool used by the embryonic Brazilian scientific community to create a favourable atmosphere in the public opinion and in the public sphere aiming to allow the development of the basic research in the country. However, science communication had still a lacunar and fragmented character as direct reflex of the fragile situation of the Brazilian scientific structure.
The main characteristics of the science communication activities in this period were: the emphasis on basic scientific concepts; the participation of professors and scientists, among them some important members of the Brazilian Academy of Science; the targeting of the activities to a small-illustrated elite.
There was also a significant link of science communication to the educational movement, seen as an essential factor for the Brazilian progress.
There was an optimist attitude toward the potential of the new mass communication media –the radio and the cinema. An evidence of this is the creation of the first radio in Brazil, in the scope of the Brazilian Academy of Science, and of an institute of educative cinema. The was the belief that the new technologies would allow a quick and cheap dissemination of knowledge even to remote regions, which would contribute for consolidating the national identity.
After the Second World War, with the national policy aiming at developing the country, several scientific institutions were created. Within this general context, science appeared under a redeeming perspective and as a tool for overpassing the economical underdeveloping.
There was a general interest from the public toward physics as consequence of the impact produced by the nuclear issue and of the participation of the Brazilian scientist Cesar Lattes in identifying the meson ð in the years 1947/48. Magazines such as *O Cruzeiro* and *Manchete* and newspaper's supplements such as *Ciência para Todos* brought several articles on science, stressing the activities of Brazilian institutions and researchers, as well as recent developments, mainly in the nuclear domain.
In 1948, a group of scientists created the Brazilian Society for the Advancement of Science, the most representative Brazilian scientific society, including science communication as a strategical issue. This period is also characterized by the late appearance –in comparison to Europeans countries– of 'science writers', in contraposition to previous periods in which scientists and professors developed science communication activities as a secondary activity. José Reis is a significant example; he wrote for six

decades for one important Brazilian newspaper and also hold other activities for different audiences.

The third and last period of our study, the 1980s to nowadays, is a rich moment in terms of science communication. It started with the foundation of *Ciência Hoje (Science Today)*, a science popularisation project created by the Brazilian Society for the Advancement of Science. It embraces magazines for adults and kids, a newsletter on science policy and a website. The first science communication TV programs were created, such as *Globo Ciência*.

Following the international tendency, dozens of science centres and museums. They have been absorbing professionals with different backgrounds: young scientists, architects, journalists, educators, etc. Some of them, with an interactive character, seek to stimulate the curiosity, the interest toward science and a critical attitude. But there is a tendency to reproduce what is done in the United States and Europe with no significant integration of science with local cultural aspects. Only around 1.5 million people visit Brazilian science museums per year (about 1% of the Brazilian population).

Many newspapers have science sections, but the space is limited and few journalists are specialised in science. Most of the published articles are adapted translations of press releases produced by international science journals, such as Science and Nature.

In the science communication activities, is hegemonic the 'deficit model'. In several cases, science communication is target to scientific marketing –emphasising the spectacular character of scientific and technological advances and with no critical attitude toward science– or as a missionary enterprise for 'science literacy' that uses to disqualify the public. Often important aspects are not considered in the construction of a realistic vision of science, including its insertion in the cultural and socio-economical context, controversies, uncertainties and risks. The organised participation of the scientists is still not very frequent and does not deserve significant institutional valorisation. The are still few studies on the activities hold in Brazil and their impact on the audience. The huge economical and social inequalities reflects in the science communication activities, which in general are concentrated in the big cities and in medium and high classes. There are still few initiatives aimed to communicate science, in a consistent way, for the poor sectors.

However, there is an interesting movement of re-thinking the activity, and several forums have been created for discussing strategies for improving it. An important characteristic of the present moment is the (small-scale) attempts throughout the country for professionalizing science communicators. In the last years, a debate has been holding on the formulation of national and regional programmes for communicating science.

Parallel session 14

Science in daily press: a cultural question?

REPRESENTING SCIENCE EDUCATION IN THE MEDIA: NEWSPAPER COVERAGE OF EVOLUTIONARY THEORY AND CREATIONIST EXPLANATIONS

Joachim Allgaier

Centre for Science Education, Faculty of Science, Open University. Walton Hall, Milton Keynes, MK7 6AA, United Kingdom, J.Allgaier@open.ac.uk

Abstract

The teaching of evolution theory in schools in several European countries and the USA has been contested by different groups of creationists. These debates have been reported in the media. Media coverage of the debate over whether creationist explanations of the origin of life should be taught in science classes is the subject of this research. The paper focuses on the role of expertise in British newspaper coverage of this issue. The results show that a range of experts were cited in the coverage, and that these experts drew on the rhetoric of science to defend their positions, whether as creationists or evolutionists.

Key words: Experts, Science Education, Newspaper Coverage.

Text

Context

The research in this paper investigates the role of experts in British newspaper coverage about the debate over whether creationist views of the development of life should be taught alongside evolution theory in British schools. Since journalists do not have the time to conduct independent research they often rely on different sources to add illustrating quotes, using expertise to add credibility to their stories. Expert sources can therefore be used for context, legitimation, explication, and balance (Conrad, 1999).

Sources that are supposed to be exceptionally credible are representatives of science (Sprecker, 2002). This paper focuses on the role of the scientific expert in this debate. It is argued that the newspaper coverage about controversial issues might have an effect on the public opinion (McCune, 2003).

Objective

An overall objective of this research is to examine the role of experts and expertise in media coverage about the representation of science education in the media; who these experts are, what they say and how they get depicted.

Methods

A sample of 66 articles which reported the debate about whether creationist explanations of the development of life should be included in science lessons were investigated in this research. The articles were examined using qualitative and quantitative methods, in a study of media content. The sample included four British national broadsheets and their Sunday equivalents, two British mid-market tabloids and their Sunday issues and two British 'red-top' tabloid newspapers and their Sunday issues. Furthermore, two British weekly publications specialising in education issues, were included in the sample. The sample period includes newspapers from Jan 01, 2003 until Feb 20, 2004, inclusive.
The articles were quantified in terms of: their distribution over time, publication, type of journalist (if named) and use of direct quotation of sources. The direct quotes were then extracted for further qualitative analysis based on the description of the experts and the content of the quotes. This categorisation was not decided a priori, but was allowed to emerge from the data and then compared across the entire data set.

Results

The numbers of different sources quoted in the articles according to the pre-established categories can be seen in Figure 1 below. The analysed quotes represent a variety of viewpoints from a range of experts. Amongst the 98 quoted experts, scientists are a frequently quoted group (24.5% of the quoted experts). The only group quoted more often were the professional educationalists (30.6 % of the quoted experts).

Figure 1 Quoted Sources in the Articles
The chart shows the distribution of the 98 quoted experts over the seven categories of experts.

The scientific sources are usually described by their name, academic title, their affiliated institution and by their discipline. The prevalent argumentation pattern that is used by the scientists relates primarily to what could be dubbed 'the scientific method'. The majority of the scientists argue against the teaching of creationist explanations in science classes. In many cases the scientists relate to "evidence", "proof" and "experiments" to justify their support for the theory of evolution. For them evolution theory therefore has greater epistemological status when compared to creationist worldviews which they often depict as religious belief. By contrast, when creationist scientists get represented in the coverage the description of these experts often challenges their credibility, especially if these experts are quoted arguing against evolution theory.

Conclusion

In this research the role of expertise in media coverage of a controversial issue was examined. The results suggest that journalists use quotes of different experts in a variety of ways. In particular, scientists are represented as credible sources. These results suggest that the use of sources in this story influences the tone of an article about a controversial issue in two ways. First, by selecting certain quotes and leaving out others (e.g. decontextualising them) journalists represent a mediated view of this debate. Second, by contesting the credibility of an expert in the description of the source that is attached to the quote, journalists frame these experts in particular ways. This affects the perceptions of their argument. Journalists and scientists are themselves located in their own professional cultures. But at the same time all share the grounds of everyday culture and public opinion. This should be taken into consideration when the relationship between media coverage, journalists and scientific experts is examined (Peters, 1999).

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POPULAR EVOLUTIONARY PSYCHOLOGY AS PUBLIC SCIENCE AND BOUNDARY WORK

Angela Cassidy

Centre for the History of Science, Technology and Medicine, University of Manchester, Maths Tower, Oxford Road, Manchester M13 9PI. Tel.: +44 16 1275 5843, fax: +44 16 1275 5699, angela.cassidy@man.ac.uk

Abstract

The paper presents findings of a study of the new subject of evolutionary psychology as it appeared in the public domain of the UK in the 1990s. Quantitative and qualitative analyses, alongside research

interviews, found that UK broadsheet press coverage of the subject rose throughout the 1990s and peaked in the year 2000, was associated with coverage of popular science books on the subject, and was written by unusual numbers of academics and book authors. I argue that this evidence, alongside material from research interviews, suggests that popular evolutionary psychology is an example of Bucchi's (1996) model of a 'deviation' route in the communication of science, where scientists have used the public domain as a forum to make arguments and reach audiences unavailable through routine forms of academic communication.

Key words: popular science.

Text

Background/Methods

Evolutionary psychology (EP) is a new area of research which first appeared in the public domain of the United Kingdom (UK) media during 1994 and in academic citations in 1989. Evolutionary psychologists, stress the importance looking to our evolutionary origins in understanding modern human psychology, behaviour and cultures. During the mid and late 1990s, the public claims made by evolutionary psychologists were extensively debated on a popular level in the UK, particularly through the publication of many popular science books on the subject, and by the appearance of many academics in the mass media discussing the issues raised by such claims. In this coverage, evolutionary psychology claims were often closely related to discussions of sexual politics, gender difference, and changes in workplace and family roles in recent years.

This paper presents research following the UK press and other media coverage of evolutionary psychology from 1990 until 2002. Press coverage of EP was analysed through searches of electronic archives of broadsheet newspapers, both quantitatively, through content analysis, and qualitatively alongside coverage from other media and interviews with academics and media professionals. In particular, press coverage of evolutionary psychology was compared directly with that of a related subject in science (articles containing 'evolved + genetic') and a related word in more general use ('Darwinian') over the same period.

Key Findings

- UK press coverage peaked in 2000 and subsequently dropped away strongly: academic citations were broadly in line with press coverage until this date, whereupon they continued to rise (Figure 1).
- Press coverage of EP was closely associated with that for particular authors around dates of publication, e.g. Robert Wright's (1995) *The Moral Animal: the New Science of Evolutionary Psychology* (Figure 2).
- 'Evolutionary psychology' newspaper articles were authored by more academics/book authors compared to coverage of 'evolved + genetic' and 'Darwinian'. They were also less often written by science journalists than 'evolved + genetic' articles were (Figure 3).
- Darwin@LSE group, from the London School of Economics philosophy of science department, organised a series of public seminars on evolutionary themes 1995-98. EP academics and authors were invited to speak at these; co-ordination with publishers on publicity; very well attended and covered by media. Interviewees were unanimous that Darwin@LSE played a central role in creating awareness of EP in the UK public domain.
- Strong evidence of interdisciplinary friction around EP arguments: e.g. evolutionary psychologists' rhetorical attacks on the 'Standard Social Science Model' (approaches

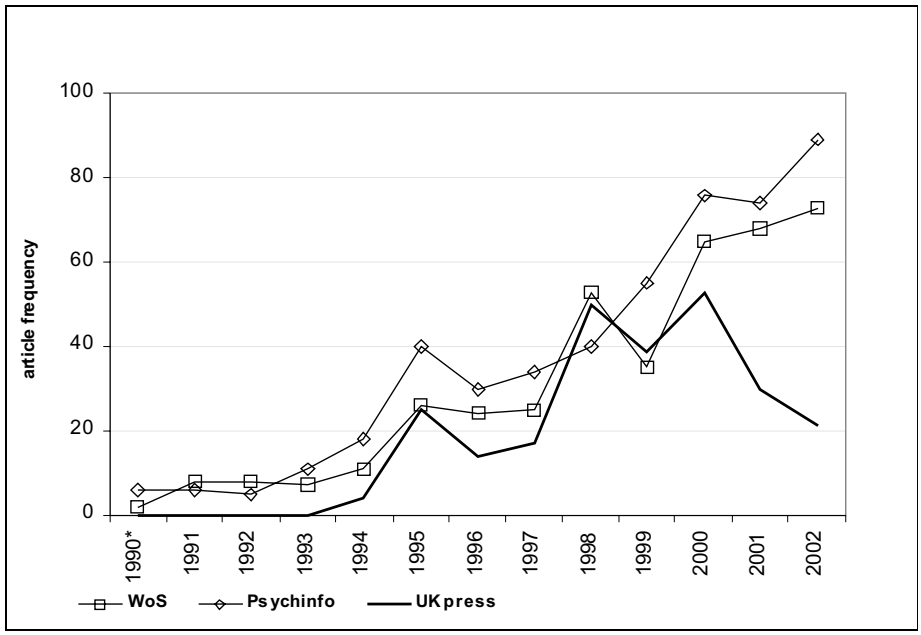

Figure 1 Frequencies of EP articles: academic citation databases; UK broadsheet press

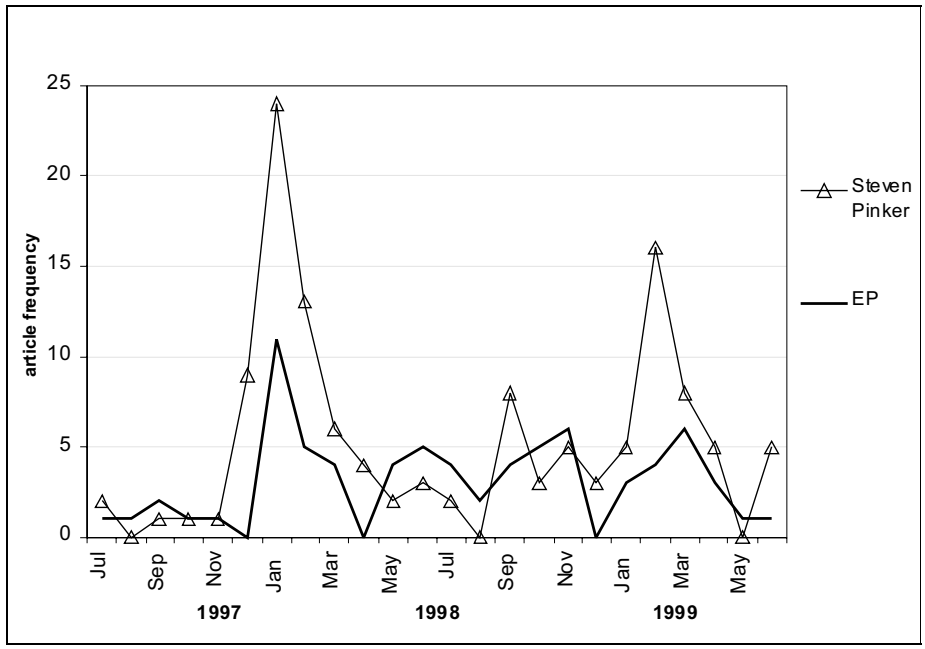

Figure 2 Frequencies of EP press articles; psychologist / author Steven Pinker

that 'ignore' the role of evolution); arguments against EP often came from sociologists/other psychologists, but also from several biologists. Participants in the debate frequently represented one another as 'unscientific'.

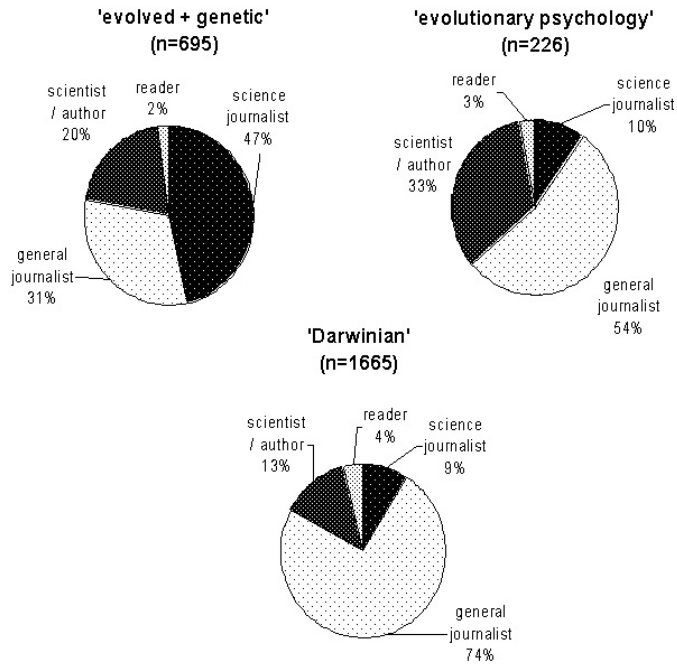

Figure 3 Comparisons of article authors 1990-2001

Conclusions

This study illustrates well the way in which different parts of the UK media can co-ordinate and set one another's agendas in their coverage of a science like evolutionary psychology, which has little relevance to wider news agendas. In particular, it provides strong evidence of the importance of the 1990s 'popular science' boom in publishing for setting the agenda in other media such as the daily press.

I would argue that the evidence presented here is consistent with Massimiano Bucchi's (1996) model of 'deviation processes' in science communication. Bucchi argues that in such cases, scientists appeal to the public domain, frequently working the media themselves, in order to make arguments that cannot be aired via everyday academic communication routes such as journal articles, or to reach audiences outside of their own discipline. Bucchi argues that such episodes are often associated with contest over, or the definition of, disciplinary boundaries in science, and cites examples such as controversy over the asteroid impact hypothesis of the extinction of the dinosaurs.

In the case of popular EP in the UK during the 1990s, a new approach to the evolutionary study of humans sought to distance itself from previous approaches such as Sociobiology, from a marginalised position within the social sciences. Books such as Robert Wright's *The Moral Animal* created awareness of 'the new science' in the public domain, not only through the books themselves, but also through associated coverage in other media, and through the activities of academics and authors themselves to create such coverage, for example by writing book reviews and other articles in the national press. Such moves were then reflected by other academics arguing against evolutionary psychology claims in a similar pattern of popular books and articles. Importantly, my research also suggests

that this kind of science 'popularisation' can have important effects in academia itself, adding further supporting evidence for interactionist, rather than dissemination models of science communication.

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QUALITY CRITERIA FOR SCIENCE JOURNALISM: SARS AS A CASE STUDY TO EXAMINE SCIENTIFIC CONTENTS

Javier Crúz Mena

Dirección General de Divulgación de la Ciencia, Universidad Nacional Autónoma de México. Casita de las Ciencias, edificio anexo a Universum, Circuito Cultural, Ciudad Universitaria. Coyoacán 04510, Distrito Federal, México. Tel.: (52 55) 5662 7332, fax: (52 55) 5665 1552, cruzmena@universum.unam.mx

Abstract

Context. Although several attempts to estimate the quality of news have been made, the concept remains ill-defined. To my knowledge, quality criteria for individual pieces of science coverage are still lacking. Here, a few criteria are proposed as an approximation to quality of contents in science journalism.
Purpose. To examine the science contents of the coverage of the SARS epidemic in daily newspapers.
Methodology. Six daily newspapers (*El Universal*, *La Jornada* and *Reforma*, from México; *Le Monde*, from France, *El País*, from Spain, and *The New York Times*, from the USA) were scanned for their coverage of the onset of the SARS epidemic. Points of information contributing to decision-making processes were recorded, as were the sources (or lack thereof) and argument forming implications.
Results. The quality criteria proposed herein allow the construction of sets of likely decisions by the readers regarding SARS, and of the necessary information points for each decision. On average, only about half of the time was an identifiable source properly quoted. Connections between information points to reproduce arguments were virtually absent in the Mexican coverage.
Conclusion. While they share many of the information points covered by newspapers in Europe and the USA, Mexican dailies limited their coverage to the very mention of this points, often without quoting authorised sources and generally failing to report the reasoning behind the information.

Key words: Science journalism, quality criteria, SARS.

Text

Introduction

While the opening of spaces for the communication of science in the news appears to follow a growing trend, news products may show a lack of scientific content. But this impression is subjective because the concept of "quality" remains ill-defined in journalism. Reviews by Meyer and Kim (2003) and Thorson (2003) document attempts to estimate quality of news coverage, while Pertilla and Belt (2002) argue that quality is linked to revenue.

The issue of quality goes to the heart of the question of whether (and indeed how) science in the daily press is a cultural matter. Two clichés serve as springboards: i) science is culture; ii) knowledge is power. Thus, science journalism lies at the juncture of the

intellectual and the pragmatic, and hence it is valid to ask the question: science journalism, what for? Indeed, Crúz Mena (2003) has argued that if one social purpose of journalism is to help inform the decision-making processes of readers, then one could estimate the quality of individual pieces of science journalism applying this criterion. For instance, Crúz Mena & Bonfil (2003) were able to construct sets of information points to feed reader's decisions regarding the SARS epidemic, the anthrax attacks and the transgenic contamination of corn in México.
Here I argue that to inform decision-making, science coverage ought to report not just on what may be perceived as facts, but also on the reasoning made by scientists to reach those facts.

Results and discussion
SARS was taken as a case study following the WHO's warning on March 12th. A table of likely decisions and corresponding information points has been reported elsewhere (Crúz Mena, 2003). Here we screened the same sample for arguments presented in the form of connections between information points until a logical conclusion is reached. A thorough presentation of results does not fit in this space, but the following example should illustrate the point:
On March 17th., on its first story on SARS, one Mexican newspaper published a photograph showing a Hong Kong patient and relatives, all wearing protective masks and gloves. The note says nothing about the possible source of infection or the ways it may be transmitted. In the days to come, the wearing of masks will be shown and mentioned several times, but always without discussing the rationale or the scientific basis for such practice.
Two days earlier, one of the foreign newspapers accompanied a very similar photograph with a logical sequence. It informed that WHO had observed that most cases occurred among hospital workers, and thus thought that the illness seemed to spread by respiratory droplets. *Then* the note informed of the shipment of masks and gloves.
Trivial though it may appear, the example shows, right from the start, a difference in coverage philosophy between those who feel satisfied with just printing isolated facts and quotations and those who seek to report on the rationale behind the findings themselves. This difference was to be further observed on subjects such as the causal agent, infection routes, clinical treatments and contention strategies, which are longer to discuss and won't fit in this space.

Conclusion
By failing to report on the reasoning behind scientific claims concerning SARS, the Mexican press left its readers no choice but to take the word of the sources solely on the basis of their status as "experts". The hypothesis that if exposed to accurate reports of the reasoning of these scientists the readers might have been in better position to make decisions concerning SARS seems worthy of further research. Moreover, the reasons which prevented the Mexican press from even attempting this sort of coverage are equally intriguing.

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MEDIA COMMUNICATION ON CLIMATE CHANGE AND COASTAL PROTECTION: RECEPTION AND INTERPRETATIONS BY THE AUDIENCE

Harald Heinrichs and Hans Peter Peters

Program Group Humans - Environment - Technology, Research Center Jülich, 52425 Jülich, Germany.
h.heinrichs@fz-juelich.de, h.p.peters@fz-juelich.de

Abstract
Global climate change has been one of the most prominent transnational risks for the last 15 years. For most citizens the media coverage is the main source to get information about this science-based risk issue. In order to gain better understanding of the communicative and cognitive processes of media reception and interpretation, we conducted a quasi-experimental study. The results confirm studies which claim, that the impact of media coverage on the audience depend on culture-specific interpretative processes of the recipients.

Key words: Knowledge, Media, Public opinion.

Text

Introduction

Global climate change and its potential consequences for example for coastal protection (sea level rise) is (at first) only accessible by scientific methods and interpretations. The development of representations about the risk mainly takes place via integrating scientific knowledge into social contexts. For most citizens the media-based public communication is an important social context to get into contact with this issue. In order to understand how citizens make use of media coverage on climate change and coastal protection this paper focuses on the following questions: Which kind of thoughts (cognitive responses) are evoked by the media coverage on climate change? To what extent do the recipients take over the perspective of the article? How are the cognitive responses influenced by recipients characteristics?

Method

At three locations at the German North Sea Coast we confronted 180 randomly chosen test readers with four articles about climate change and coastal protection. The articles discussed different aspects of the topic. The test readers were asked to comment on the articles. The cognitive responses, which were evoked by the media content, were recorded and analyzed with a coding system. Before and after presenting the stimuli articles, we collected data regarding attitudes, values and personal characteristics by questionnaire. By this design we identified interpretative patterns regarding climate change and coastal protection as well as factors guiding cognitive processes of media reception.

Results

Which kind of thoughts (cognitive responses) are evoked by the media coverage on climate change?

The cognitive responses of the test readers indicate, that the reception of media content is a highly interpretative process. The articles have evoked a broad spectrum of thoughts by the participants of the study. The cognitive responses were not only focused on aspects of climate change and/or coastal protection, but were related for example to characteristics of the medium/the author or personal dimensions. The heterogeneous thoughts can be assigned to the following categories:

- author of the article and expert quoted,
- self-references (biographical, personal competence, experience and knowledge),
- personal reaction to the article (interest, surprise, trust, mistrust),
- social systems (political-administrative, science, industry) and their problem-solving capacity,
- media performance,
- risk (existence, acceptance, responsibility, causes, coping).

The heterogenity of cognitive responses shows, that there is no linear and unique way of reading and understanding "media texts". Next to the general recipient-dependent selection of media coverage, there is a selection and variance of possible interpretations of the same media stimuli. How does this affect the impact of media coverage on the audience?

To what extent do the recipients take over the perspective of the article?

The results of our quasi-experimental study indicate that test reader do not take over simply the content and perspective of the media products: instead of linear message learning we observe active sense-making. That means: articles can be actively supported; articles may not provoke many thoughts, because it is not new or interesting for recipients; articles may be rejected, because the recipients do not believe or do not accept what is discussed in the media product. And the same media stimuli may evoke this range on different recipient-reactions within the audience.

The following tables demonstrate, how a stimuli article, which is skeptical on the CO2-hypotheses and which discusses, that geological process may be responsible for climate change, evoked very different reactions (tables 1 and 2).

Table 1 Verbalized thoughts of test-readers on the article and the author

	Positive	Negative	Ambivalent	No evaluation	Total
Evaluation Article/author	20 (26%)	**44 (57.1%)**	2 (2.6%)	11 (14.3%)	77 (100%)

Table 2 Verbalized thoughts of the test-readers on the presented expert and his statements

	Positive	Negative	Ambivalent	No evaluation	Total
Expert quotes	16 (22.2%)	**25 (34.7%)**	11 (15.3%)	20 (27.8%)	72 (100%)
Expert	9 (24.3%)	**20 (54.1%)**	2 (5.4%)	6 (16.2%)	37 (100%)

This results show, that recipients do not take over simply the message of the article. Instead, different readers express different thoughts on the same stimuli. But which factors influence this variety in cognitive responses?

How are the cognitive responses influenced by recipients characteristics?
The interpretative reception of media content points to the fact, that characteristics of the recipients are important for the understanding of media impact. As we have shown in the tables, the article on the CO-2-hypotheses obviously evoked critical thoughts by the majority of our test readers. Taking into account personal characteristics of our test-readers, which we have surveyed by a questionnaire in our quasi-experimental study, it becomes clear, that the thoughts are evoked by the media content (agenda setting), but shaped by values, attitudes, beliefs etc. of the recipients. The table below show the different reactions of test readers with low and high environmental awareness (table 3).

Table 3 Verbalized thoughts of the test-readers on the presented expert statements in relation to environmental awareness

Environmental awareness	Positive	Negative	Ambivalent	Total
Low	**9 (27.3%)**	9 (17.2%)	15 (45.5%)	33 (100%)
High	7 (17.9%)	**16 (41.0%)**	16 (41.0%)	39 (100%)
Total	16 (22.2%)	31 (43.1%)	25 (34.7%)	72 (100%)

Conclusion
Our study on reception processes of media coverage on climate change and coastal protection shows, that recipients actively engage with media content. The media provides interpretations on climate change and coastal protection, which evoke thoughts in recipients. But which kind of thoughts are evoked is to a high degree dependent on characteristics of the recipients and not determined by the media content.

INTERPRETING SCIENCE NEWS: MEDIA TEMPLATES AND SCIENTIFIC CITIZENSHIP

Richard Holliman

Centre for Science Education, Faculty of Science, Open University, Walton Hall, Milton Keynes, MK7 6AA, United Kingdom, R.M.Holliman@open.ac.uk

Abstract
Reception studies of news media coverage of science are interesting for science communication researchers because science news is a key site for disseminating newly-published scientific information. This paper briefly considers some of the results from 32 focus group interviews that examined how participants interpreted news reporting of a range of scientific issues. The results indicate that participants

remembered key events in the coverage, that they were media literate and that they had well-formed opinions regarding these scientific issues. In conclusion, the paper considers the relationship between the (re)construction of media templates of science and scientific citizenship.

Key words: Communication, Media and Public Opinion.

Text

Context

The research discussed in this paper is situated within debates about media templates and scientific citizenship. Starting from the premise that audiences are heterogeneous and that audience members are active (de Cheveigné and Véron, 1996), this research is informed by Kitzinger's (2000) discussion of media templates. She argues that:

Media templates are a crucial site of media power, acting to provide context for new events, serving as foci for new demands for policy change and helping to shape the ways in which we make sense of the world. [In this way media templates act as] rhetorical shorthand, helping journalists and audiences to make sense of fresh news stories. (*Ibid.* p. 81, 61)

Moreover, this paper starts from the premise that audience members will interpret and contextualise media reporting in terms of their prior knowledge, experiences, attitudes and beliefs; in other words, in terms of their scientific citizenship (see Irwin and Michael, 2003, for discussion).

Objective

The key objective is to investigate the relationship between media templates for news reporting of newly-published science and scientific citizenship.

Methods

Thirty-two focus groups were conducted to investigate how participants interpreted and contextualised news media coverage of four scientific issues: the cloning of sheep (Holliman, 2004); whether analysis of a meteorite provided evidence of ancient bacterial life-forms that could demonstrate primitive life had once existed on Mars (Holliman, 1999); Gulf War syndrome (Holliman, 2000); and genetic explanations for intelligence and sexuality.

The groups were drawn from a structured sample of pre-existing groups so that participants could discuss these issues in a relaxing and supportive environment (Kitzinger and Barbour, 1999). Groups were chosen to reflect those who were perceived to have a particular interest in the scientific issue for discussion (e.g. scientists, or trainee journalists) and those without a perceived interest (e.g. office workers).

Data collection involved quantitative and qualitative methods, including individually completed pre- and post-group questionnaires, a group activity where participants produced news artefacts using stimulus materials derived from content analyses of the scientific issues under consideration, and a general discussion led by the group moderator (see Holliman, in press for a description of methods). The group activity and discussion were tape recorded and transcribed, and field notes were taken to record the use of stimulus materials and non-verbal communication.

Results

The results discussed here examine the group interaction during the production of the news artefacts and the discussion that followed. These results suggest that, when compared to analyses of production and content for the same scientific issues

(e.g., see Holliman, 2000), the groups' news artefacts represented similar language and visuals, and key events and framing.
Participants were media literate and capable of reproducing, but also critically evaluating media templates for these issues. For example, following the production of their news artefacts, which reflected key issues from the actual coverage, participants often challenged both these artefacts and media reporting. In effect, these participants demonstrated awareness of the socially constructed nature of science news, drawing on their prior knowledge, experience, attitudes and beliefs of both science and the media to support their arguments.

Conclusions

The experiences of conducting focus groups discussed in this paper have investigated the relationship between media templates for a range of scientific issues and the (re)construction of scientific citizenship. In conclusion, the results suggest that participants were critical consumers of media templates for science. These participants had a reflexive understanding of the media templates for these scientific issues that both drew on and informed their scientific citizenship.
In reflecting on the topic of 'science in the daily press: a cultural question', science communication researchers can explore the diversity in how audience members come to make sense of science reporting in the context of their everyday lives. In so doing, researchers should consider how audience members interpret and contextualise both science *and* the media. Ideas about media templates and scientific citizenship could be useful concepts in this respect, facilitating systematic research into these issues.

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THE IMPACT OF SOCIO/CULTURAL HERITAGE ON MEDIA PERCEPTION OF SCIENCE IN CROATIA

Blanka Jergovic[1] *and Mladen Juracic*[2]

[1]University College London, Gower Street, London WC1E 6BT UK, b.jergovic@hrt.hr

[2]University of Zagreb, Zvonimirova 8, HR-10000 Zagreb, Croatia, mjuracic@geol.pmf.hr

Abstract

The impact of the socio/cultural heritage on media perception of science in Croatia is very strong, traditionally and after political changes in 1990. The method of content analysis of Croatian newspapers is used, and comparison with indicators of socio/political assessment of importance of science (allocation for science and higher education, statements of high state officials, incomes in science etc) has been done. Results indicate that media perception of science highly depends on place of science in society defined by socio/cultural heritage.

Key words: media, science, Croatia.

Text

Context

Political changes in Croatia in 1990 did not introduce immediate development of democracy and economic and social prosperity, as well as expected flourishing of science. Results of science policy changes are delayed. Therefore the beginning of 1990-ies still reflected negative science policy of the former Yugoslav state. In 1965, according to its scientific activity, Croatia shared similar position with Austria, Spain, Finland, Norway, Czech Republic and Hungary, and was more advanced than Ireland, Portugal, Greece, Turkey and Romania. Now Croatia shares the latest positions with Portugal and Romania (Šlaus, 1998, p. 39). The same negative science policy, that started with tightening of totalitarism after so called 'Croatian Spring' (failed attempt to introduce political and economic changes in Croatia in 1971), continued. As a result the share of Croatian scientists in world science production has fallen from 0.08% in 1990 to 0.053% in 1994. Croatia was on 53 position in the world, measured by ISI indicators, among 178 countries, between 1998-2002. Compared to the new 10 members in the EU, Croatia is following Poland, Hungary, Czech Republic, Slovakia and Slovenia, and is better than Estonia, Latvia, Leetonia, Malta and Cyprus.

The percentage of GDP for science is 0,55. Having approximately 10,000 registered scientists this makes €14,848 per capita.

The coverage of science in Croatian media traditionally follows the importance of the events. The most extensive coverage has daily broadsheet *Vjesnik*, having also special pages on science. Other newspapers cover science in accordance to their perception of importance of events and prominence of scientists.

Objectives and methods

The aim of this research was to compare the importance of science in society and in media, and to find out possible correlation inbetween. Indicators of importance of science in society are quantitative (financing) and qualitative (development strategies), whereas in media these are: number, layout and extent of articles (quantitative), and comprehensibility (qualitative). It included content analysis (397 articles: 298 in 2001 (214 high educating, 79 science), 64 from June 2002 and 35 from October 2003), open interviews with science journalists and editors, and comparison.

Results

Since Croatian independence in 1991, its declared priorities were knowledge and science, and its paragons were Ireland and Finland. However, opposing statements were present: *e.g.* president Tuðman's (1991-1999) about "genetically predetermined Croats", intellectuals as traitors and hirelings financed by foreign trusts (Soros, etc.); or one of pre-eminent former ruling party members (Ivan Milas in Parliament) about brain value of 2 DM. Today, there are no such statements, and science and education is, according to the budgetary funding, fourth most important sector. Share for science and research from 0.6-0.9% in 1990-1998 (Šlaus, 1998, p. 38) arrived to 1.19% in 2004 (Švarc *et al.*, 2004), indicating that importance of science and research has been recognized in Croatia. Croatian newspapers since formation of stable readership in second part of the 19th century are important part of the political life and depend on politics (Jergoviæ, 2000, p. 82). This is felt up to now. During the socialist regime, as a whole society, science was atomized. The interaction science-citizenship was substituted with science-politics interaction (Šlaus, 1998, p. 37). The result was obvious in printed media. After radical political changes in 1990, following the change of political agenda (war, current political events, restoration…) newspapers during 90ies introduced science topics. In 1996 *Vjesnik* introduces science section.

Articles on science are mainly of medium size (29%) or large (38%); mostly have medium (47%) or large headlines (38%) and photographs (62%). Almost 100% of analyzed articles are easy comprehensible. Sensationalism in divergence between headlines and article content is not present. Science is not ghettoised: *Vjesnik*, which only has science section covers science also on daily base and in supplements. However, articles published in *Science*, *Life* and similar sections are more prominent respecting size and layout. The weakest point is number of articles –average 1.5 daily, and on 'Croatian' science 0.8.

Conclusions

Media perception of science in Croatia follows its political perception. However, recent changes of importance of science in society (better financing, positive attitude of politicians toward science) are still not felt in media, characterized by poor interest in science, strong predominance of natural sciences, exclusive authorship of journalists (scientists write mostly in *Letters to editor*). More attractive articles in sections *Science* or *Life* suggest higher importance. This, notwithstanding meagre ghettoisation of science into sections, indicates that science is not important in other spheres of life (especially technical, social sciences, humanities). In favour of this conclusion goes also the indicated indifferentness of Croatian publics towards science (Polšek, 1998, p. 227-233).

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SCIENCE REPORTING IN THE LOCAL PRESS IN GERMANY

Markus Lehmkuhl[1] *and Winfried Göpfert*[2]
[1, 2]Free University Berlin. kuhle@zedat.fu-berlin.de, goepfert@zedat.fu-berlin.de

How does one assess the quality of journalistic science and risk reporting? There have been numerous attempts to find a common basis of assessment by applying different, intersubjectively verifiable methods, but no agreement could be reached so far (Bader, 1998; Schanne, 1998; Dunwoody; Peters, 1992). There is no point denying that journalistic products usually do not fulfill the demand for accuracy a scientist expects his own results to meet. Just as no one would doubt the fact that journalistic constructions of "reality" do not reflect the reality of the scientific result but create their own "media" reality. There is, however, reason to doubt the argument that these deficits of journalism are worth. From the point of view of the doubters though, approaches taken by the representants of accuracy research or methods comparing the reality designs of journalists with those of scientists always reach the same conclusion: When devising its selection criteria journalism refrains from taking into account the relevancy criteria of the system it observes, be it science, economy, politics, or the judicial system. Journalism has to rely on its own criteria, otherwise it becomes a mere ward of science, and ceases to be journalism (Kohring, 1997).

As a result, research approaches like the ones mentioned above, which aim at turning journalism into a transmitter of scientific interests, must seem futile. All analysis based on hierarchically comparing the reality concepts of science and journalism, eventually has to end up with the same result: that of the discrepancy between realities and hence the "contortion" of journalistic reality.

Looking upon the issue from a systems theoretical point of view, one has to ask the question of how journalism can be criticised at all when no criteria deriving from fields other than journalism itself can be applied. The answer that will be given below is easy: Valuable criticism has to be based on the very quality criteria journalism has set up for itself. Guidebooks for journalists at work serve in our study as a source for devising these criteria. This leads to the question, when exactly one of these criteria has to be considered as fulfilled. Judgements cannot simply be based upon a reference value developed in advance, a value providing reliable information on what a well-made news report is or what it has to offer in order to be called complete. Due to the lack of such reference values, our assessments shall be based on the always disputable arguments of the critic. As a result, the information value of the criticism increases and decreases according to the quality of the critic's arguments. This method basically resembles the approach of literary scientists investigating the quality of literary texts.

In the following passage I will summarise very shortly the results of our analyse of the news coverage and commentaries on the following four issues as found in 11 local German newspapers: Cloning of Dolly, the nitrofen scandal, BSE, and climate change. Analysis focuses on the science journalistic aspects of the four issues in question.

Our analysis has made partially considerable deficiencies evident. These deficiencies refer to the information depth of the coverage, the ability to comment on and to investigate into events. Regarding the extent of shortcomings, the texts differ considerably. Especially two among the three newspapers from Berlin yielded much better results in terms of quality.

The other papers usually don't succeed in competently explaining events from a science

journalistic point of view. The papers seem incapable of taking such an approach, which is particularly problematic considering the many dimensions that have to be taken into account when dealing with one of the complicated issues mentioned above. This limited ability of tackling the issues is probably due to the lack of science journalistic competence in editorial staffs. Local newspapers should therefore turn to strengthening science journalistic competence in order to improve their reporting. Considering the redundancies in our findings there is no point in hoping that the incapability of tackling scientific dimensions of issues is limited to the examples analysed in this paper. On the contrary, it is very likely that local newspapers as a rule have big difficulties in dealing with similar thematical dimensions.

What makes the two Berlin-based newspapers outstanding is, firstly, the more sophisticated treatment of issues. And secondly, science for both papers is no longer something to be seen separate from the political or the economical system. Science for them is not a source guaranteeing certainty but something that has to be questioned as well. When the Berliner Zeitung informs its readers on the economic background of the Dolly experiment, it uncovers the ties between economy and science, hereby showing that the quest for truth is not the only driving force of scientific progress but that profit interests also play a role. Here an interesting characteristic of science becomes visible: its partial loss of social detachment (Weingart, 2001). The other two papers do not only cover up this trait of science, their coverage even widens the distance between science and other partial systems of society. Science is depicted as a kind of supernatural force, in the case of Dolly even bearing demonical features.

By explaining how limit values come into being the Tagesspiegel gives his readers a glimpse as to the limits of certainty. Introducing the methodical difficulties the paper points out the fact that the production of truths has to come up against limiting factors – a fact that is usually not mentioned at all. To most newspapers, the seal "scientific" suffices to prove a result trustworthy. Never are scientific results put under scrutiny, never do scientists have to justify their opinions, the social detachedness of science remains untouched. What has been proven "scientifically" is automatically trustworthy, seems to be the conviction of all local papers. Their approach to science is similar to that of an amateur. The editors cultivate a distance to science, because its partial loss could be considered as characteristic of the "scientification" of society. They want to see science in the ivory tower it has left long ago.

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POPULARIZATION OF ECONOMICS THROUGH ARTICLES ABOUT "NEW ECONOMY" IN FRENCH NEWSPAPERS (1999-2000)

Elsa Poupardin

University Paris 7 Denis Diderot, 1 rue de Bercy 75012 Paris, France.
Tel.: 01 44 67 01 61, elsa.poupardin@wanadoo.fr

Abstract

The increasing number of articles devoted to economics and especially to the "new economy" between 1999 and 2000 in France raises the question of the vulgarization of economics in the newspapers. We examined five French national daily newspapers, two weekly magazines, and one daily local newspaper between the years 1999 and 2000. We compared the newspapers contents with the articles of vulgarisation on natural science and economics. At last we studied the common points it shares with the hygienist literature of the 19th centuries.

Key words: Vulgarisation, hygienics, economics.

Text

Context

The expression *new economy*,which is born in the middle of the 90's in USA had been enormous media in France where it arrived at the end of the decade. Written articles on "new economy" are interesting because they represent a novelty both in terms of numbers and content of articles, then because they reconcile economics and economy describing a utopian world, a new hoped economy.[1] We would like to determine to what "genre" these articles belong.

Methodology

We examined five French national daily newspapers (*Le Monde, Le Figaro, Libération, L'Humanité, La Croix*), two weekly magazines (*l'Express, le Point*), and one daily local newspaper (*Le Parisien*) for years 1999 and 2000. We choose to pick all articles where "nouvelle économie" was used in title or in body.

Results

What should be established at the very outset is that their content have many common points with the one of vulgarization articles on natural science. First of all because they consider economics as equivalent to natural sciences: they quote figures, laws (Metcalf's law, Moore's law etc.) and famous economists, use charts and tables, technical terms, and neologisms. Secondly articles show the same rhetoric as scientific literature of vulgarisation: authors use paraphrases, analogies, metaphors etc., to simplify their account.

This vulgarization is nevertheless peculiar in many ways. In the first place articles on "new economy" and economical vulgarisation differ about three points:

Our articles never mention the whys of their interest in the "new economy", whereas thirty years ago, every authors would have underscored the absolute necessity of economical vulgarisation. The standardization of the actual economic discourse is also new: two newspapers, as Liberation and Le Figaro which have obvious different political leanings display to us the same subjects, myths and metaphors and the same treatment. Secondly we can also distinguish our literature on "new economy" from vulgarisation of natural science. To begin with, articles have a conflictual relationship with the science, they are supposed to popularise. Authors denigrate methods and forecasts of the

professional economists, underscore that there are no consensus between economists, and put the "heterodox" economists forward. They also present economics as a harmless science (no "mad scientist" here) and which did not make any "progress" for a long time. Style of articles also clashes with those of vulgarisation being quite normative: They often take form of advice and above all recommend action. They are also "oriented" and peremptory, using assertions, appreciations and questionable relationship of cause and effect to describe facts.

Theses particularities lead us to suppose that a comparison with the hygienist literature of the 19th would be appropriate. The historical links between the two genres tend to confirm this hypothesis.[2]

The role of scientists in the two literatures is very close: he has to inform and convince the politics in order to make laws and to take decisions for people. He is the only one able to fix the system (economical or medical) and he has a responsibility toward the future that he has to improve for next generations. He is also often judged responsible in case of crisis.[3]

In addition the literatures of vulgarisation in hygienics or economics have the same goal: to prevent the crisis, describe the first symptom of illness. They both over and above that used the same analogies and metaphors as those around mechanics. The body is thought in terms of circuit, pump, flow, belt, lever etc. as the country was describe in our articles.

Conclusion

The study of the press on new economy reveals possibly an explanation to the joint "rebellion" of the economic student about the teaching of the discipline and the blossoming of the anti-globalisation movement in France. The augmentation of the number of economical articles and the lost of the aura surrounding economics could be taken to mean that articles revealed to readers the domination of the neoclassic theory in the public discourse and cast doubt on the legitimacy of this omnipresence.

The comparison with hygienist literature is interesting in that it lighten the links between authors, publics and scientist in these articles. Journalists seem to have a low opinion of the level of economical knowledge of their readers, they put a matter of life and death in the comprehension and knowledge of economics, and for them, economists as doctors are working for the sake of mankind. An interesting paradox lays nonetheless in the contradiction of their respective contents: promote or discourage public intervention in private life.

Notes

[1] *Économie* has in French the two meanings of *economics* or *economy.*

[2] *cf.* how hygienics has economical preoccupations and how it was often connected to economical sections in scientific societies in Bourdelais Patrice (ed.) (2001).

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DESIGN OF A STUDY ON THE COVERAGE OF SCIENCE NEWS IN SPANISH-WRITING NEWSPAPERS OF AMERICA AND CREATION OF A LATIN AMERICAN NETWORK OF SCIENCE NEWS STUDIES

Raimundo Roberts

Scientific Communication Observatory. University Pompeu Fabra, Passeig Circumval·lació, 8, dept. 201, 08003 Barcelona, Spain. Tel: +34 93 542 2446, raimundo.roberts@upf.edu

Abstract

The goal of this proposal is to improve the information about scientific information in newspapers in Latin America. This will abolish the lack of data about the coverage of science and medicine in the newspapers of mayor countries in this region. To run this project, we propose to use the methodologies of *Informe Quiral*, an annual study of five major newspapers published in Spain, and developed by Scientific Communication Observatory at the University Pompeu Fabra in Barcelona, Spain.

We want to present and discuss this project for the study of scientific news in the Latin American press with others journalists and researchers, and also, involve them in the proposed project by creating a network to develop this study, and to continue monitoring these sources of information on a long-term basis.

Text

Politics that is oriented to works an integral development of the society, in countries with different levels of development, will benefit it from the investment in education and science, which is fundamental for the progress.

Vladimir of Semir says, "precisely, when we are in an economic and social process of transformation towards new forms of living together in many aspects of our society, it is very important that the citizens possess the capacity to adapt, because the technological and scientific culture forms part of their daily routine".

From this point of view, the reflection of science in the "public space" trough the media is one of the key elements for its diffusion and social acceptance, besides it should be included in the priority list of the "policy-makers". Science, as well as technology, supposes the creation of knowledge that can and should be applied in order to have a social repercussion. To make this process effective, it is necessary to create a "virtuous circle", formed by the public exposure of the scientific local or international efforts, a strong position of an informed society and a political priorization of activities, which are directed to the creation and diffusion of the knowledge.

Similar antecedents of studies at an European level exist, like the one carried out by Holliman,[1] on the study of newspapers in five European countries, and presented at the PCST Conference of Cape Town, South Africa, in 2002, or the *Informe Quiral* that have shown to be a useful source of a large quantity of information.

Objectives

The proposal of the OCC that we present consists of the execution of a study on the scientific or medical news, in newspapers in various countries of Latin America. In addition, we propose the creation of a network of studies on scientific news, having emerged from this study.

Methodology

To study the evolution of the published issues in a specific part of the society, the OCC has implemented a study tool: the *Informe Quiral*. This study is carried out annually since 1996, and maintains since 1997 the same methodology. This permits us to successfully

study the specific development of subjects, especially those of sanitary interest, in a concrete "public space" circumscribed to the newspapers. The *Informe Quiral* has been able to establish a stable substrate of objective data on the journalistic information in media of greater credibility: the newspapers.
The Informe Quiral has as a like objective the systematic monitorization and the analysis of published texts in the five daily newspapers of greater diffusion in Spain, in relation to health, and medicine and the health. The monitorization of these media is carried out from the material communicated to the readers, through the systematic harvesting of all the information on medicine and health that have been published. From these data, we obtain sufficient information to analyze the most important issues of the year and to understand the structures to produce journalistic information, the ones that determine the form and the fund of what the readers receive daily through the newspapers.
Through the studies carried out in the *Informe Quiral*, we have been able to establish the evolution of the sanitary themes of an information media group of great coverage, credibility, and with a great impact in the public space, that influences the politicians and the "policy-makers". The collected data by this publication have been delivered to sanitary decision-makers, and the specialized journalists. Besides, we can affirm that it is a suitable tool of monitoring themes that permits to obtain data and to analyze the "reality" of a specific sector.
The general methodology of analysis of the *Informe Quiral*[2] is based on the guidelines that are described by Krippendorff[3] for the study of the content in the media and the indicators utilized by Burns *et al.* in 1995.[4]
We propose to apply this methodology in different Hispanic countries, to discover who the protagonists of information are, and which are the themes that show more interest in the media. In this way, we propose to establish an international basic study, with the same methodology that we have already tested, on the information that the Hispano-American societies receive in the field of science and medicine.

Results expected

The results expected of this investigation can be extrapolated from the ones obtained by the *Informe Quiral*. In first place, have the classification of the analyzed journalistic texts and, secondly, to have a tool to compare newspapers in different regions or countries. Furthermore, we would like to analyze and expose in what way the scientific issues are treated in the press, to explain journalistically the professional work of who reports and to stimulate the objective values in scientific communication. On the other hand, it will be possible to determine the themes that most interest have caused and most news have generated in the press, to analyze quantitatively the most important themes, and to carry out a qualitative analysis of the cases that have caused most impact.
In a second phase, we expect that this study will permit us to obtain reliable data to observe the evolution of the journalistic working processes of the themes that more impact have shown.
Also, is viable to monitor and to make comparisons of the development of the scientific journalism in each country of the study. This would be possible thanks to the creation, on one side, of an extensive database that would permit the execution of different studies on the state of science and the scientific journalism, like the one carried out by Revuelta *et al.*[5] On the other side, it will permit an exhaustive study on the issues, protagonists and informative flows of the main media of communication.

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DEMOGRAPHY AND MEDIA

Bassani Marina

ICS, Laboratorio Interdisciplinare-Scuola internazionale Superiore Studi Avanzati S.I.S.S.A., Trieste (Italy)

Abstract

In the last decades demography has confirmed a particular disciplinary habitus, which entails collaboration with public bodies concerned with social policies and a broad opening towards a non-specialist public. Our project on demographic communication in the Italian national press and the survey conducted within the community of Italian demographists are both geared towards shedding light on demographic divulgation, on the arguments and linguistic codes that communicators and demographists address to the public in general, as interaction between science and society. Rather than a 'hypercritical' consideration on the risk of popularisation, we are dealing with a hypothesis of 'reflection' on profession as social scientists.

Parallel session 15

Science on TV and radio: quality, quantity and new trends

WHAT ISSUES OF SCIENCE DO PEOPLE PREFER TO WATCH ON TV?

Pere Estupinyà,[1,2] *Cristina Junyent,*[1,2] *Miriam Pelaez,*[1,2] *Silvia Bravo,*[1,2] *and Eduard Punset*[1,2]

[1] Programa REDES, Televisió Espanyola–Catalunya. Avgda. Mercè Vilaret, s/n. 08190 Sant Cugat del Vallès, Barcelona, Spain. Tel.: +34 93 582 36 20, pere@jassworks.com

[2] Agencia Planetaria. Travessera de Gràcia, 173 4rt 4ª, 08012 Barcelona, Spain. Tel.: +34 93 285 65 47, pere@agenciaplanetaria.com

Abstract

REDES is a scientific TV program emitted from Spain during 9 years. We have recently analysed the data of audiences to investigate witch kind of scientific contents our audience prefers. We haven't found big differences between general topics but some significant and interesting conclusions: people love physics and cosmology. Psychology topics are also very successful. Genetics and biotechnology usually have low audiences, on the contrary of programs related to evolution. Programs about technology and social science have in general the lowest audiences.

Key words: television, audiences, topics.

Text

Context

REDES is a one hour scientific TV program that it's been broadcasted from Spain through the second channel of the spanish public television (on Sunday after midnight) and in all Europe and America through the International Spanish TV Station. Professor Eduard Punset, the director of REDES has interviewed the most important scientists and thinkers of the world, like Stephen Jay Gould, Edward O. Wilson, François Jacob, Sheldon Lee Glashow, Lynn Margulis, Richard Dawkins, Danniel Dennet, Roger Penrose, Ilya Prigogine, Antonio Damasio...

REDES is in its 9th year and has recently celebrated the program 300. During these years

we have talked about all kind of issues related with science (genetics and molecular biology, brain sciences, atomic physics, cosmology, technology, natural sciences, evolution...)

Objective

To analyse the data of audiences and to identify which topics on science do people prefer to see on television. To find out the influence on audience of other factors like the general reputation of the scientist interviewed or the difficulty of the subject.

Methods

The data we have are: time and date of emission, contents and scientists interviewed, share (percentage of people who is watching REDES, from global audience at that time), number of spectators. Because of the variability of total number of people watching television depending on the date, we haven't use this data and we just use the share to compare audiences between programs. We haven't included the first 56 programs in the study because they were broadcasted in a different time and day of the week, and the people interviewed were not just scientists but also famous people like actors, musicians or politicians. From January'04 REDES is emitted on Tuesdays at midnight, so we haven't used these data. We have neither included the programs that were difficult to define in a topic, those that were broadcasted 30 minutes before or after the average time of emission, and the repetitions broadcasted on summer.

The main categories of programs we have selected in order to compare the data of their audiences are:

- technology and future,
- physics and cosmology,
- biology and earth sciences,
- brain sciences,
- health, and
- social sciences.

We have also create small subcategories due to the existence of very different contents on these fields and in order to analyse particular well defined topics like cosmology, genetics or evolution.

Results

Table 1 Results

Total of programs broadcasted (until january'04):		302
Total of programs included in the study:		177
Share (average):		5.44
Main categories:		
Topic	Share	Number
Technology and future	4.64	20
Physics and cosmology	5.87	29
Biology and earth sciences	5.44	54
Health	5.49	20
Brain sciences	5.73	33
Social science	4.8	21
Total	5.44	177

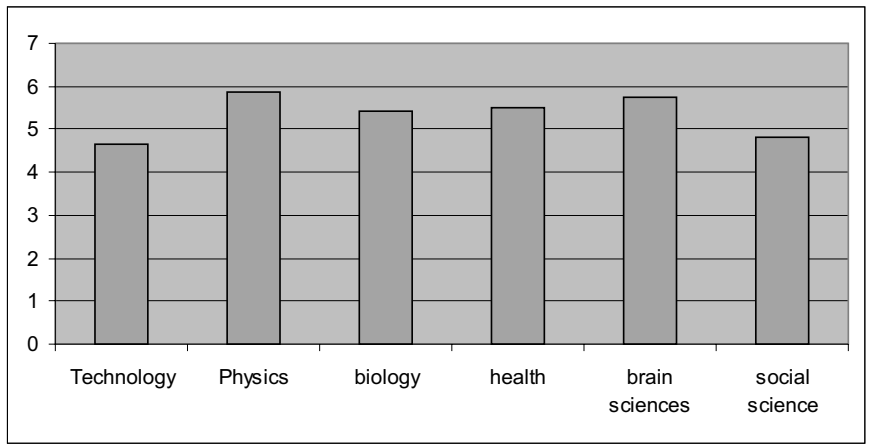
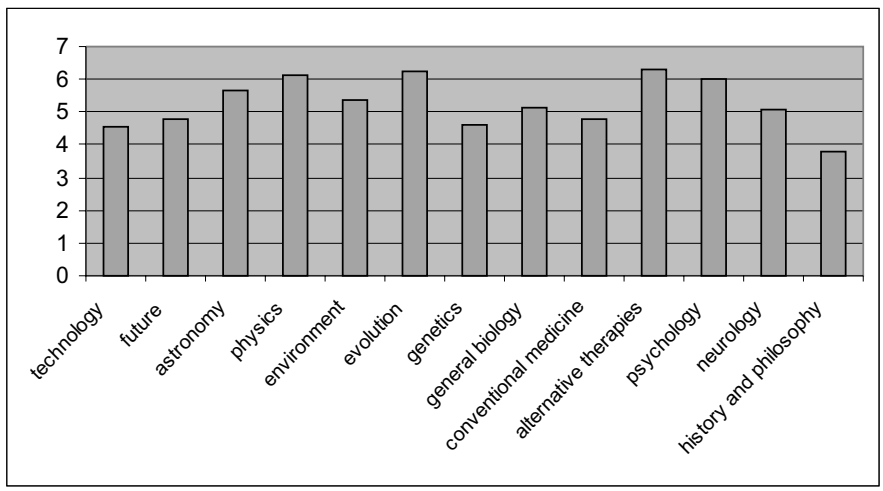


Table 2 More detailed

Topic	Share	Number
Technology	4.58	13
Future	4.76	7
Astronomy	5.68	17
Physics	6.15	12
Environment	5.37	8
Evolution	6.26	19
Genetics	4.63	11
General biology	5.11	16
Conventional medicine	4.75	10
Alternative therapies	6.30	10
Psychology	6.00	24
Neurology	5.06	9
History and philosophy	3.82	11



Conclusions

When we analyse general topics we don't see clear differences. It's interesting to see how physics and cosmology, that apparently is the topic less related with common life, has the biggest audiences. Brain sciences, that in our program are very focus on psychology, are also very successful. On the other hand, technology and social science (that are the easiest to understand for a general audience) have the worst results.

But the most interesting conclusions appear when we analyse the different subtopics. For example, inside a enormous topic like biology we can see how people clearly prefers evolution (6.2) than an apparently more topical subject like genetics and biotechnology (4.6). Even environment have a modest result (5.3).

In our program we usually talk about the laws of physics, quantum, particles... they are usually very hard programs, but surprisingly audience like them (6.1). Even more than all topics related with the space travels and universe (5.6)

When we compare the share of programs on conventional medicine (4.7) –mostly are special programs on a particular illness– with the one of alternative therapies (6.3) we also identify a big difference. There could be interesting interpretations of these fact.

Another difference appears when we compare neurology –how the brain works (5.0) with the topics on psychology –how the mind works– (6.0).

By the way we could assure that our audience is much more worried about mental illness like depression than physical ones, like diabetes.

We must also mention the low audiences of programs on philosophy or with historical contents. It's been a small surprise, because although they are usually dense, we usually have lots of comments by mail and phone the day after the emission.

Analysing audiences, we have seen other curiosities apart from the preferred topics, like the low importance of the reputation of scientists or communicators to get good audiences. We have chosen the 23 programmes where the scientists interviewed were considered the most famous, and the average share was 5.3, not very different from the general share (5.44). Another fact is that difficult programs on physics, neurology or microbiology, for example, not always have low audiences as one should expect.

VIDEO SERIE: *LES CARES DE LA NOSTRA CIÈNCIA*

Karla Islas,[1] Gemma Revuelta[2] and Oriol Albaigés[3]

[1,2]Science Communication Observatori de la Comunicació Científica, Universitat Pompeu Fabra, Barcelona. Tel.:+00 34 93 5422446, karla.islas@upf.edu; gemma.revuelta@upf.edu

[3]Blauhaus. blauhausvideo@yahoo.com

Abstract

Scientists are unknown by the general public, who usually see the figure of a scientist as "a middle-aged man, with white coat, etc.". The scientific activity seems to be distant, boring and even a little bit *dark*. The main objective is to show to the general public the most human and personal face of people who "make science" in their city (in this case, Barcelona), and to demystify the figure of the scientist giving a more realistic vision of the work he/she makes. Our methodology is the production and broadcasting of the series *Les cares de la nostra ciència* (*Our science's faces*). This series presents 25 people who work in different scientific areas in Barcelona and who represent different ages, knowledge areas, sex, etc.

The videos, that last approximately 5 minutes each one, are structured in four parts; professional trajectory, science, free time and future. The videos are being broadcasted by Barcelona's local municipal television channel (BTV), within the program focusing on the current topic of interest in science *Einstein a la platja (Einstein on the beach*).

Key words: Television, Scientific community, scientific vocations.

Text

Context

Scientists are unknown by the general public, who usually see the figure of a scientist as "a middle-aged man, with white coat, etc.". The scientific activity seems to be distant, boring and even a little bit *dark*. The scientific knowledge seems to be separated from the people who do research everyday, and is hardly imagine the process of the research and the activities that have been made in the laboratories. Also, other fields, like the science history, philosophy or education, are rarely related with this job.

Science popularisation most of the time focus on the description of the research and the results of the studies, but is less common that we can have access to know the persons who make science.

Objectives

1) To show to the general public the most human and personal face of some people who "make science! in their city (in this case, Barcelona) with a relevant trajectory in their field, 2) to demystify the figure of the scientist and give a more realistic vision of the work he/she makes, showing a diverse group of them and different atmospheres of work, ages, sex, expectations, motivations, etc., 3) to promote less slanted vision of the role of women in science by showing that is a real option of life and is also compatible with other responsibilities, like family, and 4) to boost the scientific vocations between young people, showing them like close persons and with different interests and ways of life, with different hobbies and interests, also different motivations to study science, ranging from family tradition until "causality of life".

Methods

The production and broadcasting of the series *Les cares de la nostra ciència (Our science's faces)*. This series presents 25 people who work in different scientific areas in Barcelona and who represent different ages, knowledge areas, sex, etc.

The production of the series was during 2003, and it was presented and included in the Science Week activities in presence of the protagonists of the series, finishing with a session of questions and answers.

The production of the series was made in three stages. First of all, the writer of the script –a student of the Scientific Communication Master, of de Universitat Pompeu Fabra– interviewed the protagonist in order to get the information and select the story line, and then write the script.

The second stage was the shooting. Each chapter of the series was filmed in one day. The script contains the topics in which the scientist will focus on. During the filming, the protagonist speaks about the subject in the specified time, but he/she is free to explain it in the way he/she wantes, in order to give naturalism and show him/her in his/her own words and expressions.

The videos, that last approximately 5 minutes each one, are structured in four parts; professional trajectory, science, free time and future. The first one allows to know the

main character and explains the reasons that led him/her to their current situation in the professional field.
The second part shows briefly his/her current work. It's a simple description of the job environment, including his/her working team and the place in where he/she is each day working.
The third part is more free, because the protagonist speaks about the activities that he/she makes during free time, weekends or holidays. Including the hobbies, sports, family and also telling some of their preferences like books, music or writing.
The last part let the scientific speak about the future in his/her knowledge area, but also in his/her personal life, so this part allows to know some deep aspects of the protagonist and to know something about his/her ideology.
We use different locations for every part of the video. In the part of the trajectory, most of the times was his/her office, to show the space where he/ she works everyday. Science part was in the laboratory or work centre and the two last parts in places that protagonist likes. We had personal scenarios like their home, or another like the beach, gardens, parks or the street. We let scientist participate in the decision of the locations, and also express their preferences in more technical aspects like framing, camera movements and effects, to give more personal design in each one.
The third part was the postproduction. We inserted personal pictures, videos or graphics of the family, hobbies, sports or holydays of the scientist. The sound was also election of the protagonist and we can find from classical music to rock, pop or instrumental songs.

Results
A series of 25 videos with scientist of different knowledge areas, 5 of them from Biology field, 4 from physics, 1 from psychology, 5 from medical area, 2 from pharmaceutics, 3 from engineering, 1 from history, 1 from philosophy, 1 from pedagogy, all of them are working in science topics.
The series is being broadcasted by Barcelona's local municipal television channel (BTV), within the program focusing on the current topic of interest in science *Einstein a la platja (Einstein on the beach).*
Furthermore, a summarizing video of 23 minutes has been elaborated and it will be used as a didactic material in secondary education.

INFORMATION ON SCIENCE IN EUROPEAN TELEVISION. A STUDY OF PRIME TIME NEWS PROGRAMMES

Bienvenido León

Assistant professor, School of Public Communication, University of Navarra (Spain). bleon@unav.es

Abstract
This paper presents some preliminary results of an ongoing project on science in prime time European television news. Results confirm that science is a marginal topic in the main news programmes of the five biggest European markets: Germany, United Kingdom, France, Italy and Spain. Other findings indicate that some scientific topics are common to most of the channels, although they can be covered in very different ways. The average length of the items makes it difficult to include some contextual information, which is necessary for the viewer to link the topic to his/her daily experience.

Introduction

Academic research on television news is scarce. One of the most extensive works, a study of 15 European channels of 8 countries, co-ordinated by the Centre National de la Recherche Scientifique (France) in 1994, found that science was not covered in a massive way, although it varied from one country to another. Germany was the best informed country, and Italy the one with less scientific news (de Cheveigné, 1988).

This work analyses scientific contents of European prime time television news programmes in ten channels of the five biggest European markets, in order to analyse the quantity and quality of science coverage.

Method

This study combines quantitative and qualitative research. Firstly, it tries to find out how often science and technology appear on prime time European news programmes, and what is the length of the items on this topic.

More specifically, three research questions were formulated:

RQ1: What number of items about science and technology are broadcast in European television prime time news programmes?

RQ2: How much air-time do these items receive?

RQ3: What is the average length of items on this topic?

In view of quantitative data, the study was completed with some qualitative research about how scientific topics are presented in the analysed news programmes, with special emphasis on contextual information. Following an inductive method, the case of Smart-1, the first European mission to the moon, was selected as a case study.

This work is part of the research project GLOBAPLUR ("Globalisation and pluralism. The function of public television in the European television market"), sponsored by the Spanish Ministry of Science and Technology.

The preliminary results presented in this paper, focus on the situation of the five biggest European markets: France, Germany, Italy, Spain and United Kingdom. In each country, prime time news programmes of the leading public and the leading commercial channel were recorded, during the sample week (the forth week of September 2003). Coding items include length, place an topic of each news item.

Results. Quantitative analysis

As table 1 shows, 32 items about science and technology were found during the sample week.

In relative terms, this is only a 2.37 % of the total number of items broadcast, which shows that science is far behind other topics like politics (16.79%), crime (12.55%) and sports (12.10%). Health and environment, also represent small percentages of the total number of items, although health is more frequently covered (4.01%).

Differences among countries are relatively small, except in the case of Italy, where no item on science and technology was broadcast. In the other countries, the percentage of items for this topic, ranges from 2.61 to 3.23 %.

Table 1 Number of items

	Science (%)		Environment (%)		Health (%)		Crime (%)		Sports (%)		Politics (%)		Total items
France	12	3.13	11	2.87	32	8.36	49	12.79	25	6.52	49	12.79	383
Germany	6	3.23	3	1.61	2	1.08	22	11.82	23	12.36	46	24.73	186
Spain	10	2.69	7	1.88	6	1.61	51	13.70	81	21.77	52	13.97	372
United Kingdom	4	2.61	1	0.65	9	5.88	27	17.64	19	12.41	35	22.87	153
Italy	0	0.00	3	1.19	5	1.98	20	7.93	15	5.95	44	17.46	252
Total	32	2.37	25	1.85	54	4.01	169	12.55	163	12.10	226	16.79	1346

Table 2 shows the total length of the items about science and technology, and the percentage it represents over the total air-time. Percentages are significantly higher than those of number of items. In the overall account for all the countries, 5.71 per cent of time was about science and technology, whereas only 2.37 of the items where about this topic. This shows that science items are usually longer than the average for all the topics. In this case, differences among countries are more significant, since percentages range from 15.45 (UK) to 5.35 (Spain).

Table 2 Air-time (seconds)

	Science and technology	%	Total Air-time
France	972	6.20	15667
Germany	327	9.88	3309
Spain	936	5.35	17477
United Kingdom	498	15.24	3267
Italy	0	0.00	8138
Total	2733	5.71	47858

The average length of news items about science and technology (table 3) varies significantly from one country to another. The longest items are found in the United Kingdom, where the average is 124 seconds. The country with the shortest length in average is Germany (62 seconds). In the general account for the five countries, science topics have an average length of 85.4 seconds.

Table 3 Average length of science and technology items (seconds)

France	81
Germany	62
Spain	93.6
United Kingdom	124
Italy	0
Average	85.4

Qualitative analysis. The case of Smart-1

Smart-1, the first Europe's mission to the Moon, launched successfully from Guiana Space Centre, on September 27th, 2003**,** was the subject of 10 news items during the sample week, out of a total of 32 on science and technology. The total time for this topic was 13'52", which makes an average of 1'23" per item. It was broadcast in Spain (TVE1 and Telecinco), France (FR2 and TF1), United Kingdom (BBC1) , and Germany (ARD). The length of each news item ranges from 2'40'' (BBC1) to 14'' (FR2). Some of the channels covered the topic in several days, whereas others did it just once: FR2, 3 times; TVE1 and BBC1, 2 times; Telecinco, TF1 and ARD, 1 time. The type of coverage varies greatly from one channel to the others, although there is a coincidence in the fundamental elements of the topic.

The way the channels covered this event varies significantly. In some cases, only very basic data were included, whereas in others there was some explanation of the scientific meaning of the mission. The level of depth in the treatment is closely related to the length of each item. TF1's coverage of Sunday September 28th, lasts for only 15 seconds, which allow for just the very basic data; namely, that the mission was launched successfully on board of Arianne-5, which was considered to be "good news for the European space industry". No context information was provided. It adopted the format of as a brief piece read by the presenter, mostly covered with pictures of the launch of the space rocket.

On the opposite side, BBC1's item broadcast on the same day, was 3 minutes and 23 seconds long. It was reported by a journalist in the studio and included some graphics projected on a chroma-key screen, and an excerpt of interview to an expert. In this case, some context information was included. Firstly, it compared Smart-1 mission with UUSS mission which landed on the moon, 34 years earlier. Secondly, it explained what we could learn from the moon with this new mission: how the moon was formed and evolved. Thirdly, it went into some details about the possible existence of frozen water in the south pole of the moon, which would mean that it could be colonised sometime. Finally, it explained what the mission could mean for future space flights, since it will test a new type of engine, "based on an ion-driven propulsion system".

Discussion

The results of this study show that science and technology are marginal topics within European prime time television news. Although the percentage for air-time is higher than the percentage referred to the number of items, both figures show that science and technology are not covered as widely as other topics. This points to a risk that science can be under the minimum level of attention to match the interest of citizens on this topic. The length of science items, although above the average, seems insufficient to include enough contextual information, which is important for the viewer to make the necessary connection between the scientific topic presented and his/her personal experience. If this connection is not made, then the relevance of the topic will not be clear.

SCIENCE AND SOCIETY IN EUROPEAN TV DRAMA

Matteo Merzagora[1,2] and Andrew Millington[3]

[1]CNRS Images/media (now CNRS Images), 27 rue Paul Bert, F-94204 Ivry-sur-Seine CEDEX. Tel.: +33 (0)1 49604194, fax +33 (0)1 49604156, merzagora@ivry.cnrs.fr

[2]Innovations in the Communication of Science Group, SISSA, via Beirut 2.4, 34014 Italy. Tel.: +39-040-3787462 Fax:+39-040-3787528, E-mail: merzagora@libero.it

[3]OMNI Communications Ltd., Suite 37 Chancel House, Neasden Lane, London, NW10 2TU, United Kingdom. Fax: +44 (0)1865 820533, pawsomni@globalnet.co.uk

Abstract

Main results are presented of a research carried on by the EuroPAWS network within a EU funded project (ASSEND). The best TV drama, TV films series and serial involving science and technology were identified and presented in purposely organised festivals. Grants for the development of scripts involving science and technology were awarded. An action research activity involved in depth analysis of the scripts and TV Dramas, analysis of round table discussions and semi-structured interviews with writers, directors, producers and broadcasters.

Key words: public awareness of science, films and TV drama.

Text

Introduction: the drama channel of science communication

TV drama can be both a strategic point of observation for understanding public attitudes toward science and technology, and a strategic point of action to promote the dissemination of scientific culture. We can identify at least five elements supporting this claim.

1. TV dramas address a large and undifferentiated audience. It is unlikely that people will chose to watch a TV drama *because* of the science in it, but they could *appreciate* it for its scientific content: drama has great potential to reach an audience not already sensitised to scientific topics.
2. Science communication increasingly concerns conflicts, controversies, the impact of science on society, etc.: it cannot be confined to the contents of scientific research alone. Any drama deals with conflicts and emotions and is necessarily set in a social environment. Thus many elements that have to be attained with much effort in non-fiction science communication programmes are *intrinsic* in the language of fiction.
3. The valorisation of non-expert knowledge is an increasingly important aspect of the democratic process and is hardly taken into account in TV news, documentary and

reportage. It is on the contrary easily attainable in a drama, where the main characters are often people with whom the public can identify.

4. A better understanding of the points of view of successful TV authors (who needs to understand the public to please them with their work) and producers and broadcasters (who needs to understand the public to sell their work), can be extremely useful for understanding public awareness of science.
5. As public debate needs to take place in the social environment, it is important to understand how scientific content is moulded in the public mind after entering the social arena. Thus scientists must learn the principles of the social environment that will help them correctly to judge the impact of their work on public opinion. TV drama - where the scientific content will inevitably be immersed in a social context – can be helpful in understanding how that topic is perceived.

Methods

ASSEND, Associating science and technology in European TV Drama, was a 2 years project financed by the European Commission *Science and society* programme, ended in December 2003. It included several actions: organisation of festivals and round tables, grants for the development of scripts involving science and technology, award to the best recent TV drama. Details can be found on the EuroPAWS web site (http://www.europaws.org).
A full report describing the details of the research can be obtained from the authors of this paper. In synthesis, 63 scripts from 71 writers applying for a grant were analysed in details, and a subset of writers interviewed on the origin of their ideas and their relationships with the scientific community. An survey of TV drama produced in the period 1999-2003 was also performed,
9 and 11 films were selected for screening in Paris within the *Rencontres Internationales de l'Audiovisuel Scientifique Images et Science* in 2001 and 2003. These were analysed in details and writers, producers and broadcasters were interviewed to highlight the underlying motivations and choices leading to the productions.

New idea grants: results

The largest proportion of proposals came from the UK (48%), France (17%) and Italy (10%). Over one third of the writers were women. 50% came from the TV world, but a non-negligible 23% had their main professional activity in science. Proposals concerning engineering related stories were the larger group (24%), followed by medicine and biotechnology. 43% of the stories were set in the past, 34% in the present, and 23% in the future. It is interesting to underline how the vision of science strongly depends on the epochs in which the story is set. In historical biographies, the scientist is mostly seen as a positive hero fighting against a blind establishment for the benefit of humankind; in the future, science and technology is mostly seen as a threat: the scientist is often a well motivated person loosing control over his work; when stories are set in the present, science and technology is more frequently a tool for solving (forensic) or, conversely, determining practical problems (e.g. environmental catastrophes).
A short summary of the interviews with the authors cannot render the complexity of each of their point of view. We shall highlight here that a) the large majority do not consider the need to respect scientific details as a limit on their creativity, but rather as an enriching challenge; b) a general reluctance was found for those authors with no scientific background, in interacting with the scientific community, although considering it as a potential to nurture their creativity.

Science and TV Drama Festivals: results

20 dramas with a strong scientific plot were analysed, following a 2 years long survey and selection. Plots, general data and analysis of the films are detailed on the EuroPAWS web site. Four main approaches can be identified: historical reconstruction, perspective scenarios, ethical issues, forensic.

It is worth mentioning the two films awarded with a MIDAS prize. *Les enfants du miracle* (France 2) narrates the story of the first in-vitro fertilisation in France. The author choosed to carefully respect the scientific content, while being completely free in inventing the personal life of the characters. *Virus au paradis* (France 2) astonishingly anticipated the SARS and avian flew emergencies, by presenting an epidemic spread by migratory birds and the risk management actions to stop it. This film demonstrated the potential of TV drama of covering or anticipating the news.

All professionals interviewed recognised the need for very careful documentation as a key for successful productions.

COMMUNICATING CONCERN VIA TV; OUR VIEW OF NATURE

Jeffery N. Thomas

Science Faculty, The Open University, United Kingdom. Tel.: +44 (0) 1908 654613
Fax: +44 (0) 1908 654619, j.n.thomas@open.ac.uk

Abstract

The Attenborough series *Life of Mammals* forms the basis of an Open University UK course, designed to bring students without a significant science background into university-level education. The TV programmes were found to motivate and engage students, but there is no evidence that they help dislodge deep-seated and persistent beliefs in evolution as progressive and directional.

Key words: TV, teleology, Attenborough.

Text

The communication of science on TV in the UK –and especially of natural history– is extensive and generally of high quality. The BBC TV programmes created by Sir David Attenborough have iconic status, combining elaborate technical ingenuity and passionate concern for global wild-life and for the importance of conservation.

The popularity of the *Life of Mammals* TV series prompted The Open University UK to use the programmes as the core of an introductory science 'short course' –*Studying Mammals*– studied to date by more than 1500 students in the UK and mainland Europe. The course includes specially written 'distance learning' material, supporting and developing a range of BBC resources, in particular a DVD containing all 10 *Life of Mammals* TV programmes and a BBC book that accompanies the series, written for a generalist audience. Those who study the course usually have a modest pre-existing level of science understanding, but their motivation and eagerness to learn is generally high, as reflected in their preparedness to commit to about 100 hours of part-time study, over several months. Students study with the help of a study adviser, who provides telephone support, and many of them participate in computer-based conferences that substitute for the face-to-face contact experienced by more conventional university students. Students submit one item of assessment, which tests both their level of comprehension of the

material and ability to assemble and communicate information from the different course components. The resulting (10 point) qualification can contribute to a more broadly-based Open University degree, such as B.Sc. Natural Sciences.

The striking images that comprise a key part of the TV programmes form the basis of many Student Activities in the OU course; students watch particular TV sequences and search for underlying biological explanations. Students generally find such sequences – ranging from shots of the breeding nests of the duck-billed platypus, to big cats chasing antelopes, to the striking sight of a baboon devouring a flamingo– informative and memorable. More than 90% of our student sample identified TV sequences as 'giving fresh insight into the life of mammals'. The educational value of such images is therefore significant Nevertheless, these same visual images have been the focus of concern for a number of critics of Attenborough-style TV. Programmes such as *Life of Mammals* have been criticised for elevating dramatic TV footage –especially of hunting and killing– to the status of 'central, dominating motifs, as sensational and distorting portrayals of life in the wild as scenes of human violence are in the tabloids' (Mabey, 2003). Charismatic megafauna –notably lions, tigers, cheetahs– feature strongly in the *Life of Mammals* and indeed the section of the OU course that focused on 'meat-eaters' was classified by students as being the most 'interesting and rewarding' of all. Mabey and other critics argue that such perceptions distort the viewing public's perception of the reality of nature, prompting a 'disengagement from nature' and the objectification of our close mammalian relatives.

Attenborough-style programmes are also criticised for their 'Voice of God' approach. Aldridge and Dingwall (2003) argue that the entire basis of such programmes is to 'demonstrate that nature is wonderful', with the implication that such wonders have been 'planned' by a higher authority. Indeed, the commentary *of Life of Mammals* contains a sprinkling of loose and teleological statements, risking an implication that evolutionary change is progressive and goal-oriented. Such lapses are likely to unintentionally compound the widely reported difficulty that those who learn about evolution have with understanding the nature of adaptive change via natural selection (Thomas, 2002).

A key issue therefore is the extent to which such TV programmes form a sound basis for learning about biology. Survey data from OU students (200 questionnaire returns, 50% response rate) suggests that the TV element was highly regarded. 88% of respondents felt that these course components were 'very effective' in developing their understanding of the subject. The course assessment tests students' ability to critically analyse text and TV material; pass rates on the course are high (>95%) and the assignment mean score over successive presentations have averaged 75%. No students report that the programmes increases their sense of detachment from nature and the most common response is that the TV programmes provide a vivid and memorable close-up view of mammals in their natural habitat. Of greater concern is the observation that many students are inclined to express their ideas relating to mammalian evolution in teleological terms; questions that required students to spot teleological statements are answered significantly less well than the average. In feedback comments, very few students pick up teleological sentiments expressed in the commentary of the TV programmes and in their free-writing, a significant fraction of examinees express their ideas on mammalian evolution in terms of purpose or direction.

On this preliminary evidence, such TV programmes help to motivate students and illuminate a variety of key behavioural traits in mammals. However, these programmes do

not eradicate pre-existing perceptions of evolutionary change as being progressive and directional. Indeed it is possible, as argued by Aldridge and Dingwall (2003), that such programmes may inadvertently re-inforce such beliefs.

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WHERE HAS SCIENCE GONE? THE MEDIAZATION OF SCIENCE ON TELEVISION BETWEEN 1961 AND 2000

Piet Verhoeven

Amsterdam School of Communication Research (ASCoR).Universiteit van Amsterdam, department of communication science, Kloveniersburgwal 48, 1012 CX Amsterdam, The Netherlands. Tel.: +31 20 5253130, P.Verhoeven@uva.nl

Abstract

In this paper the first results will be presented of a content analysis of medical television shows on Dutch tv between 1961 and 2000. The main question of the study has been whether or not the use of scientific information in the media has changed from 1961 onwards. This question is posed to the background of processes of scientification and mediazation of culture. From the analysis of the speaking time of experts, journalist and lay people in medical tv shows the conclusion is drawn that three different periods of medical television can be distinguished: a scientific, journalisic and lay period.

Key words: Scientific knowledge, mediazation, medicine.

Text

Context

In the ongoing modernisation of society two developments could be identified: scientification of culture on the one hand (Hagendijk, 1996) and mediazation of culture (Thompson, 1995; Altheide & Snow, 1991) on the other hand. In relation to science and media the question can be asked how those two developments relate to the representation of science in the media. Is there, for example, a scientification of media content or a mediazation of science in the media? Or does that vary over time? In order to start answering questions like these, an explorative longitudinal study of media content has been conducted, asking the question whether or not the use of scientific information on Dutch television has changed in the period 1961-2000. In this study medical television shows hava been taken as examplary for science on tv (Durant, 1992). The theory of "extended mediazation" (Thompson, 1995) has been taken a step further by defining mediazation as a journalistic order in which references and narratives of journalism and lay people are dominant over references and narratives of scientists and professionals. Leading to the hypothesis that a mediazation of medical science on tv has taken place between 1961 and 2000.

Methods

In this research content analysis, of a stratified sample of non-fiction Dutch medical television shows between 1961 and 2000, has been conducted. The content has been analysed on the level of the TV show as a whole and on the level of the statements per actor within the show. More then thirty variabeles were used, concerning classical news factors on the one hand and references to science and other sources on the other hand. In total 77 medical shows were analysed from 7 different medical non-fiction series, leading to 7242 statements.

Results

One of the main indicators of a changing content of medical television is the amount of speaking time several actors are given in medical television shows. The frequency and the length of statements of three different groups of people were registered: experts, journalists and lay people. The categorie of experts consists of scientists, doctors and other medical professionals and the category of lay people consists of patients, family and amongst others members of the general public. As Figure 1 shows the distribution of the average speaking time between the three catogories of actors has changed considerable between 1976 and 2000.[1] In the seventies experts were the dominant actors in medical television shows, together with lay people. At the end of the nineties these positions have reversed: lay people are now the dominant actors in medical tv shows, with experts in third position and journalists in the middle. In the eighties this new division of speaking time between the three categories started to emerge and stabilised in the nineties. After 1982 no person appeared in the tv shows anymore in the role of scientist.

Conclusions

On the basis of this empirical research of the development of the average length of the speaking time of different groups of actors, can be concluded that three different periods of medical television can be distinguished in the Netherlands. The first period, before 1976, could be labeled as the scientific period, followed by a journalistic period between 1981 en 1988. This journalistic period seems to be a transitionperiod towards the third period, which could be labeled as a lay-period. These results can be an indication of a changed "factuality regime" (Hagendijk, 1996) from science, through journalism, to a lay frame of reference in medical television. This leads to the provisional conclusion that the mediazation of medical of science on tv indeed has emerged. This is a provisional conclusion; mediazation also depends on the content of the statements of the several actor in medical tv shows. The second part of this research will therefore be focussed on what the different actors are saying on medical television between 1961 and 2000.

Notes

[1] To conduct an analysis of the speaking time of the actors between 1961 and 2000 was not possible, due to the availability of the data. Medical television shows were only recorded and archived in full length from 1976 onwards.

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Parallel session 16

Are Internet expectations being accomplished?

OBSERVATORY OF WOMAN AND HEALTH

L. Fernández,[1] E. Hernández [2] and A.J. L. Jovell
(Director of Observatory of Woman and Health)

[1] Observatory of Woman and Health (OBSYM). Josep Laporte Library Foundation (JLLF).
Sant Antoni Maria Claret, 171. 08041 Barcelona. Tel.: +34 93 433 50 77, fax: + 34 93 433 50 36,
Laura.fernandez@fbjoseplaporte.org

[2] OBSYM. JLLF. Sant Antoni Maria Claret, 171. 08041 Barcelona.
Tel.: +34 93 433 50 77, fax: + 34 93 433 50 36, eulalia.hernandez@fbjoseplaporte.org

[3] OBSYM. JLLF. Sant Antoni Maria Claret, 171. 08041 Barcelona.
Tel.: +34 93 433 50 77, fax: + 34 93 433 50 36, direccio@fbjoseplaporte.org

Abstract

Observatory of Woman & Health started out as an innovative Internet health project in Spain with the purpose of serving an audience interested in receiving quality information and gaining access to reliable information resources, creating a virtual community that uses the site as an information and knowledge platform. The site is an interactive tool. OBSYM came about as a response to the growing need for quality health information requested by citizens and especially women for the different health needs of this community as well as for being the main family health "managers" in our society.

Key words: Woman's health research, associations, quality health information.

Text

OBSYM is a project that was developed by Josep Laporte Library Foundation (JLLF) under an independent sponsorship of Merck Sharp & Dohme (MSD) to collect, produce, edit, disseminate, and publish information regarding health and women, creating in turn a platform for information exchange and the promotion of activities of national and international women and patient associations in the health field.

OBSYM came about as a response to the growing need for quality health information requested by women, for being the main family health "managers" in our society. Also, it pretends to modify gender asymmetries in the provision and development of health care studies.[1] OBSYM has the specific objectives:[2]

- To provide and offer the necessary information and training to promote a process of rational and high quality decision-making in health providers and health users based on knowledge.
- To promote the creation, collection, selection, synthesis, integration, transfer and publishing of information and knowledge in the field of woman and health. That includes the implementation of a website, a traditional physical library, training activities, research, and an electronic journal.
- To respond and attend current and future information and knowledge needs of health providers, teachers, students and consumers by way of specific documentation strategies that incorporate information and communication technologies in the field of woman and health.

Contents

OBSYM has been configured in six major content sections (Figure 1), so in a near future the project will grow without site structure modifications:[3]
Society (adding information about social perspective), health (including information related to specific health topics), and social community (promoting the relation between Spanish women associations).

Figure 1 Homepage of OBSYM

Services

- Health and Social Updated news.
- Documents Database.
- Electronic Journal of Woman and Health.
- Traditional Library: journals titles in woman and health.
- Health and Woman Research.
- OBSYM Meetings in woman and health topics.
- Health Offline training activities.

Certified Quality

To obtain maximum rigour in the search and inclusion of content, OBSYM has benefited from the participation of a multidisciplinary Scientific Committee, integrated with relevant personalities in Spain health scope, hospitals, research institutes and health organisms addressed to patients, which has implied the acquisition of some inclusion criteria for the website content.

In turn, the OBSYM has received the certifying seals of Health on the Net and the Certified Medical Web Site Seal of the Medical Association of Barcelona for following the quality principles of both certifications.

Finally the Project Website has a resource selection policy, to improve the quality of documents and e-resources adds to the database.

Results

1) *Web*

   OBSYM has actually a huge success with 4 millions of hits in 18 months. With the visit of 66.000 users and 108.000 visitor sessions. Users has been downloaded 60.000 files. Finally the number of subscriptions to EJWH has been 3.235.

2) *Research*

   OBSYM has the aim to promote the creation, collection, selection, synthesis, integration, transfer and publishing of health and life science knowledge with a specific research in health scope. Actually the Observatory has finished studies in topics like:[2] information needs of woman in Spain, priorities in public health, woman associations in Spain, mass media and gender, scientific evidence in the clinical management of fibromyalgia, analysis of scientific production in women's health, inequalities in gender and health care in Spain, osteoporosis, stroke, gender perspective in national Health Survey, health of physicians woman.

3) *Electronic Journal of Woman and Health*

   EJWH (Figure 2) includes the last information about the Portal and interested news to the user. It has an attractive appearance and design. All contents specific to a main topic in each issue.[1] Actually, EJWH has eleven issues edited in Spanish and three in English.

Figure 2 Electronic Journal of Woman and Health

Conclusion

OBSYM might turn, not only in an interactive tool that offers quality contents, but also into a platform that allows virtual communication between its users and associations and develop a structure which promote research in woman and health. The implementation of learning and research activities increase the quality and originality of the project. Public and private partnerships are needed to implement this kind of projects under social responsibility corporate policies.

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CONTENT AND LINK NETWORK ANALYSIS OF FIVE SCIENCE COMMUNICATION WEBSITES IN LATIN AMERICA

Fabio Castro Gouveia[1] *and Eleonora Kurtenbach*[2]

[1]Museu da Vida, Fundação Oswaldo Cruz, Brazil. Av. Brasil, 4365, 21045-900 Rio de Janeiro, RJ, Brazil.
Tel.: +55 21 3865 2103, fax: +55 21 3865 2121, fgouveia@coc.fiocruz.br

[2]Departamento de Bioquímica Médica, ICB–UFRJ, Brazil. Universidade Federal do Rio de Janeiro, Departamento de Bioquímica Médica/ICB/CCS, 21941-590 - Cidade Universitária, RJ, Brazil.
Tel.: +55 21 2562 6753, fax: +55 21 2270 8647, kurten@bioqmed.ufrj.br

Abstract

One of today's most famous search engine (Google®) is primarily based on the PageRank® methodology described by Brin and Page (1998). As part of this methodology of indexing pages there are some features that could be of great help for those looking to evaluate the impact of a website over the Internet. The links pointing to a particular URL (link network) can be obtained with a simple query search. Here we present an analysis of the link network of five Latin American science communication websites, exploring the applications of this methodology and what to remind of during this evaluation.

Key words: Internet, Link Network, Search Engine.

Text

Introduction

One of the first things we teach to a new Internet user is how to search and find specific information. It is known that over 85% of Internet traffic is driven directly or indirectly by search sites. Each one of these sites uses a methodology of indexation, and we can divide them into two categories: directories and search engines (Hu *et al.*, 2001).

Search engines create their database automatically using "spider" programs. The resulting database is then indexed using an algorithm to sort the search results. After the publication of Page & Brin (1998), their search engine (Google) has become the most used worldwide.

Google uses an algorithm called PageRank in order to sort its results. It is based on the fact that the more one site is referenced by other sites, the greater its relative relevance. This algorithm greatly improved the accuracy of search results.

Method

The database that Google has can be accessed using special search tags. One of them is the "link:" tag that shows the list of pages in the database that point to a particular web address (link network). To obtain that the steps should be as follows:

- Open a Google session.
- Set the preferences of *number of results* to the maximum (100).
- Do the search using the tag *link*: + the desired URL.
- Save each of the pages.
- Consolidate the pages in one document.

In general the links pointing to a particular website can be placed in one or more of the categories listed in table 1.

We selected five websites of institutions involved in science communication in Latin America to perform a link network analysis. They were arbitrarily chosen as examples for

Table 1 Types o links pointing to a website

Type of Link	Comment
Links from the same site or from the same institution	Structural – to be discarded from the evaluation
Links from institutions, associations or networks	Relation to other institutions on the web
Links from news or from events hold or supported	Ability to communicate new activities over the web
Links from visitors or groups that enjoy the content of the site	Result from the strategy of the website
Links from directories and link lists	Increase visibility and access
Links from documents or references	Documents on the web or personal pages

this study. Briefly the results obtained are listed in the next session. They will be better explored during the open plenary with other general information.

Results

- Fundación CIENTEC, in Costa Rica, had a list of 98 links from which 40 were from the same site. Besides that it had a good list of institutions linking to the website and some from special events (http://www.cientec.or.cr/).
- Maloka, a Science Centre in Colombia, had a total of 100 links of which 70% were from list of links or directories. The website is very well indexed and have links from visitors which is very important for a science centre website (http://www.maloka.org).
- Papalote, a children museum in Mexico, presented a similar amount of links (92) and a similar link network result from Maloka (http://www.papalote.org.mx/).
- Programa Explora, a science popularisation program in Chile, had a total of 101 links, but half of them were from the same site or institution. The rest of them were from events and directories (http://www.explora.cl/).
- RedPOP (Science Popularisation Network from Latin America and the Caribbean) from UNESCO had the modest link network of all five sites. With only twenty links from which ten had to be discarded, the rest were from directories and supported events. For a website of a network that recently promoted a congress and have several institutions this can be considered a really modest result http://www.redpop.org/).

Conclusions

We conducted the present study with five arbitrarily selected websites as examples for a link network analysis. We could observe that some of these sites were not referenced by their potential community while others have a good link network.

For Latin America standards, a list of about 100 to 200 links for a site dealing with science communication is quite common. Different languages represent different communities, and nearly the same happens about different countries. Contents in English are more capable of producing a greater network, since they are the majority of pages on-line. Search Engines can't index all the pages on the Web, so the link network obtained is a subset of the real link network on the Internet.

We think that link network retrieval should be part of the routine evaluation of a website.

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THE INTERACTION COLLABORATION. THE ROLE OF THE WORLD WIDE WEB IN GLOBAL PHYSICS COMMUNICATION

Judith G. Jackson

Office of Public Affairs, Fermi National Accelerator Laboratory, Batavia, Illinois 60540 USA.
Tel.: +630 840 4112, fax: +630 840 8780, jjackson@fnal.gov

Abstract

The science of particle physics requires international collaboration, because of the scale and cost of particle accelerators and experiments. Global collaboration promotes cooperation and understanding among scientists from all parts of the world. Recent world events have strained the traditional collaborative relationships of international particle physics. Particularly in the United States, issues of visas, access to national laboratories, and travel restrictions create barriers to scientific collaboration. The InterAction Collaboration of particle physics communicators was founded as a countervailing force to these strains on the international particle physics community. Its Web site, www.interactions.org, is critical to the collaboration's effectiveness.

Key words: Collaborative physics communication.

Text

Context: A Global Science

The science of particle physics today is a worldwide collaborative endeavor. The scale of the particle accelerators and detectors required for research in this field dictates a degree of international cooperation that is perhaps greater than in any other field of research. Experiments at a handful of high-energy particle accelerator laboratories in Europe, Asia and the United States bring together men and women of science from nearly every country of the globe to carry out research on the fundamental nature of matter, energy, space and time. Born of necessity, these collaborations offer an inspiring model for the free exchange of scientific information. Moreover, the discoveries of the future will require still greater cooperation among laboratories, among nations and across the fields of physics.

At the same time, recent world events have begun to strain the traditional collaborative relationships of international physics. Issues of visas, travel restrictions and access to national laboratories by foreign nationals have created barriers to international collaboration and raised doubts about the feasibility of future large-scale international projects.

Objective: A New Model of Physics Communication

In the field of particle physics, most communication resources are concentrated at the large national or international laboratories. The laboratories have the missions, the dedicated budgets and the professional expertise required for sustained communication

with key audiences. Traditionally, each laboratory and communicated independently of the others, with little coordination and frequently at cross purposes.
The InterAction collaboration was founded in 2001 (Jackson, 2003) by particle physics communicators from six particle physics laboratories in Europe and the United States in order to create a new model of physics communication. The founding members defined the collaboration's mission as "Not only to support the international science of particle physics but to set visible footprints for peaceful collaboration across all borders." At their initial meeting in Hamburg, the members decided to develop a new, collaborative method of global particle physics communication that would be better suited to the global nature of the field. The members developed strategies to strengthen collaboration among laboratory communicators in order to share resources, speak with a common voice and communicate a common science message.

Methods: Common Web site, News Wire

The InterAction collaborators moved forward on several projects. Key among them were the development of a common Web site for particle physics communication and a news wire for the timely distribution of particle physics news.
The Web site, www.Interactions.org, would be designed to serve as a central resource for communicators of particle physics: science journalists, educators, policy makers and opinion leaders, and physicists themselves. The site would be updated daily with news, information, images and links from the world of particle physics. It would provide links to current particle physics news from the world's press; high-resolution photos and graphics from the particle physics laboratories of the world; links to education and outreach programs; information about science policy and funding; links to universities; a glossary; and a conference calendar. It would offer "work space" to groups within particle physics who were preparing reports or studies and needed a common work area for drafts, images, schedules and bulletin boards. It would have a dedicated webmaster with daily responsibility for updating the site.
The News Wire would offer free subscriptions to an electronic news service. Subscribers would receive particle physics news from the world's universities, laboratories, government agencies and others. The first news wire, a press release from CERN, the European Organization for Nuclear Physics Research, on a development in Grid technology, went out to a small number of subscribers on September 17, 2002.

Results

In the two years since its founding, the InterAction Collaboration has created a global electronic News Wire http://www.interactions.org/cms/?pid=1000379 for particle physics news, with over 1,000 subscribers, including most of the world's physics press, from 51 countries. It has issued more than 160 news wires on subjects from dark matter to neutrinos.
In August 2002, the collaboration launched the Interactions.org Web site www.interactions.org. A dedicated Web master monitors physics news from the world's press, maintains an image bank http://www.interactions.org/imagebank/index.html with high-resolution photographs from the world's particle physics laboratories, and continually develops the site to meet changing communication needs.. A Google search for "particle physics news" returns the Interactions Web site as its first entry. Praise from journalists, policy makers and physicists indicates that it reaches those it is designed to serve. Six physics working groups use the Interactions work space for their projects.

Conclusions

The InterAction collaboration began with six member laboratories. It now includes 22 members from laboratories, professional organizations and funding agencies from 10 countries in Asia, Europe and the U.S. Every member contributes to and uses the services of the electronic news wire and the Web site. The collaborators carry out many other joint communication initiatives. Other scientific communities have asked the collaboration's help in developing similar collaborations and Web sites. The Web site has been critical to success in creating a fundamental change in the model of communication in this field of science.

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SCIENCE, SOCIETY AND INTERNET IN POLAND. WHAT ARE DOING POLISH SCIENCE INSTITUTIONS FOR INTERNET SCIENCE COMMUNICATION WITH THE DIFFERENT GROUPS OF THE PUBLIC?

Magorzata Jaskowska

Department of Information Science and Librarianship. Jagiellonian University, Gronostajowa 7, 30-387 Krakow, Poland. Tel.: +48 12 644 67 04, fax: +48 12 644 69 08, E-mail: jaskowska@bilon.miks.uj.edu.pl

Abstract

WWW services of scientific institutions have become a communication platform with different groups of audiences. The each of them: scientists, students, science journalists, government, industry, teachers and wide public have their own reasons to look for information and dialog. It is the question if the services may be joined with the different needs of the different groups?

The content analysis of Websites services of all public scientific institutions in Poland: universities, Polish Academy of Science and R&D institutions were the main method used in the research.

The results may show, the most important group of audiences of the universities' WWW services are: students and scientists, of PAS: scientists and industrial organizations and of R&D institutions - industrial organizations mainly. There is little information straight addressed to the wide public, no information for teachers, science journalists. The results may also show, inside the services there are too little activities for *public understanding of science and technology*.

Key words: Scientific Institutions, Public, WWW Services, Poland.

Text

Introduction

It is a fact that, both the Internet that is generally accessible for senders and receivers of scientific communication and the technology development raising the quality of World Wide Web services, caused that the dialogue of the science and the society in the Polish digital environment has no more the testing capacity. The age of the thoughtfulness of the services quality and making them the platform of communication for any group of users that belong to scientific institutions environment, begins.

In Poland there are three types of public and research institutions that are bound by particular ministries, such as the higher education institutions [U] conducting educational

and research activities (103 institutions and 100% has the WWW service), the institutions of Polish Academy of Science [PAS] conducting scientific activity (87 institutions and 98% has WWW services) and the Research and Development institutions [R&D] centred on research activity and the practical use of results of the researches (236 institutions and 72% with the WWW services).

The analysis

The aim of the analysis is to receive the answer if the scientific institutions communicate with all groups of users using the WWW services. The types of users are scientists and students; institutional and individual customers of the products and services, including the knowledge based enterprises; science journalists; people interested in science that are teachers, young people and children; wide public for whom the results of research could be useful for everyday life and the foreigners.

The questions asked in the analysis were:

Q.1. What groups of customers are distinguished in the WWW services and which are preferred? What are the differences in communication between scientific institutions, educational and scientific ones and between scientific research institutions and the public ones?

Q.2. What type of information that is the results of scientific research is addressed to each group of users?

Q.3. Is the communication bilateral or is the unilateral? What are the forms of communication used in Websites services?

Methodology

The content analysis of Websites services for all public scientific institutions with the use of questionnaire was the main method of gathering the data in research. The content analysis had been also used in similar research before [see References]. The websites representing the whole entity such as the home pages of general institutions and the interdisciplinary departments web sites were analysed in services, but without the WWW pages of faculties, institutes, chairs and departments. The author carried the research personally between October and December 2003. Generally the 1893 web pages were analysed. The questionnaire contained the users with the type of information addressed to them and the forms of electronic communication with the representatives of particular groups. The analysis of the data was carried using the statistic method.

Results

Q.1.

The priority group of users in the WWW services of analysed scientific institutions are [see Chart 1] scientists and students: 83% of all services have the information presented on the libraries and the scientific publishers websites and addressed to that group. Then 32% of services present information dedicated to products and services customers. 28% of information is addressed to people interested in science, 12% to wide public, 11% to foreigners and 2% to science journalists.

The higher education institutions address information in following proportions: 92% to scientists and students, 33% to teachers and young people, 13% to foreigners, then 5% to customers, 3% to wide public and 2% to journalists.

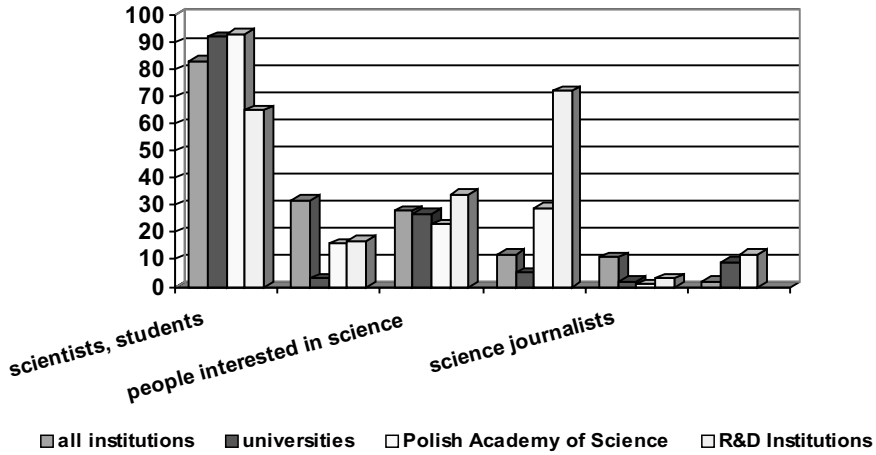

Figure 1 Representation of information in WWW services addressed to different groups of users in different types of institutions the data are in percentages (%)

The institutions of Polish Academy of Science recognised as their priority groups the scientists (93%), customers (29%), young people interested in science (23%), wide public (16%), foreigners (9%) and science journalists (1%).
The Research and Development Institutions recognised as the main and most important groups of users their customers (74%), scientific environment (65%), people interested in science (34%), wide public (17%), foreigners (12%) and science journalists (3%).

Q.2.
The analysis showed that the following types of information are addressed to particular groups of audience:

- Academic environment (academic staff, scientists, students): information about research (89%-R&D institutions, 87%-Polish Academy of Science, 71%-universities); bibliographic information about research record (79%-PAS, 65%-U, 62%-R&D institutions); special scientific bibliographies; library online catalogues (91%-U, 45%-R&D, 39%-PAN); information about scientific events (25%-PAS, 12%-U, 11%-R&D); electronic publications, factographic databases (19%-PAS, 16%-R&D, 12%-U); scientific services for selected knowledge domains or issues (15%-U, 6%-PAS, 5%-R&D); scientific publishers catalogues (92%-U, 73%-PAS, 67%-R&D).
- Institutional and individual customers of the products and services such as catalogues of products (77%-R&D, 5%-PAS, 0%-U) and the services offer (54%-R&D, 29%-PAS, 5%-U).
- Wide public: the service for scientific findings (5%-U, 4%-PAS, 2%-R&D); popular services for scientific methods for study the world, such as astronomy service (11%-PAS, 9%-R&D, 1%-U); information service for selected issue, e.g. environmental protection or health protection's services (34%-R&D, 33%-U, 23%-PAS); databases (16%-R&D,11%-PAS,9%-U); information service for public use, e.g. meteorology's service, maps of forests fire danger (17%-R&D, 16%-PAS, 3%-U).
- Science journalists: press room (3%-R&D, 2%-PAS, 1%-U);
- Foreigners: the co-operation offer or the utilization of the research results offer-using products and services is presented in English (13%-U, 12%-R&D, 9%-PAS).

Q.3.
Presentation of information is the beginning, encouragement, and the attempt to interest the user the selected issue, curious because of the young people or hobbyists interests. However, the real co-operation begins when the invitation to discussion is received, when the information is exchanged or if there is a willingness of the experts employed in scientific institutions to answer the question and when the young people are engaged in participating in projects popularising science and knowledge. The following groups are invited to dialog via different forms:

- Academic environment: e-mail (8%-PAS, 7%-U, 4%-R&D); discussion lists (3%-PAS, 2%-U, 1%-R&D); the invitation to participation in discussions for academic staff and/ or students (4%-U).
- Products and services customers: e-mail (33%-R&D, 29%-PAS, 5%-U); FAQ (13%-R&D, 2%-PAS, 1%-U); newsletter (6%-R&D, 4%-PAS).
- Wide public: e-mail (5%-R&D, 4%-PAS, 2%-U); discussion lists (2%-R&D, 1%-U, 1%-PAS); FAQ (3%-R&D, 2%-PAS, 1%-U); science knowledge competitions for young people (3%-PAS, 3%-R&D, 2%-U); newsletter (1%-PAS).
- Science journalists: press room (3%-R&D, 2%-U, 1%-PAS).
- Foreigners: e-mail (12%-U, 12%-R&D, 9%-PAS).

Conclusions

- The access to scientific information for academic environment is accommodated satisfactorily thanks to professional libraries activities (especially the higher education institutions libraries stand out among all higher institutions).
- Institutions, that are concentrated on research and development activities address information particularly to potential users.
- Science journalists, even the intermediaries in scientific knowledge communication to wider users environment, they are unfortunately nearly omitted in WWW services.
- The appearance of the websites in English and the information addressed to foreigners indicates that the educational and scientific co-operation with other countries is revealing now.
- The wide public such as young people, teachers, hobbyists, people interested in science are more and more often visible in the services as the very important group of users. Statistically the few number of services addresses the information to such groups, but the large and supple institutions that boasts the scientific achievements employing the scientific authorities serve them setting the examples. Mainly, the astronomy and the physic are the issues of the services.
- More and more often the information useful in everyday life, following the research, reliable, appears in WWW services. The only source of such information is scientific institutions. The environmental protection and the health protection are the mainly issues of the services.
- Generally the Polish scientific institutions' websites use the interactivity of the Internet to a little degree. The dialogue is carried using the e-mail as the simplest form.

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WHEN SCIENCE GOES PUBLIC ON THE WEB: AN ANALYSIS OF THE ONLINE PR STRATEGIES OF GERMAN UNIVERSITIES AND RESEARCH ORGANIZATIONS

Utz Lederbogen

University of Osnabrueck, Head of Press and Public Relations Office, Neuer Graben / Schloss, 49069 Osnabrueck, Germany. Tel. +49 541 969 4370, Fax +49 541 969 4570. Utz.Lederbogen@uni-osnabrueck.de

Abstract

The surge of interactive media and the Internet has posed particular challenges to universities and research organizations in Germany. The virtual space of online communication has given them access to an entirely new form of publicity, enabling them to make use of a communication forum received worldwide, with its own structure, topics, means of communication, and interests. But are German universities and research organizations prepared for these challenges? Which public relations strategies have they developed, and do their offers on the Internet meet the demands of target groups? What kinds of opportunities does multimedia communication provide for enhancing the dialogue with the public? This paper introduces an integrative study that was undertaken at the Free University of Berlin. It consisted of several parts: a written investigation of suppliers of science information, two online surveys aimed at the users of science news and information, and, finally, a content analysis of the websites operated by German universities and research organizations. The research objectives formulated in each partial study were overlapped somewhat, which made it easier to relate the respective results to each other. We were, for instance, able to compare the deliberations of suppliers and users with the results of the content analysis. The studies' overall objective is to do the groundwork for the development of popular science communication on the Internet by means of analyzing empirical data, which will in turn provide a basis for practical, relevant concepts.

Key words: Internet, Science Communication, Public Relations, University, Research Organization.

Text

Introduction

A society that considers knowledge and science its most important fundamental resources needs new ways for producers and consumers to exchange knowledge. Here, the Internet is on the way to becoming one of the most important communications tools. Almost all German universities and a large number of research organizations have their own Internet sites. The flexibility of the Internet and the many ways of combining its technologies has led to many different types of use. These institutions do not simply use their websites to provide information about their spectrum of services and achievements. Social dialogue is being sought on an increasingly frequent basis. This has not been completely voluntary,

for currently in Germany, discussions concerning academia and the public are marked by worry about the loss of trust in academia, its lack of legitimation and acceptance in society, and, last but not least, continuous financial woes.
This study analyzes the Internet PR activities of German universities and non-university research organizations. It also suggests strategies for an integrated online PR concept. The investigation deals with a series of issues in research, which will be briefly examined here.[1]

Results

Research question one

Universities and research organizations must communicate their operative and strategic goals in various arenas: in market communications, in competition with other academic organizations; in public relations in social and political fields; and in internal communications involving the organization's own members and committees. How is it possible to apply familiar PR theories to both the university and the academic organization, and to continue to develop online communications?
In developing PR theories, two significant influences are: 1) social and organizational theory, and 2) marketing theories for another. The strengths of the individual approaches are connected with serious weaknesses, however. Economic approaches to public relations largely disregard communications studies and issues. At the same time, communications studies and sociological theories ignore many economic and political organization factors. Universities and research organizations must communicate their operative and strategic goals in various arenas. Therefore, a more comprehensive theoretical approach is necessary here. *Zerfass* produced such an approach in 1996, with his "Grundlegung einer Theorie der Unternehmenskommunikation und Public Relations" [Establishing a Theory of Business Communications and Public Relations]. An action-oriented concept of public relations, Zerfass's approach bridges social theory, communications, and economics. Pragmatically speaking, internal communications, market communications, and public relations are distinguished by their divergent problems. While economic theory positions these three things in a hierarchical order, Zerfass's theory regards them as equal. Instead of being nothing more than a subordinate element in the marketing mix, public relations are an equal, supporting element of organizational communications.
Universities and research organizations must achieve recognition on national and international levels, develop their profiles, and specify goals. In this sense, they must conduct themselves as "businesses". They must communicate their operative and strategic goals in different arenas. For one, they have to pursue market communications in competition with other academic organizations. They also have to practice public relations in the social and political fields, and take care of internal communications for their own organization. Seen from these standpoints, business communications theory can also be applied to universities and research organizations. Public relations can only succeed in universities and research organizations if PR is included in the institution's overall concept. Online communications is an increasingly important fundamental element of an integrative overall concept.

Research question two

Scientists and scholars are called upon to inform the public about their work and to legitimize it in society by allowing the public to view it. This is not simply about gaining acceptance or polishing one's own public image for political purposes: it also involves the critical dialogue between academia and the public. How does academia communicate its

knowledge both in and outside of the scientific community? What role does science journalism play? How does the public perceive academic studies? What is the difference between science journalism and science PR? What kind of communications strategies, goals, and themes are used in PR at universities and research organizations outside of the university? What does the German PUSH program[2] contribute to the dialogue between academia and the public?
This research question addresses the perspectives of those disseminating scientific information, as well as those of its recipients. Five perspectives were selected for investigation, and the following results were achieved:

1. Communication in the Academic System. Scholars depend upon communication within the scientific community when they want an overview of the current state of research in their field of expertise, or when they want to comment upon or judge their colleagues' work. Many scholars are now accustomed to using the Internet as a source of data and literature, as well as a place to present their findings. At the same time, the Internet is used as an investigative tool for scholarly research purposes.
Scholars are now able to draw attention to their research and reach interested parties in their fields of expertise and disciplines much faster than before. They are also able to reach a broader audience. Moreover, it should not be underestimated how much the Internet, as a public tool, is able to attract the public's attention to academic studies. The scientific paper published on a university's or research institute's Internet page is, at the same time, "PR" for its scholars' work and for the institution. Many scholars are still unaware of this public platform.
Scholars primarily use the Internet for interpersonal communications, most often via the mode of communication known as e-mail. Other possibilities of communicating over the Internet (chatrooms, computer conferences, newsgroups, and discussion groups) play a less important role in the scientific discourse.
The greatest reservations toward publishing online have to do with the habits of the scientific community. Currently, arguments in favor of online publishing, which cite speed and cost effectiveness, still have an uphill battle against the reputation of the traditional forms of publication, as well as their academic and sociological functions.

2. Scientific Expertise. As an expert, the scholar's opinion is requested, whether the issue is the implementation of knowledge in decision-making processes, analyzing situations (judging risk), forming opinions, or developing solutions for problems. Citizens have a strong need to participate more in making decisions. Therefore, there must be more of an effort to include the public in the development, evaluation, and application of scientific knowledge – to enter into a dialogue with the public. Here, the Internet provides more chances for communication.
An organization, which in the meantime counts 460 universities and research institutes as members, is known as the *Informationsdienst Wissenschaft (idw; Scientific Information Service)*. This group helps print, television, and radio journalists research scholarly topics. One model that has been successful in conveying scientific, psychological, sociological, and medical knowledge from experts to citizens is the *Krebsinformationsdienst (KID; Cancer Information Service)* in Heidelberg. Their use of the World Wide Web to distribute information has allowed them to reach an audience that could not be attained through other media. Chatrooms, discussion groups, and e-mail can reach previously unheard-of numbers of new target groups, independent of place, time, and national boundaries.

This concept of transferring knowledge via user-focused dialogue also works for other academic themes. Successful examples are *ScienceLine* and *ScienceNet* in Great Britain. A small team of young scholars at the *Broadcasting Support Services (BSS)* operates this service. They research, make phone calls, and publish individual answers to questions on the Internet. Some of their sponsors include the large television channels, museums, the *Novartis Foundation,* and the *Wellcome Trust*. Currently, Germany is still lacking this kind of collective action on the part of its universities and research institutes.

3. Science and Media. In order to do their jobs successfully, journalists –especially science journalists– take on the role of mediator. On one hand, they act as conversation partners for scholars, and, on the other hand, as critical observers of academia. In the best case scenario, the journalists themselves have some education in the particular fields in which they work, yet they also have the ability to question scientific information and contexts and to represent them so that they are comprehensible and interesting to a broad public.

Many scholars see journalists in the role of "information mediator", treating public relations work and journalism as if they were the same thing. Very seldom does one hear of the critical, guiding functions of science journalism. Furthermore, the problems academia has in transmitting information and gaining public acceptance is explained away as a problem of science journalism: it is journalism that has trouble transmitting information and gaining public acceptance.

Criteria selected by journalists are criticized, especially reporters' permanent focus on the newsworthiness of topics. Apart from a small amount of information concerning audience numbers and attention span, little else is known about how useful and effective science journalism is for the public. There is a great need for more research here. Research question three deals with the user data retrieved from this integrative study.

In the meantime, a series of investigations proves that public relations determine the themes and timing of reports in the media. Public relations officers of universities and research institutes estimate this sector to make up sixty to 90% of all reporting. This makes it quite clear how very influential public relations are –since they determine which scientific themes and experts are ultimately represented in media– and how very dependent the mass media are upon the public relations work done by the universities and non-university research organizations examined here.

4. PR Management in Universities and Research Organizations. Press and public relations offices at universities and research organizations fulfill three functions: they are seismographs measuring the transference and mediation of changing states of affairs. They are also communicative mediators between academia and the public, and, last but not least, they represent the interests of their own institutions.

Whereas there have been several studies of universities' public relations work, there are no comparable studies providing information about the communications strategies, communications goals, relevant target groups, and topics covered by non-university research institutions. Since this type of information is an important requirement for any investigation of the online activities of universities and academic organizations, the information was derived from a preliminary empirical study. The most important conclusions, which apply to PR management at both universities and research organizations, are once again summarized here:

- At the universities, public relations work is almost entirely centralized, but at non-university research institutions, it tends to be decentralized. 97% of the universities and 70% of the research organizations examined here have a press office. The average number of press office employees at the universities is 1.7; at the research organizations, the average is 1.9. Almost one-third of the universities do not even have a full-time employee in the press office.
- Although 20% of the universities and 31% of the non-university research organizations have in the meantime developed a marketing concept, only 12% of the universities and 29% of the research organizations have a communications concept.
- Due to increasing competition and limited resources, the most important communications goal for universities and research institutions is to improve their profile and increase their recognition factor.
- Active PR work focused on the principles of improving profile, competition, and transparency must fulfill different functions. However, only 40% of the universities and 51% of the research organizations believe that the work involved in organizing the public dialogue is complete. Universities are mainly concerned with providing information about instruction, study programs, and research activities, while research organizations provide research information and facts. 72% of the research organizations believe that improving public understanding of science will be an important task for communications in the future.
- Media and potential students are particularly important target groups for university public relations; research organizations are interested in reaching a public made up of their peers in the scientific community.
- The wide variety of communications tools is remarkable. Universities and research organizations send out large quantities of press releases. Only the information available in the Internet is considered by the research organizations to be more important.
- Corporate design plays a larger role in the non-university research organizations than it does in the universities.
- Up until now, there has hardly been any kind of evaluation of the effectiveness of public relations work.
- The barriers to communication that exist between scientific and non-scientific cultures are also mentioned. If their press and public relations work is to succeed, universities and non-university research organizations must take these barriers into consideration.

5. Public Understanding of Science – The Scientific Community in Dialogue. A society that considers knowledge and science its most important fundamental resources needs new ways for producers and consumers to exchange knowledge. While the concepts of popularization, explanation, and mediation of science are based on the claim that they will allow the layperson a better understanding of science, continually growing segments of the public are no longer satisfied with the role of passive listener. Journalists, too –such as science journalists– who, for a long time, were solely occupied with gaining public acceptance for science, are no longer content to simply act as a conduit for scientific knowledge and claims. Critical dialogue is in demand.
In May 1999, after several years of discussion, top representatives of German academic groups from the *Stifterverband für die deutsche Wissenschaft* spearheaded a PUSH

organization. PUSH is an acronym for "Public Understanding of Sciences and Humanities." Initiators signed a memorandum calling for a stronger dialogue with the public. In the following years, the foundation announced the start of "PUSH – Academic and Social Dialogue" programs, which would each be funded with 250,000 euros. Soon, however, the dialogue metaphor came under critical fire. Were scientific organizations really interested in critical dialogue between the scientific community and the rest of society, or simply in gaining acceptance – mere image polishing? If not, then support would not just be in the form of informative events for the public, but efforts would also be made to strengthen the sensitivity of the scientific community for the public.[2]
PUSH's innovative contribution in Germany is certainly based in the motivating power that brought together experts and non-experts. Universities and research organizations can help solve complex problems by making more efforts to allow the information and knowledge available to their own institutions to be utilized in community processes of making decisions and shaping opinions.

Research question three
Interactive PR employs new channels to open up technically mediated dialogues with community target groups (e-mail, newsgroups). It makes it possible for communications partners to call up specific electronically distributed information (WWW, CD-ROM), and it can support PR management. Which tasks and goals do universities and research organizations pursue with their online presence? Of what use is the information to the recipients, and what are their demands?
Universities and research organizations use their online sites to represent themselves in cyberspace, to increase their name-recognition around the world, pursue image politics, and support dialogue with target groups. Currently, all German universities and 99% of the research institutions are represented in the Internet. However, there are enormous differences among the sites. Whereas the main pages of the universities and research organizations are often several hundred to several thousand pages long, other top German research institutes make do with a short description of their field, a reference to the institution's address, and an e-mail address to contact.

1. Image – Corporate Design. In almost all of the university Internet sites investigated, a uniform image is –at the most– recognizable on the central pages published directly by the university administration. On the department level, including the institutes and research groups, "chaos rules." Often the pages cannot be identified as part of a university site. The *Fraunhofer Gesellschaft* institutes and most of the institutes at the *Max Planck Gesellschaft* place more value on a uniform external image, using the same typography, colors, and logos. On the pages for the institutes of the *Wissenschaftsgesellschaft Gottfried Wilhelm Leibniz*, the coding was not always visual, and the contents did not always make it clear that the various pages belonged to the same institute.

2. Responsibility for the Internet Site. Responsibility for the online presence of universities and research institutes is of strategic importance. The responsible party ultimately influences the concepts and contents of the site. A good case can be made for assigning this responsibility to the press office. It makes a great deal of sense if the press office is regarded as the leading communications office for the organization, and the Internet as a tool for public relations work.

A large number of universities and research organizations have in the meantime hired "Internet officers", some of whom, however, work independently of the press office. For the reasons outlined above, they should be working for the press and communications office.
The investigation also showed that, at some universities, the chief responsibility for the Internet site lay with the data processing department. This might have been the right place in the beginning, due to the many technical problems. With a view to communications, however, this decision should be reconsidered, as there is a danger that technical skills might be more highly rated than content.

3. Desired Target and Dialogue Groups. To have an efficient PR strategy, it is essential that communications be focused on particular target groups. Of course, various communications partners have different expectations and want them to be specifically addressed in the Internet. The study shows that, up until now, universities and research organizations barely take advantage of the Internet as a PR and marketing tool. This becomes clear in the way target groups are defined and addressed.
Pre-existing and desired target and dialogue groups are ascertained by surveying the press offices and analyzing the contents of websites. Comparison shows that there is still a wide gap between wishes and reality. On the university sites, students and scholars were overloaded with information, whereas there was a lack of information for journalists. On sites belonging to non-university research organizations, there is need for great improvement in the information available to scholars, students, and journalists alike.
Finally, the user survey also showed which main groups use the sites belonging to the universities and scientific organizations. The scientific community itself is in first place (41%), followed by secondary school and university students (37%), journalists (14%), and companies (2%).

4. Tasks and Goals of Online Communications. Until now, the public understanding of science and humanities has been of secondary importance to the universities. To the research organizations, it is still the third most important reason for maintaining an Internet site, preceded by the presentation of the institution and information for potential employees. The investigation revealed that only 5% of the sites operated by the top research institutions advocate public understanding of science and humanities and publish information specifically for an interested lay public.
As far as Internet communications are concerned, press offices consider their primary tasks to be publishing press releases, administrating the institutional and departmental websites, and presenting courses and research projects. In addition, the survey made it clear that for instance, not only journalists avail themselves of press information. This information fulfills the main criteria desired by those who use the websites: it is current, understandable, and above all, prepared according to journalistic standards.
Whether scholars, secondary school students, university students, or companies, many target groups regard the press office pages as an information point, where they hope to find current, well-prepared, and understandable information on their topic or problem. This supports the idea that universities and other scientific organizations should maintain extensive, well-prepared services in a central place –for example, in the form of a current news magazine on the home page.
Altogether, it is clear that until now, university and research organizations' Internet pages have only minimally contributed to scientific communication with the public.

5. User Needs and Internet Services. According to the wishes of users and producers, online sites should be "highly up-to-date." The content analyses showed, however, that only 1% of website contents fulfilled this wish. The fact that many documents were not dated was more frequently criticized than the fact that the dated documents were no longer current. Many documents are still current after six months. Results of studies carried out in fundamental research were valid for the longest periods of time. However, the reader should have the opportunity to see how much time passed while the research was carried out, reports written, and the results published online.
Another important criterion for academic pages in the Internet is the "comprehensibility" of the contents –a demand that also happens to be made across the board by scientists, journalists, students, and interested laypersons. Here, the situation of the websites investigated is not quite so dramatic. Even though only one-tenth of the online documents manage without scientific terminology, 31% of university documents or 39% of research organizations' documents include explanations of such terms.
More than one-third of the users would like material targeted specifically for their groups. Companies and journalists value this service especially, because they want fast access to information. In the meantime, however, 71% of universities investigated and 67% of the research organizations offer this service on their homepages. Things are different on the pages and documents administrated by academic departments or labs. Only one fifth of the webpages administered by the research institutes contain target group information for users. The percentage increases to 35% on university pages, but employees and students still remain the chief addressees. As a target group, journalists are of almost no significance when it comes to the distribution of scientific information. For the most part, communications are meant for the scientific community.
Altogether, it is clear that users and publishers still have very different ideas about the ways the Internet is used and what the contents of webpages should be.
As more people increasingly turn to the Internet for information about scientific themes and organizations, this should play a more important role for those involved in public relations. Ultimately, each organization must bear this in mind, and develop and agree upon its own strategy. All of the schools, departments, and employees must work together. The positive effect of a homepage, no matter how well-made it is, will quickly dissolve when the information offered by the departments and research groups is not sufficiently tailored to the target groups, with a communicative, engaged approach.

6. Application of Participatory Elements. A society that considers its most important foundation to consist of knowledge and science needs new ways of sharing information between producers and consumers. Broad segments of the population are no longer satisfied with the role of passive listener. A critical dialogue is necessary. It is precisely in this area that online communication offers great advantages.
However, up until now, universities and scientific organizations have generally offered information that can be called up by the user, instead of elements that encourage dialogue. True, the user has the opportunity to call up information. But, apart from e-mail, there is hardly any other way of participating in decision-making routines through dialogue with the provider. The symmetric type of communication touted by public relations as ideal is seldom offered. Press office managers are completely aware of this shortcoming. It is necessary to keep looking for ways to create dialogue.

Research question four
Communication with various social target groups means a multiplicity of communication forums and thus a multiplicity of integration strategies. Public relations can only be successful when it is a part of the overall concept. Seen from this point of view, how is it possible to develop an integrated online PR strategy for universities and research organizations? What standards should be taken into consideration for structure, content, and design of such a concept?
Online PR management strategy comprises different steps that correspond to the classic cycle of business management. It must be integrated into the communications concept. Beginning with the formulation of communications goals, the analysis phase should at first systematically examine the network of relationships between academic organizations and external interest groups in society. Issue analysis (tracking themes) thus identifies relevant themes, and organizational analysis identifies the online PR potential of the organization.
In the process of planning, goals for online presence are formulated in agreement with the PR guidelines for scientific organizations. In addition, other kinds of communications tools must be tested, in order to see which can be used for the online site. During the operative planning phase, the dimensions of the Internet strategy will be transferred to real programs of action with regard to process organization, scheduling, and budgeting. The final PR control will determine how many of the goals have been achieved through the actual communications activities. Simultaneous testing will continually control the process to see if it is necessary to redirect the goals or even rethink the entire communications process (PR controlling).
With just a few exceptions, universities and non-university scientific organizations have not had any goal-oriented strategies for their online presentations up until now, and so these control mechanisms are lacking.

Notes

[1] For the complete study, see Lederbogen, Utz (2004). *Wissenschaft im Netz. Analysen und Strategien der Online-PR von Hochschulen und Wissenschaftsorganisationen* [Science on the Web. An Analysis of the Online PR strategies of German Universities and Research Organizations]. Frankfurt am Main / New York: Peter Lang (in print).

[2] Top representatives of German academic groups signed a memorandum calling for a stronger dialogue with the public. PUSH is an acronym for "Public Understanding of Sciences and Humanities."

BIOTERRORISM: ANALYSIS OF DIGITAL DOSSIERS ON 11-S

Luciana Moretti[1] and Edgard Antunes[2]

[1] Institutional Communication: Policies and Processes, School of Communication and Arts. Universidade de São Paulo, Brazil. Tel.: +55 114191 2894, lumore@bol.com.br

[2] Digital Communication, School of Communication and Arts. Universidade de São Paulo, Brazil. Tel.: +55 11 9565 4594, edgard@eca.usp.br

Abstract
As part of a broader study on terrorism under the approach of Political Communication and the process of public opinion, this paper analyzes dossiers on the 11-S attacks specially designed for the digital environment. The objective is to analyze how digital ventures in Brazil use technology for the in-depth

coverage of terrorism. Special attention is given to the use of available resources and to the adaptation of the products to the digital environment, as well as to navigation, structure, categorization of contents and to concepts as user, time and space.

Key words: New media, internet, bioterrorism, political communication.

Text

Context

This paper is part of a broader study about the media-centered goals of terrorism[1] under a political communication[2] approach. Under the asymmetric warfare paradigm, the hyperterrorism makes states and modern cities vulnerable to individuals capable of using violence in defense of private interests. Randomness, irrationality and fanaticism are considered distinctive marks of hyperterrorism. The term bioterrorism emerges to define one of its instrumental manifestations, representing the highest randomness and unpredictability possible by evoking the idea of catastrophe triggered by the invisible and contagious enemy. This paper focus in how dossiers on 11-S published by the main digital ventures in Brazil use new media resources in their hyperterrorism coverage.

Methods

Dossiers specially designed to the digital environment released with certain historical view have been chosen instead of the limited, rushed on the spot coverage. Three dossiers belonging to leading groups in the Brazilian digital market are discussed in depth: UOL, FolhaOnline and Estadão.

According to Ibope eRatings, UOL and Folha takes 63,4% of the whole Brazilian Internet market (September/03). Estadão is the online resource of one of the most traditional Brazilian newspapers.

The categories of analysis were chosen based on expert suggestions on the use of digital media[3] and in qualitative observation of the piece. Content analysis goes beyond the goal of this paper and may be dealt with in the future.

Discussion and findings

The structure of the dossiers shows a clear shift of printed press techniques to the digital media, hindering navigation and understanding. Specialists suggest that the transposition of the traditional logic to the digital media hinders the development of its true potential,[4] as it will not conceive the reader as a user and will not treat the environment as a 3D interactive product.

Navigation

The dossiers structure does not provide a proper overview of the categories of contents available and relevant issues discussed. There is no clear differentiation between facts, related documentation, historical data, concepts, opinion and others. Only one of the dossiers analyzed attempts to categorize the related information, which is often presented as a chronological sequence of headings without context as retrieved from a database.

Stories

Stories are too long for the digital environment, frequently recycled from traditional media or press agencies. The inverse pyramid style is used extensively and there are few links within the text to clarify information and concepts. By placing links within the text the writer provides additional resources without having to include explanatory data in the

story, creating shorter pieces that improve mobility unveiling new dimensions of the subject.

User

Still conceived as a passive reader. In the digital environment, the user controls the narrative instead by gathering different pieces of information during the navigation. Space and time are also controlled by the user, who can always cross the limits of the story in the screen.

Digital dossiers are long-lasting materials that make possible to explore concepts that the immediacy and limitations typical of the printed media will not allow. Although the content of the dossiers analyzed is broad-ranging, all of them failed to create a structure that made possible to spot all the resources available and still make the navigation easier. Leaving the quality of the content apart, the conclusion over the dossiers analyzed is that they lack USABILITY (figure 1).

Figure 1 Sample of first level page from Folha Online (http://www.folha.uol.com.br)

Second level page, special session on bioterrorism. Example of lack of categorization of information in the in-depth coverage. Related information is presented as a mere sequence of links to headings without context leading to already published stories. There are no clear groups of relevant information that could improve the understanding of the subject (figure 2).

Figure 2

Recommendations

Review studies on communication of science show the limitations of the traditional pedagogical unidirectional model[5] and point out to a growing concern with the public. Focusing in the processes rather than in results is especially useful in the digital environment, in which it is the user who actually builds the story by making navigation choices.

Web experts suggest that the mediators between public and content will be portals, intelligent programs, software, and editorial teams capable of organizing contents to meet the user needs.[6] Overcoming the traditional techniques for the new media demands a bigger effort from the professionals involved, but only this way we will take advantage of its full potential.

Notes

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NOVATORES: AN INTEGRAL PROJECT FOR SCIENCE COMMUNICATION

Miguel Ángel Quintanilla, Marcelo Sabbatini, Sonia Martin Cerro, Esther Palacios Mateos and Pedro José Gómez López

Instituto Universitario de Estudios de la Ciencia y la Tecnología – Universidad de Salamanca. Paseo de San Vicente, 81, 37007, Salamanca, Spain. Tel.: +34 923 294834, fax: +34 923 294835, maquinta@usal.es , sabbatini@usal.es , cerro@usal.es , estherpm@usal.es , pjgomez@usal.es

Abstract

The Novatores project has the objective of promoting the diffusion of scientific and technological information and of building in society as a whole the degree of awareness and understanding of science deemed necessary for eliciting the citizenry support to public activities of scientific research and technological innovation in Castile and Leon, Spain. Its main product is an Internet-based technical platform for the management and diffusion of scientific and technological information, open to the participation of the region's scientific and technological institutions. In the present work we describe the project's background, strategies, sub-projects and expected results.

Key words: Scientific knowledge, models, TIC.

Text

Background

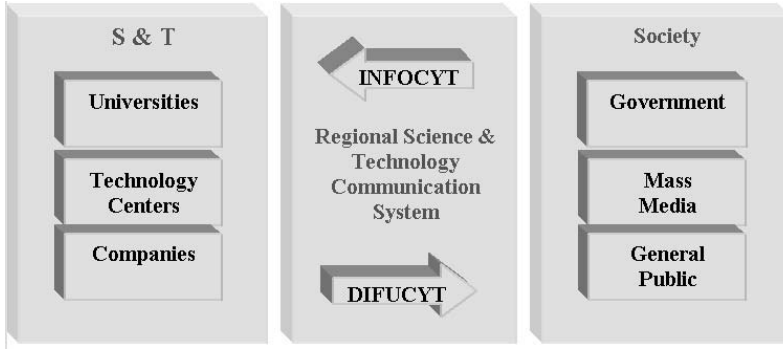
In present times, it is very common to consider scientific information diffusion as a main point in research and development (R&D) policies. A science and technology system disconnected from the society that supports it, due to an absence of reciprocal communication between both of them, is under the risk of loosing citizen support and of being condemned to stagnation and inefficiency. For this reason, the major acts in science policy try to incorporate elements directed to harness the diffusion of scientific and technological information, the accessibility of research results accomplished by companies and a general outreach among the population of a culture favourable to research and innovation processes.

The Novatores Project

Within the bounds of this context appears Novatores Project, whose main objective is to develop a *Regional System for Science and Technology Communication,* bringing scientific activities closer to society and increasing the social valuation of this performance. The project is born from the Regional Science and Technology Strategy prepared by the Junta of Castile and Leon, Spain, that proposed the implementation of a "social" information system directed to the whole of society, to make citizens participant of science and technological advances' benefits. The Internet based system is being developed by experts from the University of Salamanca, with financial and political support of the Junta.

Besides approaching science to society, it is also the project's aim to provide researchers and people responsible for science and technology institutions and companies access to all relevant information, responding to the necessity of society's demands and priorities being fully met. Thus, science and technology policies initiatives prepared by the government should reach the R&D system and its members: researchers and technologists. Additionally, the system helps in the internal management of the local government's science and technology policy, as well as to any institution that may wish to use it.

Agreeing to the marked objectives, the system is articulated in two main parts: a scientific and technological information system (INFOCYT) and a system for science and technology popularization (DIFUCYT).



The name Novatores hides a demand: it is an archaic word used in 17th and 18th centuries to contemptuously give name to a group of thinkers and intellectuals that claimed for the modern scientific method. As the Authorities Dictionary published in 1743 states, Novatores is one that is a "novelty inventor. It is taken regularly as the one that invents them dangerously in doctrine matters". The modern Novatores try to recover this innovative spirit.

Subprojects

In order to accomplish these multiple objectives, Novatores is divided into different subprojects.

The *Novatores Core (INFOCYT)* is a system for information on and management of science and technological activities, aimed for individual researchers, R&D groups, universities, public institutions, companies and social organizations that carry out research, technological development and technological innovation activities. Its content is information that calls for a demand for activities or that reveals a supply of R&D results. In the first case, there are calls for congresses and events with scientific character, grants and financial helps and technological demands. In the second case, information about projects, finished or in course, scholarly publications, thesis, patents and other gray literature, education programs and technological supplies. Additionally, it offers for the individual researcher a set of services: *curriculum vitae* management to make easier their participation in scientific activities calls and an *e-prints* server for the storage of and open access to scientific literature and electronic thesis and dissertations.

The *Science and Technology Communication Agency (DICYT)* is a specialized news agency, focused in science and technology subjects in Castile and Leon. Its final users are mass communication media (radio, press, television), for whom it provides exclusive science and technology information in different genres (news, articles, interviews) which is completed with additional elements like infographics, video files and audio clips. Its main contribution is to make up a reliable and rigorous communication channel, in which information is prepared by specialized science communicators (Sabbatini, Maciel & Coll, 2004).

InfocienciaNet is an Internet portal dedicated to science popularization with a regional focus and reaching for the most general audience possible. It is based upon the experience of homonymous portal that has been working since 2001 as an communication / interaction space in Internet and dealing with Science, Technology and Society subjects and also as a practice field for students of the Science, Technology and Society: Communication and Culture in Science and Technology Master course from the University of Salamanca (Quintanilla *et al.*, 2001). In its objective of bringing science closer to society, distinguishes form other initiatives by integrating all Novatores products, reflecting science as process rather than closed results, as well as promoting its historical sense and social importance. Besides that, the portal makes a creative and efficient use of multimedia elements, improving comprehension of scientific processes and concepts, rather than using it as cosmetic accessories.

Conclusions

Novatores project is a novel science communication experience, considered that it has an integral approach characteristic, in which information is used in different contexts, being reformulated and adapted according to the audience demands, and also establishing a *continuum* between highly specialized and technical information and that information that can be absorbed by the public. With this project, it is intended to bring the science and technology system closer to society, ultimately boosting regional economic development, trough active participation of all actors involved in this dynamics.

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THE FACILITATING ROLE OF AN ITC CENTRE FOR RURAL AFRICAN WOMEN. AN EMPOWERMENT EXPERIENCE

Gideon de Wet

Department of Communication RAU, Johannesburg, South Africa, PO Box 524, 2006. Cell: 0832904566, gdw@rau.ac.za

Abstract

Empowerment includes transformation and liberation processes in complex contexts, including personal, interpersonal, group and society levels. The aim was to investigate the facilitating and empowerment role that an ICT centre played in the lives of rural South African women.

This research was qualitative. The data analysis was done through Morse and Fields' approach.

ICT did play an important role in their empowerment. It manifested at various integrated levels, with emotional, personal, interpersonal and community consequences. Technology and religion also came together in an interesting way.

Key words: Empowerment, women, communication, ICT, facilitation.

Text

Context

Nelson Mandela (1996) said that the legacy of oppression weighs heavily on women that as long as women are bound by poverty and as long as they are looked down upon, human rights will lack substance.

The United Nations Fourth Conference on women (Beijing, 1995) can be regarded as a giant step in favour of the empowerment of women worldwide. (United Nations, 1995). Participating governments declared inter alia that the empowerment of women and equality between women and men are prerequisites for achieving political, social, economic, cultural and environmental security among all people (United Nations, 1995: 14). The question is what role does ICT play in this respect as facilitating system?

Many scholars describe empowerment as an ongoing, fluctuating, lifelong transformation and liberation process involving positive changes in the individual's psychological well-being (self-esteem, self-concept), the development of meaningful social relationships (friendship, informal and formal support) and the pursuit of positive experiences. (Arai, 1997: 1-5; Gutiérrez, 1995: 229; Engberg, 1995: 95).

Methodology

The study was conducted at the ICDL Centre in rural South Africa with 30 conveniently selected women with a grade 12 educational level

Research question and objectives

How do women get empowered through ICT communication facilitation processes as experienced at the ICDL Centre in order to contribute towards community development?

To analyse the experiences of facilitation and empowerment of women through ICT at the *intrapersonal, interpersonal, family and community* levels.

Analysis of data: Morse and Field's approach

Four integrated qualitative data analysis processes were applied: comprehending, synthesising, theorising and re-contextualising.

Findings and discussions

Empowerment at the intrapersonal and interpersonal levels

The process of empowerment of women at the intrapersonal level operationalised on interrelated levels, such as at skills, technical and at social value levels. Technical skills indicate, for example, the ability to apply computer skills, which makes a difference to their practical performance in the work place. Social skills involve skills like the ability to communicate effectively within a certain group or to maintain oneself. Values indicate the importance of something in comparison with others. It also indicated certain standards or principles, which were accepted by a particular group and thus added particular value to a person as a human being.

The mastering of these skills led to personal fulfilment and self-confidence and a sense of empowerment. Gaining of these skills also led to the fact that the women started functioning on a higher level and that, in turn, resulted in a higher level of acceptability in the community. A total of more than 50% of the respondents indicated that they are had learned certain computer skills and they felt that they were computer literate and well qualified.

Religion plays a very dominant role in the lives of these women because the overall majority indicated that they took part in religious activities. Out of the importance of their religious principles flowed their service to the community, to serve the community through skills that they have learned (e.g. on the administrative level). As already mentioned, one respondent indicated that some people felt more comfortable asking help from women.
The role models of the respondents are predominantly female (mother, aunt, pastor's wife, political figures) and could be regarded as empowered women themselves due to their profiles in society.
When comparing the different sources of information at the interpersonal level, in the empowerment process, namely the family, husbands/boyfriends, children, colleagues, friends, the facilitator and fellow students it appeared that fellow students acted as the biggest source of information and input of knowledge in this regard. One possible reason for this is because of the act of sticking together tightly, to share knowledge and motivate each other. The fellow students form part of the educational environment at the study centre and played a very important role in the empowerment process. They served as a strong information source and served as a very positive reference point.

Empowerment at the community level
It appeared as if the organisations in the community, especially the church as institution, were not facilitating agents on the level of practical skills, in the process of empowerment. The reason could be that the majority of the respondents indicated that they did not obtain information about the course from talking to people at the organisations to which they belonged.

Conclusions

The most evident empowerment aspects were:

- The personal fulfilment, improvement of quality of life, more self-confidence and could get a better job and higher status in the community.
- Close relationships within family and a higher level of emotional support.
- Role models are predominantly female, especially the maternal figure which places a very high value on education.
- Relationships with friends and colleagues for emotional support.
- Religion and a sense of serving the community as a God given instruction
- The role of the fellow students played a major role in the empowerment process because of the relative same frame of reference and the group cohesion that exists.

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Scientists and science institutions as PCST agents: responsibilities

HOW PRESS COVERAGE ON TRANSGENIC FOOD HAS EVOLVED IN COLOMBIA?

Mara Brugés Polo

President, Colombian Association of Science Journalism, ACPC. Cra. 7 No. 69-05, Bogotá, Colombia, South America. Tel.: (571) 3102911, fax: (571) 3104988, mara_bruges@yahoo.com

Key words: Genetically Modified Organisms, media, public perception.

Text

Transgenics have been controversial throughout the world, and Colombia is not the exception. This year, for the first time, the Colombian government approved Monsanto's BT cotton and it has been a red-hot issue in the national and regional press. The media, through editorialists, columnists and journalists, has taken on the task of informing, and sometimes misinforming, the public.

The approval of the BT cotton crop has managed to change the journalistic speech and the speech of government sources. The print media, that was indifferent to these matters, now publishes related articles; others who had positions against plant biotechnology now tend to be neutral on the subject. Although opinions and columns harshly questioning the benefits of genetically modified organisms, GMO, are still being published, the media is now more cautious than it was 5 years ago when transgenics were recorded by the Colombian media for the first time in 1999, on occasion of the Biosafety Summit held in Cartagena de Indias.

An analysis of the media coverage since then up to the present day, allows us to confirm that the Colombian press coverage of transgenic food has evolved positively for those who endorse these new technologies.

We found that the articles analyzed were written mostly by science journalists, editorialists and columnists, each one in their own journalistic style, but, what about social responsibility? The journalist must try to find the truth, show the public the different angles of the news; explain the controversy and provide arguments, so the public can take a stand on this issue. Editorialists and columnists must act based on knowledge, recognize the power of the pen and be aware that their comments affect the public opinion. However, in 1999, we found comments like this, from an editorialist opining on biotechnology: "a genetically modified product: a monster that nature by itself would never produce...".
With the objective of analyzing the print media's stand on this issue, we reviewed information published by 26 national and regional circulation newspapers in Colombia. We defined three analysis categories, as follows:

1. PRO articles: those that show a positive angle of the news, from a single source.
2. NEUTRAL articles: those that examine different angles of the news, from several sources.
3. CON articles: those based on a single source against GMO's.

These same categories were applied to columnists and journalists to define their stand on the issue.
How does the transgenic issue should be covered? Although there are many ways to do science journalism, we established that a good article must have: journalistc rigor, suitable sources, different angles of the news, plain language and responsibility.
Considering all the above, we established the evolution of the news coverage on GMO's from the point of view of reporters, sources, the media and the public.
We concluded that in 1999, with the Biosafety Summit, the media was characterized by its immediacy, aggressive headlines, unbalanced visual resources and the importance of the subject, which made front page news.
We found front page information with no further follow-up, as the newspaper did not have the complete news story. This is the case of a ship supposedly loaded with transgenic corn from the United States, arriving in Santa Marta. The news was published as a front page headline with a one-fourth page photo, but no further information.
Headlines such as "*Terminator* protocol to be signed…", "*Frankenstein* Food…" and "Genetic curse", are samples of the aggressiveness with which the media published the information.
News reporters did not research the issue and arrived in Cartagena without a clear understanding of the Summit dimension and the implications of what was to be defined there. As days passed, the quality of the news articles improved, as news reporters steeped themselves in the subject.
Although reporters made efforts to keep the public informed, journalistic flaws were exposed with the publication of inaccurate data, influence on the part of the sources and lack of follow-up to the news generated.
GMO's were new to the sources, so, some were emotionally passionate about it and others preferred not to talk about it. Greenpeace took advantage of the Public Officials' lack of knowledge and organized a protest in Cartagena to grab the media's attention.
By the end of the Biosafety Summit, the public was left confused. The public's perception on the subject was based more on the headlines than on contextualized information.
In 2001, no notable coverage event occurred. There were no scandals about transgenics, but the subject was discussed in the media, considering social, political and economic

aspects. The issue didn't make front page, but editorials and opinions were published that have influenced the public opinion.
Columnists, in some cases, explained better the scope of plant biotechnology than the journalists who wrote the articles. The difference was the colloquial language used to talk about transgenics. This situation showed the need for training writers in the handling of these matters: So, the Colombian Association of Science Journalism, with the support of Colciencias and AgroBio, carried out regional science journalism workshops aimed at students and journalists.
Sources consulted, including government representatives, private businesses, scientists, etc., are now more knowledgeable, as compared to 1999.
This time, the public took part in the debate through letters that were published by the media. This is a good indicator of the audience's interest in biotechnology issues.
2003 was a key year for biotechnology. The Colombian Ministry of Agriculture approved the sowing of BT cotton in the Cordoba Province and included transgenics in the government plan as an alternative to save the agricultural sector. This brought press coverage from the approval of this initiative to the first cotton harvest.
Journalists, now more familiar with the subject, decided to rely more on government officials to write their articles. The economic aspect is evident. The reports are now more comprehensive and contextualized than they were in 1999. The journalistic speech is more neutral and the sources consulted are more in favor of biotechnology. In other cases, some personalities who oppose GMO's, are the same who always appear in the articles to balance the information, as it is the case with Germán Vélez, of the "Grupo Semilla".
In conclusion, transgenics will continue to be present in the Colombian and international press for a long time. For this reason, it is necessary to conduct coverage studies for specific cases to give the journalistic community the tools to judge their rights and wrongs in relation to the information delivered to the public. It is important to have qualified journalists to cover this subject with responsibility and journalistic rigor.

COLOMBIAN SCIENCE NEWS WIRE SERVICE, NOTICYT

Lisbeth Fog[1] and Mara Brugés[2]

[1]A Colombian science journalist, current Director of NOTICyT, a program of the Colombian Association of Science Journalism, acpc. Carrera 7 # 69 – 05, Bogotá, Colombia.
Tel.: (571) 310 2911, fax: (571) 310 4988, lisfog@tutopia.com

[2]A Colombian science journalist, editor in chief of NOTICyT and current president of the Colombian Association of Science Journalism, acpc. Carrera 7 # 69 – 05, Bogotá, Colombia.
Tel.: (571) 310 2911, fax: (571) 310 4988, mara_bruges@yahoo.com

Abstract

The Colombian Science News Wire Service, NOTICyT, created in January, 2003, has become one of the most effective instruments of the National policy on science communication. It consists on a weekly bulletin, with three articles on average, that reaches more than 700 journalists from Colombia and Latinamerica. Cosponsored by the Colombian Institute for the Development of Science and Technology, Colciencias, and the National Academy of Medicine, NOTICyT is an initiative of the Colombian Association of Science Journalism, acpc. As an independent program, it has conquered spaces in the written media, specially newspapers and magazines, and in some Internet academic and press pages.

Key words: Science journalism, science news wire service, NOTICyT.

Text

Designed to popularize the Colombian science research and technology innovations, NOTICyT has been alife since January, 2003.

Based in Bogotá, Colombia, and cosponsored by the Colombian Institute for the Development of Science and Technology, Colciencias, and the National Academy of Medicine, NOTICyT is an initiative of the Colombian Association of Science Journalism, acpc.

The idea became a programme as a response to different facts that science journalism was showing in Colombia, and became identified through different studies[1] done by the acpc between 1999 and 2002:

1. Mass media scarcely informed about science.
2. When they did, news referred to stories of the developed countries: Seldom they referred to research done in Colombia.
3. Science community activities were not visible to Colombian society.
4. Lack of science journalists in the media: When there is a science journalist, he (she) had to cover other sources as well.
5. Science journalists did not have enough time to report, nor they had enough space to publish their articles.

Members of the acpc thought that if it was imperative to do something in order that Colombian society would have access to knowledge, the best way was to create an effective and easy-to-use instrument for journalists and editorial branches of the mass media industries. At that point, we started to shape a news wire service, thinking that it would be neccessary to emphasize in the science research and technology innovations produced in Colombia, or produced by Colombians living abroad.

NOTICyT, 2003

NOTICyT has had two seasons, the first one being from January to September, 2003, and the second one that started in January, 2004, and is still running: in eight months during

2003, NOTICyT sent 106 Colombian science and technology stories, and 28 sections describing science and technology events held within the country. Of those, we have figures of the response of the Colombian newspapers, as they are presented in the following chart:

NOTICyT (February–October, 2003)

Newspaper	**City**	**Number of published articles**
Diario del Sur	Pasto	60
Diario Occidente	Cali	51
Portafolio	Bogotá	20
El Universal	Cartagena	12
El Heraldo	Barranquilla	12
El Colombiano	Medellin	12
La Tarde	Pereira	10
Diario del Huila	Neiva	9
El Tiempo	Nacional	9
El País	Cali	6
Vanguardia Liberal	Bucaramanga	2
El Nuevo Día	Ibagué	1
El Espectador	Bogotá	1
El Informador	Santa Marta	1
14	**11**	**206**

Achievements, 2003

- NOTICyT stories started to reach the written media because they were reliable, consulted more that two sources in most cases, were current, were news, and were nicely written.
- NOTICyT was also present in radio programs and Internet news and academic pages, such as terra.com and universia.com
- We consulted about 200 human sources, among scientists, policy makers, engineers and science communicators. Scientists became more confident when speaking to the press.
- Thanks to NOTICyT service, four newspapers reopened their science and technology sections
- NOTICyT trained 5 journalism senior students from four universities.
- NOTICyT promoted the idea of covering Colombian science in the newspapers: The science stories published in the newspapers, not only the ones produced by NOTICyT, started to speak about Colombian achievements.
- We have a database of Spanish speaking journalists with almost 300 entries

NOTICyT, 2004

In September 2003 we had to stop the service due to lack of funds. However in January 2004 we came back with some changes, being the most powerful, that we are sending the news along with pictures and illustrations that refer exactly to the story being told. Since February, we have written 58 stories. The newspapers have published them in 65 ocassions, and they have appear 74 times in Internet pages.

As achievements of this second season we can highlight the following:

- NOTICyT conquered front page in five ocassions.
- NOTICyT stories have been published also in newspapers from Ecuador.
- NOTICyT trained other four students as science reporters.
- NOTICyT has stringers in Cali and Medellin.
- NOTICyT is preparing to start sending a short bulletin in English.
- NOTICyT has a database of Spanish speaking journalists with almost 700 entries.
- NOTICyT is not sending only its weekly bulletin. It is now prepared to send information in the moment it occurs.
- NOTICyT has conquered other media: Revista Javeriana and Portafolio have commissioned NOTICyT specific articles, as exclusive stories for them.

Conclusions

NOTICyT has become an effective instrument for socializing Colombian science and technology activity, through the written and electronic media. Radio and TV are still media that it has to conquer, but that means more funds to invest.

Through its articles, NOTICyT is improving the quality of the science stories published in the Colombian media. It is also promoting that within the media editors and journalists put more attention to science stories running in the country.

Although NOTICyT is independent, the science community is starting to realize that this science news wire service is helping make visible the science activity in the country, which, in the end, is good for them.

NOTICyT is also training science journalists that in the future can find jobs as such in other media.

Finally, NOTICyT has become one of the most important communication instruments Colombia has currently to democratize science and technology. It has been a novel experience with some impact in the written media, that is now crossing the countries frontiers.

Notes

1 Biosafety protocol and its coverage in the written press, research done by Lisbeth Fog and Mara Brugés, Colombian Association of Science Journalism, October, 2000. Review of science in Colombian newspapers, 2002. Others.

NANOTECHNOLOGISTS' SELF-CONSIDERATIONS ABOUT THEIR SOCIAL VIEW

Miguel García-Sancho

London Centre for the History of Science, Medicine and Technology, Imperial College, South Kensington Campus, London SW7 2AZ. Tel.:: 00 44 79 06324362, miguel.garcia-sancho@imperial.ac.uk

Abstract

This paper analyses the responses of 29 nanotechnologists to a survey about their profession's social view. The researchers of the London Centre for Nanotechnology consider British public is not aware of the discipline and place the academic background as the most influential factor of awareness. Nanotechnologists think their discipline is dominantly associated with computing and has a slightly negative image. The investigators' perceptions square with the awareness of the discipline detected in general public-based surveys and are too pessimistic about nanotechnology's social assessment.

Key words: Nanotechnology, attitudes, survey.

Text

Introduction

In the last five years, nanotechnology has become a priority for the European and United States scientific authorities, due to its significant research potential. Either the European Commission and the National Science Foundation have fostered studies about the discipline which frequently include general public-based surveys (A). The curiosity for knowing laymen's perceptions contrasts, however, with the absence of similar polls among investigators.[1] The present paper aims to address that gap presenting the results of a survey performed in March 2004 among a group of researchers of the London Centre for Nanotechnology (B).[2]

Methodology

A questionnaire with eight statements was distributed to the nanotechnologists. The questions referred to British general public's level of awareness of nanotechnology, the factors which determine it (age and studies), the fields with which the discipline is dominantly associated (computers, materials or biomedicine) and its positive or negative assessment (figures 1, 2 and 3). The investigators had to express their agreement or disagreement with the statements through a Likert Scale (C). The questionnaire was submitted to all the researchers and answered by 29 (55%).[3] Many of the scientists who did not co-operate alleged knowing nothing about the discipline's social view.

Results

The surveyed nanotechnoligsts perceive the social awareness of their profession is near to zero. According to their responses, the factor which determines the level of knowledge about the discipline is the academic background instead of the age. Physicists are the researchers who more strongly support the influence of the education and are more moderately against the significance of the age (figure 1).

Computing is the first field with which investigators consider general public links nanotechnology, followed by biomedicine. On the contrary, the materials area is seen socially farther away to the discipline. Curiously, the most negativistic researchers about the materials association are the engineers (figure 2).

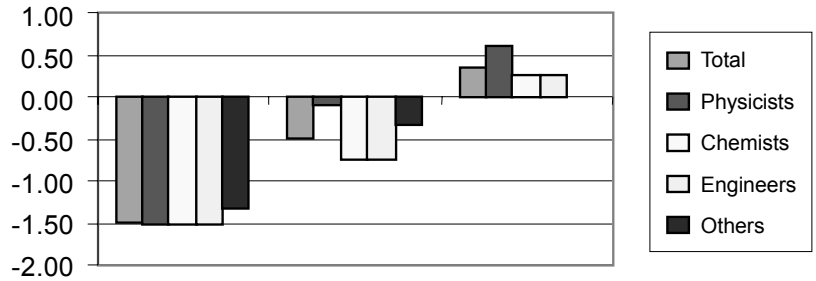

Figure 1 Nanotechnologists' perception about public awareness of their profession

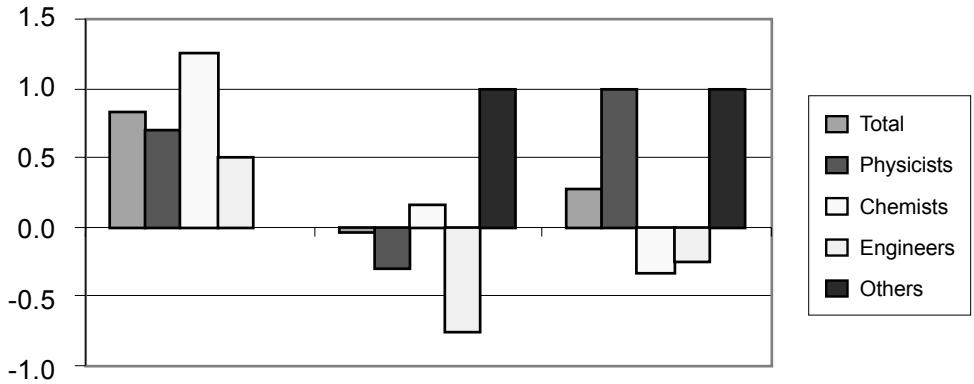

Figure 2 Nanotechnologists' perception about the applications of the discipline

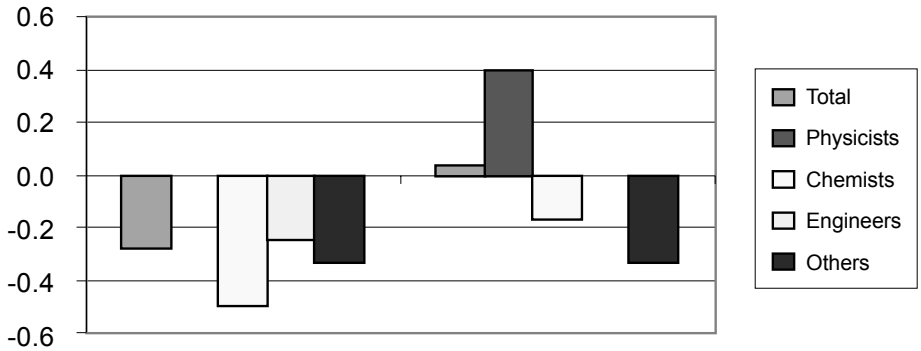

Figure 3 Nanotechnologists' perception about the social assessment of the discipline

Nanotechnologists are pessimistic about the social assessment of their profession and cautious about the public perception of its consequences. In the responses, they consider Britons have a slightly negative opinion of nanotechnology and are almost indifferent about the effects of the discipline in their lives. Physicists and chemists are respectively the most optimistic and pessimistic researchers in these issues (figure 3).

Conclusions

When compared with general public-based surveys (D), the opinions of the investigators correspond with the reflected awareness of nanotechnology and are more pessimistic about its social assessment. The inaccuracies nanotechnologists perceive in the public knowledge of their discipline square with the results of a Royal Society survey performed in January 2004 among 1000 Britons. According to this poll, the social class is a more influential factor of awareness than the age,[4] as nanotechnologists consider (table 1).

Table 1 Comparison between the nanotechnologists' survey and other general public-based surveys

Topic	Nanotechnologists	General public
Public awareness of nanotechnology	General public's notion of nanotechnology is severely inaccurate	71% of the Britons have never heard about nanotechnology
Influence of socio-demographical factors	Academic background is considerably more influential than age	Gender (male) and social grade (high) are the most influential factors
Most popular applications	Nanotechnology is more often associated with electronics and health than with engineering	The most popular images of nanotechnology are linked to computing, robotics and medical devices
Social assessment	Britons have a slightly negative opinion of nanotechnology	68% of the Britons think nanotechnology will make future better

The Royal Society's survey also shows that, as nanotechnologists perceive, the majority of the respondents link the discipline with electronics (computers, microchips, circuits and robotics), as well as medical applications (devices circulating through the blood stream). On the contrary, Britons' references to materials are scarce.
Nanotechnologists' negative consideration about the social image of the discipline does not correspond with the results of the Royal Society's survey. According to it, 68% of the Britons consider nanotechnology will make future better[5] and only 4% are explicitly against this discipline.
The researchers of the London Centre for Nanotechnology are, hence, aware of the low public knowledge about their discipline and wrongly believe this slight account corresponds with a negative opinion.[6] This perception leads them to a pessimistic position which sometimes derives in disinterest about the public dimension of their job. The correction of this view would become them more actively involved in Public Communication of Science and Technology.

Notes

[1] One of the few initiatives in this direction is a workshop with scientists and engineers held by the British Royal Society within a project for exploring nanotechnology (see http://www.nanotec.org.uk/).

[2] This institution hosts 53 investigators from two British universities (Imperial College and University College of London) in the fields of physics and astronomy, chemistry, electrical and electronic engineering, materials, geology and medical research (see http://www.london-nano.ucl.ac.uk/).

[3] This sample includes 10 physicists, 12 chemists, four electrical and materials engineers, one geologist and two medical researchers.
[4] However, the Royal Society's survey points to gender as the most influential factor of awareness.
[5] According to a United States survey, people favourable to nanotechnology are older than 45, university educated and politically conservative, also supporting the space program, nuclear power and research on cloning (see Sims Bainbridge, 2002).
[6] In this belief, they are probably influenced by the especially high activism of anti-nanotechnology groups in the UK and by the unfavourable claims of some British celebrities.

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THE SCIENTIFIC COMMUNITY AS A SOURCE OF INFORMATION ABOUT THE *PRESTIGE*

Jiménez-Aleixandre, M. P., Federico-Agraso, M., Eirexas-Santamaría, F.

Departamento de Didáctica das Ciencias Experimentais. University of Santiago de Compostela, Xoán XXIII Av., 15782 Santiago de Compostela, Spain. Tel +34-981563100 x 12015,
E-mails: ddmaleix@usc.es , maragra@usc.es , fins@wanadoo.es

Abstract
The scientific community as a source for information on the *Prestige* oil spill in Galician journals is discussed. All environmental news were indexed in a database as a part of a wider study. This paper analyses the percentage of sources from he scientific community; the content of the scientists'statements, the support for their claims and their role in the media communication. The sources from the government outnumber the scientific voices, so the scientific community is not the main source of information. The transformations in the discourse are also analysed.

Key words: Press communication, scientific community, transformation of discourse.

Text

Context and objectives

The scientific discourse experiences transformations, from science reports to vulgarization in journals and other media (Jacobi, 1999). When the object is a catastrophe of great impact, the number of voices besides the scientific community increases. The case studied is one of such catastrophes: the *Prestige* oil spill which hit the Galician

shoreline from November 2002, causing substantial ecological damages and social commotion. The oil spill had great impact on the Galician media: 2,671 from 8,084 environmental news in 2002 (Agraso, Eirexas e Jiménez, 2003). The objectives of the study are:

1) To identify the proportion of sources from the scientific community in the press information about the *Prestige*.
2) To analyze the content of the scientists statements and the support for their claims.
3) To analyze some cases of transformations in the scientific discourse such as: reformulation, language changes or image use.

Methods

Data are drawn from a study about the coverage of environmental news in newspapers (Jiménez, Agraso e Eirexas, 2003). All news are indexed in a database. The object is the study of the *sources*, understood as individuals, institutions, documents or other media explicitly quoted. Four categories were established:

- Journals: including periodicals and bulletins.
- Press agencies and other media.
- Institutions: Government offices, research institutes, universities (as entities, not as individuals).
- Social actors and expert voices: either from scientific community, or from NGOs, associations or civical platforms.

For the first objective, the sources in each category were sorted according to their origin in the scientific community or not. For objectives two and three, 65 files related to he *Prestige* were selected, which reflected the scientist's voices. From these, six were chosen for in-depth analysis. Jacobi's (1999) frame was used for studying the transformations.

Results: weight of scientific sources

Two types of primary sources were analysed to explore the proportion from scientists: social actors and expert voices (73.4%) and institutions (14.8 %), because in press agencies (11.5%) there were none, and the journals (0.3%) were not significant.

From the *expert voices*, the majority (55%) correspond to political or government sources, then sailors and other directly damaged by the spill (17%), and only a 11.5% from the scientific community.

From the *institutions* also the government offices are the most quoted (74,5%). It is worth nothing that the foreign (Portuguese or French) research centres are quoted three more times (11.2%) than the Spanish Oceanographic and Marine Research Institutes (3,6%). The sources from Universities (1.9%) are very scarce.

Results: content and support of the statements

The experts' statements and supports revolve around four issues:

a) The decision about sending the ship off the coast: some criticizing it because because of the spreading angle ("fan effect") affecting a longest coastline (V. Urgorri), some supporting it, based on the difficulties of transferring the oil.
b) The situation of the sunken hull: the risk of oil coming out or not from the ship; turning or not solid, or the risk of corrosion. Some scientists predicted that the oil will

not leak because its state will turn solid at this temperature and because the hull will not suffer corrosion due to the lack of oxygen. Others predicted that it would leak, based on empirical data from other sunken hulls.

c) The consequences of the spill in the environment: the degree of damages in the ecosystems and food webs. It seems to be an agreement on ecological damages, but one of the experts claims that oil is not as toxic when spilled on the sea as would be on the air.

d) The recovery of damaged areas: differences about recovery time from 6 months (Ministry of Environment) to more than ten years, and methods.

Results: transformations of the discourse

The transformation include:

Lexical reformulations: two types (Jacobi, 1999), paraphrases and substitutions of specific terms. Some instances: explaining tar (Spanish "fuel") as a "thick and viscous oil" (Spanish 'petróleo'), referring to concrete as a lasting solution for the hull, because it does not "rot", instead of "disaggregate"; or to damaged animals as "sand hoppers" instead of amphipods.

Analogies and metaphors: some current metaphors used in scientific communication can be misleading when the "label" function of language takes over interpretation (Sutton, 1992), for instance "food chains". Other clarify the meaning, as "fan effect" or "to asphalt beaches".

An original analogy is the comparison of the coast recovery to wood fires.

Discussion: features of scientific discourse in the media

The first issue arising from the data is the scarce frequency of sources from the scientific community, compared to institutional and government sources, despite the great involvement of Galician research institutions since the first days of the spill.

There are great differences among the statements: some seem supported on available empirical evidence or theoretical knowledge, while other ignore it, as shown in the controversies about the oil freezing point.

About the transformations of the discourse, there are different types of it that seem to serve the purpose of a better understanding for the public.

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PERSONAL, PROFESSIONAL PROFILE, AND MOTIVATIONS OF SCIENTISTS INVOLVED IN PCST ACTIVITIES: THE CASE OF THE MADRID SCIENCE FAIR

M. José Martín-Sempere,[1] Jesús Rey-Rocha,[1] Belén Garzón-García,[1] Pilar Tigeras-Sánchez[2] and Jaime Pérez-del Val[2]

[1] Group for Scientific Activity Studies, Centre for Scientific Information and Documentation (CINDOC). Spanish Council for Scientific Research (CSIC). Joaquín Costa, 22. 28002 Madrid, Spain. Tel.: +34 91 563 54 82, ext. 301, fax: +34 91 564 26 44, sempere@cindoc.csic.es

[2] Institutional Delegation at the Autonomous Community of Madrid, Spanish Council for Scientific Research (CSIC). Serrano, 113. 28006 Madrid, Spain. Tel.: +34 91 585 53 44, fax: +34 91 585 52 97.

Abstract

The project '*Scientific Culture and Communication of Science in the Community of Madrid: A study to encourage scientists to participate in PCST activities*', is here presented, together with some of the preliminary results obtained. The objective of this study is to define the profile of scientists who participate in the Madrid Science Fair, as well as to identify the motivations that prompted them to take part in the Fair, with the purpose of proposing strategies and actions directed towards promoting and improving their participation in this and other PCST events. The study has been carried out through personal interview with scientists.

Key words: Public Communication of Science and Technology, Researchers, Motivations, Science Fairs.

Text

Context

The project *Scientific Culture and Communication of Science in the Community of Madrid:*
A study to encourage scientists to participate in PCST activities,[1] is here presented, together with some of the preliminary results obtained.

Objectives

The objective of this study is to define the profile of scientists who participate in the Madrid Science Fair (MSF), as well as to identify the motivations that prompted them to take part in the Fair, with the purpose of proposing strategies and actions directed towards promoting and improving their participation in this and other PCST events.

Methods

The analysed sample is constituted by the staff of the spanish council for scientific research (CSIC), participating in the three latest editions (2001 TO 2003) of the MSF. The study has been carried out through personal interviews with the participants, who where asked about the following aspects:

1. Professional and personal profile: professional status, scientific field, size and composition of their research teams, age, gender, family, involvement in other participatory activities, hobbies.
2. What made them take part? (own initiative, told to, obligation due to its professional position); What was their task? (coordinator, collaborator, expositor)
3. Motivations that prompted them to participate.
4. Its perception of whether activities presented aroused public interest, and their utility (for the public, for themselves, for their centres, etc.).

5. Benefits gained from their participation.
6. Main limitations and problems they encountered.
7. Participation in other PCST activities.
8. Proposals for promoting scientists' participation in PCST activities.

Results

Table 1 shows some data relating to the professional and personal profile of interviewees.

Table 1 Personal and professional profile

	Professional status			Total
	RS	TE	FE	
Population				
N	42	35	88	165
%	25.5%	21.2%	53.3%	100.0%
Distribution by field				
BB+NR+AG				47.3%
PHY+MST				39.4%
HS				10.9%
Support Units				2.4%
Sample interviewed				
N	38	25	56	119
%	31.9%	21.0%	47.1%	100.0%
Population interviewed (%)	90.5%	71.4%	29.5%	72.1%
Distribution by field				
BB+NR+AG				52.9%
PHY+MST				36.1%
HS				8.4%
Support Units				2.5%
Gender				
Male	76.3%	68.0%	33.9%	54.6%
Female	23.7%	32.0%	66.1%	45.4%
Age (average)	51.6	47.2	30.4	40.3%
Have dependent relatives	78.9%	68.0%	12.5%	45.4%
Carry out other participatory activities	57.9%	56.0%	33.9%	46.2%

BB=Biology and Biomedicine; NR=Natural Resources; AG=AGronomy; PHY= Physics science and technology; MST=Materials Science and Technology; HS=Humanities and Social sciences

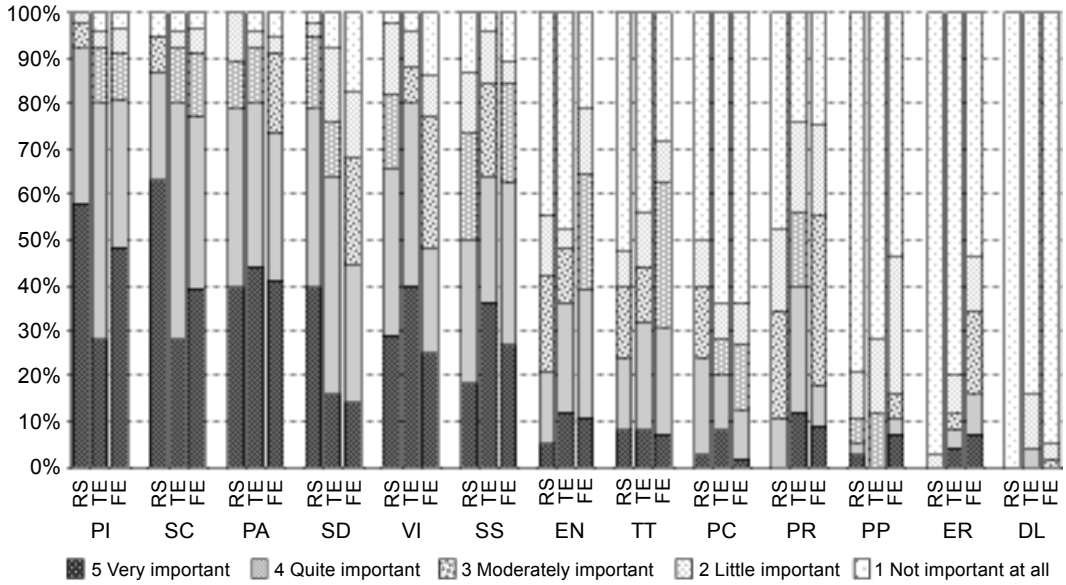
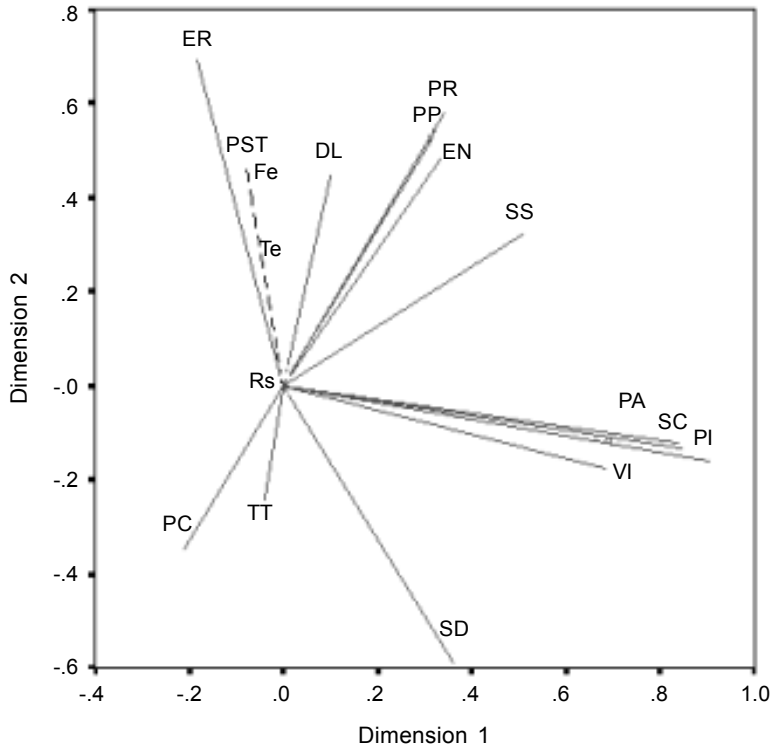


Figure 1 Motivations of scientists to participate in the Madrid Science Fair, by Professional Status



PC, SD, VI, SC, PA and PI show a positive correlation with PST (the higher the PST, the higher the value assigned to the corresponding variable). ER, DL, PR, PP,EN,TT and SS are negatively correlated with PST.

Figure 2 Principal Components Analysis for Categorical Data (CATPCA) of Motivations and Professional Status

Figure 1 shows motivations that prompted scientists interviewed to participate in the Fair, showing differences based on the professional status (PST).“Economic Reward” is the motivation that most discriminate among individuals in relation to their PST, followed by the “Sense of Duty”. The former shows a negative correlation with PST, while the later shows a positive one (see Figure 2).
In general, interviewees faced few limitations at the time of participating in the Fair. Economic, time and space are, by this order, the most significant limitations for Senior Researchers, although they were no more than moderately important limitations (valued below 3 in a “1-to-5” scale). Space and time, followed by economic, were also the main limitations encountered by Technicians and Support Staff. Finally, the most important limitation for Fellows was the time, over the space. The rest of problems on which interviewees were asked, were valued, in average, as of little importance or not important at all (technical limitations, problems with other colleagues, no recognition, problems with the public, administrative, personal problems, stand short staffed, staff attending stand scarcely trained, transport).

Conclusions

The results obtained show that, although motivation vary with the professional status, CSIC staff appear to be motivated more by a desire to communicate science and increase the public’s understanding of science and scientific culture, than by personal, professional or economic motivations.
In what respect the profile of scientists, stands out the relatively high participation of fellows, group that is characterized by the low percentage of individuals having dependent relatives and by its unexpected reduced implication in other participatory activities, probably derived from its little availability of time. On the other hand, it is worth noting the reduced participation of scientists from the Social Sciences and Humanities, probably due to its less experimental character.
Results are expected to allow to promote initiatives aimed at encouraging and improving the participation of the scientific community in future editions of the MSF and, in general, to increase their interest in PCST activities, as a way of increasing public’s awareness of science and technology and the scientific culture of our society.

Notes

[1] Project funded by the Directorate of Research of the Autonomous Region of Madrid.

SCIENTIFIC RESEARCH AND SOCIAL CULTURE. SOCIAL RESPONSIBILITY OF RESEARCH CENTRES

Luis A. Martínez Sáez

Head of Director’s Support Team. Instituto de Astrofísica de Canarias (IAC) (http://www.iac.es).
Tel.: (+34) 922 605 207 (08), fax: (+34) 922 605 194, lms@iac.es

Abstract

The scientific and technological knowledge are unable to form part of our popular culture.
Important historical marks, deficiencies in educational policy, and the mass media are frequently pointed at for being responsible of the divorce between *both cultures* giving rise to many severe evils in our society.

Who should be the driving force of this cultural change?
In our view, the leaders of that cultural revolution should be the science centres and universities.
For this to be possible, it is necessary to tear down the following myths that limit us when suggesting scientific communication.

Key words: Cultural revolution, social returns, tear down myths.

Text

The relationship between science and society continues to be a cultural challenge yet to be solved. Immersed in this 21st century, identifying an economic or a simple daily activity, in which technological innovation is not decisive, is difficult. Science, technology and innovation constitute a fundamental chain in the nature of the modern citizen. However, and this is one of the paradoxes suffered in the world of science, scientific and technological knowledge are unable to form part of our popular culture. Moreover, the word "culture" is still reserved for traditional culture, the so-called artistic-literary one, in the same way that the scientist is still denied the condition of "intellectual."

Important historical marks, deficiencies in educational policy, and the mass media are frequently pointed at for being responsible of the divorce between *both cultures* giving rise to many severe evils in our society. It is pointless to look for culprits and to repeatedly discuss what we are already aware of if we do not find ways to change these things.

The *Encyclopaedia* compiled and made the knowledge of the time available to the bourgeoisie. It was a cultural initiative of great ideological importance. It is now our turn to create and develop efficient means to enlighten the great public with a scientific and technical understanding.

The question is: Who should be the driving force of this change? In our view, the leaders of that cultural revolution should be the science centres and universities. These centres are the deposits of the knowledge we are trying to transmit, and it is in these places where scientific advances take place. Expecting the public administration, businesses, or the media to begin this process is the same as asking one to share what one does not possess. The cultural extension of science should be carried out with the deep conviction that knowledge is not an exclusive treasure belonging to the scientists that produce it, or the centres or the Universities they work at. Science is to be shared, making it accessible to all citizens.

In reality, how do we carry out this cultural revolution? The first step will be to make efficient systems available in the research nuclei in order to inform, in a feasible way, about what researchers do and to explain its importance for citizens. For this to be possible, it is necessary to tear down the following myths that limit us when suggesting scientific communication.

First myth: "The communication of science demands exclusive approaches, very different than those of commercial communication"

It is certain that science, due to its abstraction and complexity is a *rara avis*, in terms of communication. However, besides knowledge, laws and formulae, filled with complexity and abstraction, science is also a "product" with great attraction offering unsuspected possibilities if we are able to apply techniques used in the world of commerce.

Second myth: "The mass media are the essence of communication"

The mass media are the transmitters, not the essence or the origin of scientific messages.

It is in these facilities where these messages should be generated, based on new discoveries. Research entities need to create specialized departments for communicating the results and organizing outreach activities (visits to scientific institutions, exhibits, digital and printed publications, activities related to the week of science, outreach talks, courses for educating teachers, participation in radio and television programmes, etc.) directed to the public.

Third myth: "The challenges to the Department of Communication come from the outside"
False. The first great challenge that a Communications department must face is internal, and it begins with the complicated task of changing the Pythagorean philosophy of many scientists and winning them over to the cause of outreach, showing them that this is the best way to achieve the support that they claim from society.

Fourth myth: "Scientists are busy enough doing quality science!"
This is certainly their best contribution to society. However, the scientific community cannot be a reservoir of knowledge, culturally futile to the great public. Scientists must understand that it is the citizens who pay their bills and that, for this reason, they have the right to obtain at least three "social returns" from science:

- *First return:* The right to take part, in some way, in the prioritisation of areas of research to be funded.
- *Second return:* The right to demand more outreach, which will allow them to increase their scientific and technological knowledge.
- *Third return:* The right to demand that the "science-technology" chain also benefit business and increase the well being of the citizens.
- If the world of research were to take on this social challenge, its relationship with society would be much better.

Fifth myth: "Our senses play no part in understanding science"
Science = concepts and laws = abstraction. This is true, but experience facilitates understanding. Conceptual coexistence generates strong emotions that should also be transmitted.
Putting it in a more philosophical way, we are trying not to forget the basis of that old adage, compiled by Locke*: Nihil est in intellectu quod prius non fuerit in sensu ('the intellect knows nothing that our senses have not known beforehand'*), which translates into favouring direct contact between the public and research centres, and their respective scientists and technologists, allowing for the citizens to have new experiences and, thus, mobilize their intelligence.

Sixth myth: "Popularised science is no longer science"
This is as true as saying that flour isn't wheat. Science popularisation generates a new product to which it would be inappropriate to apply the conceptual precision of the original science, but that allows for a better understanding of science by the man on the street.

Seventh myth: "Communications do not need human or material resources"
More than a myth, this is nonsense. Communication requires management and communication professionals, journalists, graphic designers, computer services, and in short, funding. Around a 3% of the centre's annual budget and projects should be destined to these tasks.

NO ONE IS AN ISLAND: BIOTECHNOLOGY RESEARCHERS TALK ABOUT COMMUNICATING

Eve Merton

Biosciences and Society, National Institute for Cellular Biotechnology, School of Communications, Dublin City University, Dublin 9, Ireland. Tel.: +353 1 700 5049, fax: +353 1 700 5447, eve.merton@dcu.ie

Abstract

This paper reports work-in-progress: a pilot study of biotechnologists communicating their work, with the aim of developing a research instrument to map communication attitudes and activities of researchers at the National Institute for Cellular Biotechnology in Ireland. The research has also enabled a limited exploration of communication models. A series of semi-structured interviews were conducted, producing data that was analyzed descriptively. Each question was re-assessed using the pilot responses and respondent-identified problems. The results show a willingness and responsible attitude manifested by biotechnologists in communicating their research and has led to a stronger emphasis on mixed methods in the re-development of the research instrument.

Key words: Biotechnology; research scientist; communication; semi-structured. Interviews.

Text

Context

Increasingly, research scientists are encouraged to communicate their work to specialists and non-specialists, and nowhere more so than in the diverse and sometimes controversial fields of biotechnology. Yet, a mapping of biotechnology researchers' current communication activities and an understanding of their attitudes towards communication has been neglected. The aim of this research is to explore these issues with biotechnology researchers employed at the National Institute for Cellular Biotechnology (NICB) in Ireland.

The NICB has adopted a novel approach to biotechnology in Ireland: its research themes incorporate the entire value chain of activities from discovery to clinical treatment, including communication and educational considerations.

Objective

The long-range objectives of this research are to explore the following questions:

- What beliefs about and attitudes to communication of their own work do biotechnology researchers at the NICB hold?
- How do biotechnology researchers at the NICB communicate with each other, with other biotechnology researchers, other scientists and/or non-scientists?
- How do these compare with the beliefs/attitudes of scientists in general from a similar cultural milieu?
- What constraints on or encouragement for communication exists for biotechnology researchers?

Scientists are often accused of practicing the Shannon and Weaver 'injection' model of communication. This model emphasises a difference in status/expertise between sender and recipient, and assumes that the audience is passive. An unnecessary dichotomy has been created between the way scientists are accused of communicating and the emergent emphasis on a more egalitarian 'dialogue' model in science communication (i.e. interaction and debate between individuals and groups, treating science as simply another facet of life). If it is assumed that scientists use the injection model by default (and

preference), a corollary is that the communication complexity afforded to other professional groups is not acknowledged for the science community.
In order to explore these seemingly simplistic assumptions and gain an empirical understanding of communication by scientists, the present pilot study gathered data about the communication attitudes and activities of a sample population of biotechnology research scientists. This information is being used as feedback in the development of a research instrument to gather census data about the communication attitudes and activities of the biotechnology research scientists at the NICB.

Methods
A series of face-to-face semi-structured interviews was carried out in April 2003. The interview instrument used the Wellcome Trust-commissioned MORI survey *The Role of Scientists in Public Debate* (MORI, 2001) as a starting point, but evolved into an exploration of specific instances of communication by scientists in formal and informal contexts and with specialist and non-specialist audiences.
A database of the interview responses was constructed. Descriptive statistics were generated and the database was interrogated using the text tool WordSmith. Some interesting trends were identified using these methods, although these were limited in scope due to the small size of the pilot population. More importantly, each question in the pilot interview instrument was re-assessed for relevance and appropriateness using both the responses *and* respondent-identified problems associated with the questions.

Results
The descriptive statistics and WordSmith identified a positive association between 'years since receiving a PhD' and a range of activities and achievements (e.g. membership of professional organisations, applications for or ownership of patents), which is both obvious and expected, given the longer working life of respondents who have held PhDs for longer. These respondents also tended to spend less time in the laboratory than respondents either working towards a PhD or in post-doctoral research. In addition, they had more often practiced across the spectrum of least- to most-interactive communication activities. All respondents believe that there are real personal and professional benefits accrued in speaking with others and listening to feedback about their work.
In general, results have indicated a willingness and a sense of obligation in scientists doing biotechnology research to communicate their work, a belief in the social benefits of their work with a concurrent responsibility to demonstrate these benefits to others, and a positive attitude to face-to-face questioning/debate in informal situations, despite personal fears of being ill-equipped to deal with such situations.
Some methodological observations have been possible regarding the appropriateness of different approaches in large-scale multi-interviewer questionnaires compared to small-scale census (whole population) single-interviewer instruments. For example, large sample questionnaires are usually designed such that inferences may be made to a larger (untested) population. However, emphasis in the present research on a sub-group (biotechnologists at the NICB) calls for the use of more qualitative open questions. In addition, the population is 'captured' and may be re-tested at the will of the researcher. Set against this is the assumption that the respondents place a high value on quantitative methods because they are trained research scientists (as I was) –this has created a tension in the current re-development of the research instrument.

Conclusions

These results illustrate that biotechnology researchers do communicate about their work with others. At this stage it is safe to conclude that just as much complexity exists in communication by biotechnologists as it does in other professional groups. I would argue that there is a place for each model of communication (dissemination, engagement, consultation, dialogue etc.) depending on the communicative context.

The communication complexity practiced by these biotechnology researchers, coupled with tensions between divergent approaches to its exploration, is prompting a theoretical and methodological reappraisal, but is also leading to a more difficult and potentially more rewarding project.

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EXPERTISE FOR THE PUBLIC: THE SCIENCE-JOURNALISM INTERFACE IN GERMAN DISCOURSE ON GLOBAL CLIMATE CHANGE

Hans Peter Peters and Harald Heinrichs

Program Group Humans - Environment - Technology, Research Center Juelich, 52425 Juelich, Germany.
h.p.peters@fz-juelich.de, h.heinrichs@fz-juelich.de

Abstract

Based on a mail survey of journalists and experts we analyzed the science-journalism interface in the German discourse on global climate change. The purpose was to better understand how scientific knowledge is integrated into public discourses and to explore what happens to the meaning of scientific knowledge when it enters the realm of the media. We found a strong co-orientation of experts and journalists. Furthermore, we identified some characteristics of "meaning production" in the journalistic processing of expertise. The survey is part of our project "Climate Change in the Public Sphere" and was funded within the German Climate Research Program.

Key words: Global climate change, science-journalism interface, experts.

Text

Introduction

Global climate change is one of the major environmental challenges. In Germany, the expectation of raising sea levels and increased storm tides have led to concerns about coastal protection at the North Sea coast.

Scientists have been very active putting the climate change issue on the political agenda and still are important protagonists of that issue (Weingart, Engels, Pansegrau, 2000). The climate change issue provides an excellent opportunity to study the inclusion of scientific expertise in public discourses. This paper deals with the interface of science and journalism: How do experts and journalists interact? Is there cooperation or antagonism? Which semantic processes take place when scientific expertise is included in media reports?

Method

Monitoring the coverage of climate change and coastal protection in 32 newspapers, magazines, radio and TV programs from February 2002 to February 2003 we identified experts quoted as sources. Experts and story authors received matching questionnaires by mail. Each questionnaire included a general module and one or more special modules referring to specific expert-journalist encounters.

169 experts returned questionnaires providing information about 186 encounters with the media (response rate 58%); 85 journalists returned questionnaires with 103 completed special modules about encounters with experts (response rate 35%).

Results

The analysis of information channels shows that public relations as well as journalists' initiatives in contacting interview partners are important means to initiate contacts. About two third of the quotes are based on face-to-face or phone interviews.

The experts and journalists have remarkably similar beliefs about science, the media, the rights and duties of experts and journalists and the climate change risk. Selected items where there is some difference between experts and journalists are listed in table 1.

Table 1 Beliefs and expectations of experts and journalists

	Experts (*n* = 169)	**Journalists** (*n* = 85)
I1: Experts have a say in the journalistic framing of the media product, for which they have been interviewed	1,09	-1,93
I2: Journalists can expect experts to express themselves in an understandable manner	2,10	1,27
I3: Environmental sciences should select their research questions based on purely scientific criteria	-0,02	0,47
I4: The media should always be critical regarding environmental experts and probe into their interests	1,31	2,32
I5: The media should dramatize the environmental situation a little to effectively warn the public	-1,19	-1,68
I6: Environmental experts should not only express their opinion on technical questions, but also criticize decisions and propose options for action	1,40	2,05
I7: Experts should warn the public, even if there is only a suspicion of possible dangers	1,12	1,62
I8: Environmental experts should contact journalists themselves and offer information	1,10	1,93

Mean values of a 7-step scale ranging from -3 ("strongly disagree") to +3 ("strongly agree"); all differences are statistically significant (t-test, $p<0,05$)

Sometimes the experts even take a more "journalistic" view than the journalists (I2) and journalists a more "scientific" view than the experts (I3). This is an indicator of co-orientation: Journalists respect expert norms and goals; experts on the other hand anticipate journalistic norms and goals.
There is only one item (I1) where experts and journalists outright disagree: Experts claim a say in the shaping of journalists' stories for which they have been interviewed, a demand that is clearly rejected by journalists.
Experts and journalists assess climate risks very similarly: 90% of the experts and journalists are convinced that climate change will happen. Somewhat more than half of each group say that it is still possible to prevent climate change. And slightly more than half of the experts and journalists agree that Germany can cope with climate change. Although risk perception varies *within* the groups of experts and journalists, there is no great difference *between* the groups.
Guided by journalistic principles, "meaning production" takes place during the interactions. It is based on processes such as inquiring, selecting, emphasizing, re-contextualizing and evaluating. By means of qualitative content analysis of the answers to open questions we identified characteristics of journalistic processing of expert information:
Focus on a core message: Journalists rigorously reduce the complex expert information. They select a single aspect, omit details and apply an "angle".
Change of context: Journalists put research results into other contexts. They make connections to political processes and everyday experience.
Preference for concrete over abstract information: Experts tend to volunteer abstract information whereas journalists expect concrete information.
Preference for definite over vague information: Experts try to be cautious. They prefer to say "something could happen" rather than "will happen", for example. Journalists prefer definite statements and tend to omit qualifications.
Despite some criticism in detail –caused by discomfort because of semantic changes and factual errors– most experts in the climate change discourse have a lot of sympathy for the journalistic approach. Both groups express high satisfaction with the interaction partners (see table 2). About 90% of the experts are at least "rather satisfied" how the journalists used their information.

Table 2 Evaluation of contacts

"How would you describe your contacts with journalists [experts] in general?"

	Experts	**Journalists**
Mainly good	78,6%	91,7%
Good and bad experiences are balanced	20,8%	8,3%
Mainly bad	0,6%	0,0%
	100,0% (*n* = 168)	100,0% (*n* = 84)

Conclusion

The science-journalism interface in the climate change discourse is well-developed. The relevant scientific communities obviously include scientists who feel comfortable talking to the media and who are prepared to meet the media's demand of not only facts but also interpretations. This expertise is processed according to journalistic rules. The resulting semantic changes only mildly irritate experts. We observe a strong co-orientation of experts and journalists, a situation that might be called "symbiotic".

Similar to other studies (Peters, 1995), there is strong disagreement between experts and journalists about how much control the experts should have over media coverage. Because of the strong co-orientation this control issue hardly leads to conflicts and frustrations: Journalists and experts seem to pull at different ends of a rope, but apparently they pull in the same direction.

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Parallel session 19

Scientists and science institutions as PCST agents: experiences

SANT PAU PROJECT: URBAN KNOWLEDGE PARK ON HEALTH SCIENCES

Johanna Cáceres,[1] Mariona Grau,[2] Josep M. Fernández,[3] Miquel Modrego,[4] Josefa Puig[5] and Josep Antoni Grau[6]

[1] Head of Projects and Press Office at the Communication Department, Hospital de la Santa Creu i Sant Pau (HSP). Sant Antoni M. Claret, 167. 08025 Barcelona (Spain). Tel.: +34 93 291 99 07, fax: +34 93 291 90 62, jcaceres@santpau.es

[2] Director of the Communication Department at HSP. mgrau@santpau.es

[3] Head of Publishing at the Communication Department, HSP. jfernandezr@santpau.es

[4] Manager of the Heritage Division at HSP. mmodrego@santpau.es

[5] Manager of the Hospital Division of HSP. jpuig@santpau.es

[6] Managing Director of HSP

Abstract

The Hospital de la Santa Creu i Sant Pau (HSP) was created in 1401, in Barcelona. It is currently situated in several different Art Nouveau pavilions which have been declared a World Heritage site by UNESCO and are of patent cultural and tourist interest. The hospital is building a new site that will concentrate healthcare activity. The pavilions and surrounding gardens will host teaching and research activities, together with new cultural and social uses. HSP believes that, in the 21st century, a hospital must be regarded as a knowledge centre, which involves engaging in popularisation activities aimed at stimulating the scientific and medical culture of the population. This is why the hospital area will become a knowledge park on health sciences.

Key words: Health & Medicine, Public Understanding of Science, Knowledge.

Text

Context

The Hospital Santa Creu i Sant Pau (HSP), in Barcelona, is one of the most important university and research hospitals in Spain (3000 employees and a catchment-area of 400,000 people). It is over six centuries old and its current site was declared World Heritage by UNESCO.

HSP is in a period of change as healthcare activity moves to a new building. This move will leave 18 Art Nouveau pavilions empty, that will be occupied by research and teaching activities (existing and new) and other activities which have not been carried out by the hospital so far: activities related to science popularisation and education and aimed at schools, tourists and the local population at large.

Methodology

HSP considers the change to be an opportunity, a chance to define what a 21st century hospital should be and it proposes a new way of understanding and managing a hospital. The Sant Pau Project (SPP) makes strategic use of the three pillars upholding HSP (healthcare, teaching and research) and adds a new one: putting its cultural heritage within reach of the people by means of the following:

1. Promoting science-healthcare culture.
2. Integrating artistic and medical heritage in a popularisation project .

The HSP Communication Department is responsible for defining and implementing the SPP and thus has been provided with resources and integrated within the management team as a strategic department.

This task is carried out with the involvement of social partners, both citizens and institutions: neighbourhood and patient associations, the city council, professional associations, etc. The final aim is to get all the vital forces involved in the project so they feel it to be their own.

Results

So far, the Communication Department at HSP has designed and initiated different popularisation programmes (schools, associations, general public and journalists), all of them integrated within the project of a Life and Health Museum that the hospital plans to open in the medium term.

Furthermore, an agreement has been signed with a local institution that is, in fact, in charge of co-ordinating the European Art Nouveau Route, an initiative aimed at reclaiming this heritage. In the case of HSP, the architectural relevance of the complex is not only for artistic reasons but also for functional: there are no other living examples of pavilion-structured hospitals, a design that answered to the criteria of medical science at the beginning of the 20th century.

The Domènech i Montaner Foundation has also been created to promote the study and diffusion of this extraordinary architect's life and work. We have also started work on a sponsorship and patronage programme, and we are opening lines of business to generate some income from guided tours, school activities, renting spaces for films and advertising spots, etc.

Conclusions

HSP is the first large-scale hospital centre in Spain that has been designed within the knowledge society and it concludes that it should be transformed into an urban health-sciences park. The SPP is a cultural project aimed at promoting culture among citizens, where culture is understood as a set of concepts and ideas that help us to understand the world we live in and participate in it.

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BEST PRACTICE IN COMMUNICATING THE RESULTS OF EUROPEAN RESEARCH TO THE PUBLIC

Michel Claessens

Head, Information and Communication, Directorate-General for Research, European Commission, 200 rue de la Loi, B-1049 Brussels, Belgium. Tel.: +32 2 295 9971, fax: +32 2 295 8220, michel.claessens@cec.eu.int

Abstract

The presentation will outline the initiatives taken by the European Commission to improve communication, outreach and dissemination of results from EU-funded research projects, and to facilitate the work of project contractors in this respect. Guidelines and best practices to help project participants in communicating and disseminating their research results will be presented and discussed. The European Commission draws in particular the attention of participants in FP6-funded projects on the fact that they can no longer ignore the 'public communication' dimension of their activity and that they are also in an excellent position to improve the image of science and technology among a broad public.

Key words: Information and communication, media, research projects, best practices, scientific awareness.

Text

The European Commission is launching some 2,000 new research projects every year. An annual budget of more than EUR 4 billion is being allocated by the European Union for funding research projects.

In the Sixth Framework Programme 2002-2006 (FP6), the European Commission supports very large projects (50-100 partners). Against this background, dissemination of results is a contractual obligation of participation in research initiatives supported under the European Union's FP6. The specific aims of this provision are to promote knowledge sharing, greater public awareness, transparency and education. Consortia are required to provide tangible proof that collaborative research not only exists, but also pays dividends in terms of academic excellence, industrial competitiveness, employment opportunities, environmental improvements and enhanced quality of life for all.

At the same time, the communication of successes and the announcement of exploitable developments are of direct value to the participants themselves. Suitably framed messages can help by:

- Drawing the attention of national governments, regional authorities and other public and private funding sources to the needs and eventual benefits of the research.
- Attracting the interest of potential partners and/or correspondents.
- Encouraging talented students and scientists to join the partner institutes and enterprises.
- Enhancing the reputation of participants, at local, national and international level;
- Where appropriate, aiding the search for financial backers, licensees or industrial implementers to exploit the results.
- Generating market demand for the developed products or services.

However there are some specific difficulties to communicate in the European dimension (fig. 1). As the European Research Area becomes a reality, Europe is sorely lacking a mechanism enabling it to draw full benefit from its "home grown" research activities. At present, there is no structured mechanism for informing the media in one Member States of scientific activities going on in another and giving the highest possible profile to

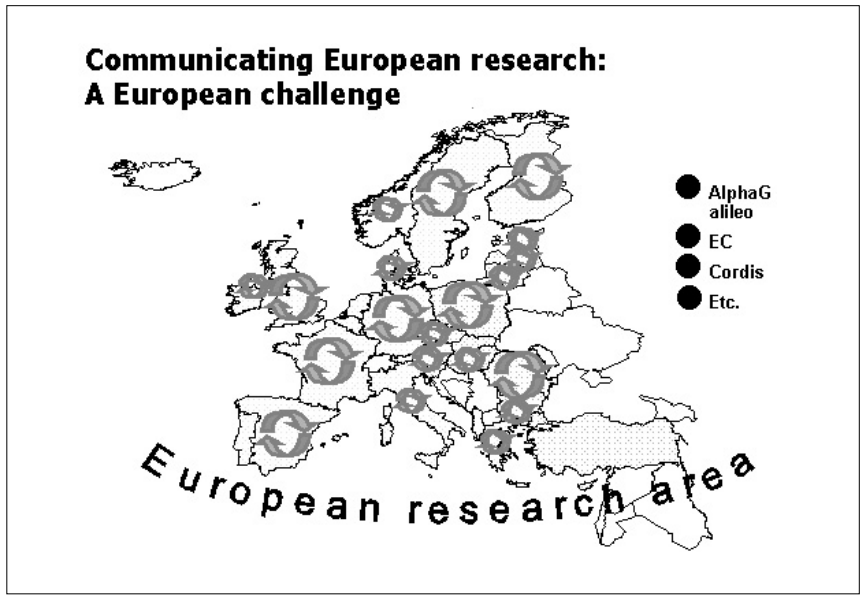

Figure 1

European research. A survey made by ESO (European Southern Observatory) showed that 67% of the articles published in Germany on space and astronomy concerned US research. US research still dominates the European media.

The European Commission's Directorate-General for Research is heavily involved in communicating the results of EU-funded research to the media and the general public. Support and help are provided to assist project coordinators and team leaders to generate an effective flow of information and publicity about the objectives and results of their work, the contributions made to European knowledge and scientific excellence, the value of collaboration on a Europe-wide scale, and the benefits to EU citizens in general.
The European Commission's communication strategy particularly addresses communications via the "mass media" (TV, radio and the written press), the workings of which may be less familiar to scientific/academic partners. It also covers websites 1 and other internally generated support such as print publications, CDs and video.
The European Commission draws in particular the attention of participants in FP6-funded projects on the fact that they can no longer ignore the "public communication" dimension of their activity and that they are also in an excellent position to improve the image of science and technology among a broad public. Exposing non-specialists to the results of research work helps to improve their understanding of scientific and technological developments and stimulate public debate on important issues, which not only meets a very real social need but also contributes to the success of RTD policy. The 2001 and 2003 Eurobarometer Surveys (two opinion polls "Europeans, science and technology" that were conducted at the Commission's request in the fifteen Member States between 10 May and 15 June 2001, and in the ten new Member States plus Romania, Bulgaria and Turkey in November 2002) of European attitudes to science showed that Europe's citizens have a very positive perception of science and technology.

However, research has shown that our acceptance or rejection of technological and scientific innovation is determined largely by our preconceived ideas. This means that we must therefore dispense with the widely held belief that high-quality scientific information can influence people's judgement. Many researchers continue to claim, for example, that opposition to genetically modified organisms is due to the fact that most of the population fail to understand the underlying scientific notions.
The presentation will outline the initiatives taken by the European Commission to improve communication, outreach and dissemination of results from EU-funded research projects, and to facilitate the work of project contractors in this respect.
Guidelines and best practices to help project participants in communicating and disseminating their research results will be presented and discussed.
The presentation will also include examples of successful approaches that have been used to date.

Notes

[1] http://europa.eu.int/comm/research/index_en.cfm.

ENVIRONMENTALISTS VS SCIENTISTS: TWO CASE STUDIES IN SCIENCE COMMUNICATION

Tiziana Lanza

Istituto Nazionale di Geofisica e Vulcanologia. Via di Vigna Murata, No 605, 00143 Rome, Italy.
Tel.: +39 06 51860218, fax: +39 06 5041303, lanza@ingv.it

Abstract

How much environmentalists influence people when science is involved? To this aim I will consider institutional communication and press clips available online, related to two case studies in my country. The first case, Geological Carbon Sequestration (GCS), is a high-tech solution internationally studied to solve global warming, almost unknown to Italian public. The second case concerns the possible health effects of exposure to Electro-Magnetic Fields (EMF) that in Italy has been the cause of deep controversies among environmentalists, scientists and politicians. Both these cases show an important influence of environmentalists on people and institutions and a great difficulty for scientists to address their message to society.

Key words: Environmentalists, scientists, public.

Text

Introduction

In August 2002 I have published an article in a popular science magazine concerning GCS, a technique studied by my colleagues of Fluids Geochemistry Laboratory.[1] The international scientific community is studying the possibility of storing in some geological sites the CO_2 coming from sources contributing to global warming. Satisfied by my article, my colleagues invited me to attend an outstanding conference in Kyoto, where, in the controversial case of ocean storage, scientists themselves were presenting case studies in public and institutional perception.
Environmental organisations were considered the main cause of experiments' refusal.[2,3] When invited to a workshop on risk perception in the framework of an Italian project

devoted to the safeguard of men and environment from the EMF,[4] I found again scientists facing the difficulty of addressing their message to people. From my part, I had to conclude that an honest confrontation with the environmental organisations is a good a starting point, and now I am glad to realize that Legambiente is promoting the debate.[5] In the present paper, I will analyse some records obtained browsing the web with the aim of better investigating the relation between the two and their influence on people. The research is limited to online records and to my country.

Methodology

To obtain items I have visited the online press archive of the Italian Chamber of Deputies and of the Civil Protection; the Italian web sites of Greenpeace, WWF and Legambiente; those of ENEA, INGV and Enitecnologie, and the site of "Elettra 2000", a consortium of scientists working on EMF health effects. For further records I have sometimes used google. In the second case, I have considered highly significative the year 2001 since the Italian parliament was discussing the Law on Elettrosmog, while a legal controversy between Radio Vaticana and the citizens of Cesano (Rome) was creating a big political turmoil.

Main results

With a totality of 23 significative scores in the time-interval going from the year 2000 to April 2004, it is clear that GCS is not so much popularized, even if from one of the few clips scored we learn that experts are ready to choose sites where conducting experiments. It is noteworthy that only in Greenpeace web site, we read that they will contrast the introduction of the "Clean carbon" and consequently this technique. Most of the scores come from online magazines. I have summarized the different positions (see Table 1 below).

Concerning elettrosmog, it is really controversial the message addressed to people.

A confrontation between the Legambiente Faq[6] and those of "Elettra 2000" experts[7] is illustrative of the two different approaches (see Table 2 below).

An analysis of the press clips scored in the time interval going from 1999 to 2003, shows that newspapers have emphasized the political debate and the legal controversies between citizen committees and antennas and radio basis owners. In March 2001 a letter signed by outstanding scientists has clearly introduced their point of view in the communication addressed by the press to the public. The letter content is well reported by an American journalist.[8] I have summarized the main arguments in the following Table 3:

Conclusion

Why in Italy there is not a public concern on GCS? The answer is that since environmentalists are not taking so much care about it, nobody worries and the press can be positive. On the other hand, Elettrosmog controversy shows that environmentalists have driven the political debate even if scientists have taken a public position. The limits for the level exposure in my country are the most severe. Compare, for instance, for RFR (Radio, TV, Cellular phones) the 6 V/m for Italy and the 60 V/m for France, Germany and Great Britain. If it is generally accepted the influence of the media on people's risk perception, the relation between the media and the environmental organisations towards the public requires more attention in the future to promote a debate where scientists could also be efficaciously involved.

Table 1 Reports the different opinions on GCS obtained in the present research. Note that environmentalists' opinions come mainly from other countries

Favourable	Not Favourable
Press clips scored in my research are mainly positive about it: • The technique, considered safe from many studies, will allow reducing CO_2 emission in time with Kyoto parameters • It is encouraged by Kyoto Protocol	Online records are also negative: • It will not solve the problem cause the gas will be released again in the atmosphere even if in geological times • It is quite expensive. Capturing and storing the gas will require further energy supply Environmentalists affirm that: • The use of this technique will encourage our dependence on carbon fossil fuels • It is a solution industry promote to keep on polluting

Table 2 Shows some deeply contrasting answers to similar Faq

Legambiente	Elettra 2000
What risks are associated to people's exposure to EMF? … Some studies have shown a high incidence of cancer and leukaemia compared to the normal referring average in population living near radio and television systems and exposed to electric fields major than 60V/m…	*Are there evidences of long-term effects due to Radio Frequencies Radiations (RFR) exposure?* According WHO, in the present scientific literature there is no evidence that RFR exposure reduces human life expectation, or causes cancer…
What steps can I take to reduce my exposure to EMF? … Avoid cellular phone with integrated antennas.	*Cellular phone with integrated antenna are more dangerous than the traditional ones?* No. Shape and dimensions of cellular phones are not fortuitous…in cellular phones with integrated antennas the best performance can be obtained that way.

Table 3 Main arguments

Scientists	Environmentalists
• The WHO does not even list EMF among the 385 agents clearly causing cancer • The 40% of cancers is due to unknown causes • There is also an elettrosmog business based on environmental issues	• Italy has a sad supremacy: 60,000 radio and TV antennas compared to the 10,000 in the Usa • We should avoid what happened with studies on lung cancer caused by asbestos exposure: Law arrived 40 years later with many victims

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UABDIVULG@: A NEW CHANNEL TO BRING RESEARCH TO SOCIETY

Octavi López Coronado

Àrea de Comunicació i de Promoció. Universitat Autònoma de Barcelona, 08193 Cerdanyola del Vallès.
Tel.: +34 93 581 33 01, octavi.lopez@uab.es

Abstract

Universitat Autònoma de Barcelona generates a large quantity of research results and knowledge on experimental and social sciences. More than 1000 research papers and nearly 300 PhD Thesis per year are produced at the UAB. Few of them, just some of the most relevant results, are published widely by means of press releases and reaches the general public. In order to fill the gap between press releases and research papers and increase the rate of research activities that reach society, UAB has added to its science communication programme a new communication channel: the web site UABDivulg@ (www.uab.es/uabdivulga). The site brings scientists the opportunity to publish at their own rhythm their research results and projects, in a comprehensible level to the general public.

Key words: Institutional science communication, Internet.

Text

Context

Universitat Autònoma de Barcelona (UAB), as a research institution, generates a large quantity of research results and knowledge on experimental and social sciences. As many others do, this institution brings some of these results to the general public by means of sending press releases to the media and publishing articles in the house organ and in the institutional web site (www.uab.es) (O. López-Coronado and A. Reig i Malla, 2001). This activities are being done with relative success. But just some of the most relevant discoveries (from the social impact point of view) can be released to the general public in this way. This implies that just a very few percentage of the research produced at the University has a stablished way to reach the general public. Therefore, there is a gap between press releases and scientific papers in the stablished science communication channels.

Objective
Science communication programme at the UAB now includes a new communication channel that fills this gap between press releases and scientific papers: the web site UABDivulg@. The aim of this web site is to bring scientists systematically the opportunity to publish at their own rhythm their research results and projects, despite of its social impact or relevance, in a comprehensible level to the general public. The web site has been designed as an information source for science journalists, scientists, institutions, enterprises, and also as a tool for educational purposes.

Methods
In order to accomplish the main objective of bringing the opportunity to every research to be published in a comprehensive level, despite of its social impact or relevance, we have tried to optimise every step in the process:

1. Getting as much information as possible. It is taken into account almost all the scientific production from the University: research articles in scientific journals, PhD thesis, approved research projects, books and chapters, etc.
2. Asking everyone to write a comprehensible article. There is no filtering in the process. Every researcher gets a general invitation to participate in this project, and everyone of them is asked again whenever he publishes a research article, gets a new project, etc. Researchers are also asked for complementary images or links.
3. Writing a very comprehensible introduction. Staff from the Public Information Office, with sicence communication skills, writes a brief and very comprehensible introduction to every article and prepares a pre-publication in the www.
4. Review process. Trying to make UABDivulg@ as rigorous as possible, researchers receive a pre-publication access to the article, in order to review it and give their approval to its publication.

Results
The primary source of information is guaranteed, due to the high numbers in research papers and PhD thesis at UAB, but the rate of participation of the researchers in communication activities can still can still be increased. From May to November 2003, we have had access to about 550 research results, PhD thesis and new projects. In every case, the principal investigator has been asked for an article to be published at UABDivulg@. In this period UABDivulg@ has received about 110 articles for publication. This means that, in its 6 first months, UABDivulg@ has achieved an average rate of participation of 20%, i.e. about 15 contributions per month. This guarantees the future feasibility of the project. Promotion of the site and evaluation of how it is reaching the public are the main future projects.
Beyond the interest of this iniciative as a way to communicate scientific research to society, we find UABDivulg@ a powerful tool for further objective sudies about scientific community participation in science communication activities. Also, due to the easy tools that electronic media brings to evaluate their audience, it will be very interesting to study public preferences and behaviours on institutional science communication.

Conclusion
We have developed a new web site, UABDivulg@, as an information source for the general public. The site brings scientists the opportunity to publish at their own rhythm

their research results and projects, in a comprehensible level, in order to increase the rate of research activities that reach society. In this site, all the contributions are written directly by the researchers. It has been achieved a rate of participation of about 15 new contributions per month, which guarantees the future feasibility of this initiative.

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OPENING THE BLACK BOX: A CROSS-NATIONAL SURVEY OF VISITORS AT EUROPEAN RESEARCH CENTRES

Monica de Pasquale-Jacobsson,[1] Monika Kallfass,[2] Federico Neresini,[3] Francesca Forno[3] and Hans Peter Peters[2]

[1] CERN, Geneva, 1211 Geneva 21, Switzerland. monica.de.pasquale@cern.ch

[2] Research Centre Juelich, 52425 Juelich, Germany. m.kallfass@fz-juelich.de

[3] *Observa-POSTER, Stradella del Garofolino, 20 - 36100 Vicenza, Italy. http://www.observanet.it/*

Abstract

In a comparative study of the visitor programmes at European research centres for physics in Germany, Greece, France/Switzerland and Italy, the contents and effects of this communication activity between the centres as producers of scientific knowledge and the public were analysed. A combination of qualitative and quantitative methods was used and more than 3600 visitors were surveyed several times. The results promote the understanding of this traditional kind of PCST activity in various respects (e.g. visit effects) and make suggestions for improving communication with the public through visitor programmes.
The research was funded by the European Union.

Key words: Public communication, visitor programmes, research centres.

Text

Introduction

Many European research centres offer regular visitor programmes and Open Days for the general public as part of their public relations work, and each year thousands of visitors, e.g. school classes, students, and groups of lay persons, take the opportunity of looking behind the scenes at these institutions for the production of scientific knowledge. But what exactly happens during these visits and whether visitors and centres benefit from them still resembles a “black box”.

In order to study these visits and their effects on the visitors we conducted a cross-cultural survey of visitors at four major European research centres: CERN (Switzerland/France), Demokritos (Greece), DESY (Germany) and LNGS (Italy).[1] The research design of this EU-funded project “Inside the Big Black Box – Analysing visits to physics laboratories” (IN3B) included in-depth interviews, ethnographic observations, and a survey. A total of 3600 visitors were interviewed before and immediately after the visit; a sub-sample was re-interviewed by telephone several months later along with a matching sample of non-visitors.

The visitors and their expectations

School classes and groups of pupils aged 15 to 19 were the predominant visitor type at all research centres, representing between 52% and 92% of the samples. The other visitors were university students, professionally interested and non-expert visitor groups.

Most visitors regarded their knowledge about the research centre as low before the visit, but their interest in scientific research as rather high (58% to 81% indicated a rather strong or very strong interest). Between 30% and 55% of the visiting pupils were interested in a science career. The visitors' initial image of the research centre and the research done there was rather positive. Prior to the visit, approx. 60% preferred public funding of research with practical benefits to basic research with no practical implications.

The visitors' main motive for the visit was a general interest in scientific research, and they primarily expected to see what kind of research was done at the centre.

The visitors' level of satisfaction

The results from the quantitative analysis revealed that the overall satisfaction was high in the four research centres. In particular visitors appreciated the possibility to ask questions to the guides and the quality of the guides' answers. Sometimes, visitors had encountered acoustical problems during the visit.

Almost all visitors (95%-98%) confirmed that they had seen what kind of research was done, and 86% - 93% had received an overview of the centre.

From the sample of visitors who had volunteered to be re-interviewed by phone several months later, most confirmed that they were satisfied with the visit. However, these re-interviewed visitors already had been more satisfied than others when interviewed directly after the visit. In contrast to the quantitative analysis, the in-depth interviews revealed other remarks: for example, difficulties in understanding the guides' explanations and a lack of involvement. The most liked items of the visit were indeed the experimental sites, because of their large size and contact with real science.

Effects of the visit

The visitor programmes of the research centres studied share several aims: to inform visitors of ongoing research activities, stimulate interest and curiosity toward science, channel scientific contents, encourage a positive attitude to research.

Based on the comparison of answers given before and after the visit we could assess the main effects of the visit concerning these aims. The visit appeared quite effective in the short run and less so in the medium term; a kind of "snowball effect" was observed, as the large majority of visitors talked with others about the visit afterwards; the visit had quite a positive effect of increasing the visitors' knowledge about the research centre and the research activity done; after the visit, the number of pupils who wanted to become a scientist increased, even if this positive effect was lower in the case of physics; visitors' knowledge of some fundamentals of physics increased, although to an extent which varied from case to case and was not always so evident.

Surprisingly, despite a high level of satisfaction, the visitors' image of the research centre and its research was hardly changed by the visit.

Conclusion

With respect to the general goal of improving communication between science and society, the research centres play a strategic role based on their distinctiveness as

institutions for scientific knowledge production and dissemination.
In this regard, visits to these authentic places for the production of science can be an invaluable experience for visitors, as confirmed by their high level of satisfaction. Therefore the possibility of this encounter with research in progress and the occasion to have a look behind the scenes should not only be maintained, but also further used. Our research project has also provided a lot of insights for improving the visits and for reflecting on their relevance as PCST tools.

Notes

1 Besides the authors of this paper the following partners collaborated in the IN3B project: Roberta Antolini, LNGS, Lida Arnellou, University of Patras, Massimiano Bucchi, Observa-POSTER; Paola Catapano, CERN, Kostas Dimopoulos, University of Peloponnese, Stella Efthimiopoulou, Demokritos, Giuseppe Pellegrini, Observa-POSTER, Heiner Westermann, DESY. Project reports: http://user.web.cern.ch/info/IN3B/Reports.html

ARGENTINA'S SELLING OF A NUCLEAR REACTOR TO AUSTRALIA. SCIENTIFIC INFORMATION AND PERCEPTION OF RISK

Leonardo Vaccarezza,[1] Carmelo Polino[2] and María Eugenia Fazio[3]

[1] Grupo REDES, Mansilla 2698, 2° piso, C1425BPD, Buenos Aires, Argentina. Tel./fax: +54 11 963 8811/7878, vaccarez@mail.retina.ar

[2] Centro de Estudios sobre Ciencia, Desarrollo y Educación Superior (REDES), Mansilla 2698, 2°, C1425BPD, Buenos Aires, Argentina. Tel./fax: +54 11 963 8811/7878, cpolino@ricyt.edu.ar

[3] Centro de Estudios sobre Ciencia, Desarrollo y Educación Superior (REDES), Mansilla 2698, 2°, C1425BPD, Buenos Aires, Argentina. Tel./fax:+ 54 11 963 8811/7878, mefazio@ricyt.edu.ar

Abstract

This paper focuses on analyzing a public controversy started in 2001, when INVAP –an Argentinean firm belonging to a provincial state– obtained an international tender to build a nuclear reactor in Australia. This case allows both a review about social perception of technological risks and limits, and conditions of the citizen participation in science & technology sphere. Furthermore, to promote this kind of public appropriation is useful to consider other approaches toward the idea of the scientific culture in society.

Key words: Citizen participation, public perception of risks, public information.

Text

Context

Different surveys around the world support that most of the society trusts on the ability of science both to solve problems and improve the quality of life. Sometimes, however, the confidence diminishes when controversial ideas about risks that arise from technological development appear in public opinion. In some cases, these situations mobilize citizen participation.

The intersection between science & technology, risks, and citizen participation in a social controversial context was described in a joint investigation of RICYT/CYTED and OEI. As a part of that research, six Argentinean cases of "citizen participation" were characterized in order to analyze techno science and social processes. One of the main goals of the project was to include citizen participation in public policies agenda of science &

technology in Latin American countries. There are at least two arguments to point out in that direction: one of them, the public culture of participation in S&T is poorly installed. A regional pilot survey also carried out by RICYT and OEI in cities of Argentina, Brazil, Spain and Uruguay showed that less than 10% of the persons interviewed had been actively involved in some activities of citizen participation.[1] The second one, to understand this type of social processes is important because of public institutions admits the relevance of citizen participation but there are not public institutionalized structures to support it. In addition, to continue systematic investigations about citizen participation could facilitate the clarification of this incipient social research concept.

Results

Argentina has a strong tradition in nuclear research. Generally, nuclear research and civil Argentine society have had a pacific coexistence. Nevertheless, at the middle of 2001, when the Argentinean enterprise INVAP won an international tender to build a low power nuclear reactor in Australia, a controversy was installed in public opinion. As a backing for the contract an agreement was signed between the states that included a clause which unleashed the controversy: in case that Australia requested it, Argentina should recycle the combustible used by the reactor.

Five social actors were directly involved. Their positions were the following:

- Environmental organizations (Greenpeace and Amigos de la Tierra in particular), stated that this contract would turn the country into a "nuclear waste disposal". From the beginning, these actors installed an effective media campaign: the general tonic was apocalyptic images about nuclear dangerous consequences for environment and health.
- Most of the scientific community rejected the condemnations and emphasized technological and commercial success. Furthermore, scientists accused environmental organizations: they said that, eventually, there would no be "nuclear waste" but used up fuel from the reactor. However, they reacted later, even not clearly, and lost "the battle" in the media.
- Government's authorities supported scientific community's arguments.
- The media system was the principal scenario where the actors showed their points of view. However, the environmentalist influence predominated in the media.
- The society. First, people who lives close to the place where the used up fuel from the reactor should be treated. This people relied environmentalist's arguments; in particular, a group called Asamblea Barrial de Ezeiza. Second, media readers and viewers in general.

In a few months, the controversy disappeared as a new in the journals. Yet, public exposition avoided, at least for the moment, that the National Congress endorse the bilateral agreement. Even though, INVAP goes on building up the reactor as it was planned. The controversy remains latent. The conflict will become public once again.

Conclusions

The citizens' participation implies the existence of opportunities to accede to and appropriate of scientific contents and reliable information, as well as the involvement in the decision-making on public policies and in the social debates on these subjects. The "scientific culture", so understood, supposes a kind of conscience acquired by citizens. This case shows that effectively existed some kind of citizens' participation. But, can be said that the involved actors have fostered a democratic participation in the terms above

described? Probably no. Participation was restricted to a dispute of interests that weakened the possibility of a social learning. In this sense,

- Greenpeace attempted to mobilize population from fear, appealing to the usual phantoms about nuclear power. The style of the protest reduced the possibility of a democratic debate.
- Scientific community holds a basically defensive attitude, with an ineffective communication policy, and could not give an answer to the subjective perception of risk experienced by the public, an issue that environmentalists knew how to appropriately exploit. That is an evidence of the lack, into the scientific system, of practitioners capable to articulate with the rest of society.
- Government did not assume a role as articulator. This reveals the lack of permanent policies and structures capable to answer the citizen's participation.
- Media privileged spectacular information and not the research journalism.

These results are important data for the public policies aimed to put in touch science and society. The pointed deficiencies allow to suppose that the existence of spaces for debate or the circulation of information don't guarantee by themselves an effective participation. The public was caught into a crossed -interests logic and stood outside of a fundamental discussion: the future of the management of radioactive waste in the country and, largely, of the nuclear policy.

Notes

[1] This comparative methodological non-statistical survey was answered by 300 people in Buenos Aires (Argentina) and 150 in Campinas (Brazil), Salamanca y Valladolid (Spain), and Montevideo (Uruguay).

Parallel session 20

Museums and science centres in the transmission of cultural diversity

PROGRAMS OF SOCIAL PARTICIPATION OF THE SCIENTIFIC OBSERVATORY OF THE MEDITERRANEAN CITY

Sílvia Bravo,[1] Carme Prats,[2] Pau Senra[1] and Tina Roig[1]

[1] Observatori Científic de la Ciutat Mediterrània. Avda. Marquès de Comillas s/n. Poble Espanyol-Parc de Montjuïc. 08038 Barcelona. Tel.: + 34 93 426 1999, cimciencies@mail.bcn.es

[2] Subdirecció General del Patrimoni Cultural. Direcció General del Patrimoni Cultural. Departament de Cultura. Generalitat de Catalunya. Portaferrissa, 1. 08002 Barcelona. Tel.: + 34 93 316 27 40, fax: + 34 93 316 27 52, carme.prats@gencat.net

Abstract

The Scientific Observatory of the Mediterranean City (SOMC), the program of public communication of Science leaded from the Science Centres and Museums of Catalunya, promotes projects to introduce science to all audiences, using new technologies and background experience of traditional museums. Three successful projects have already started:

1. Medciencies Forum (www.bcn.es). Experts introduce different subjects to promote the participation of online users.
2. laTalaia laboratories. Experimental laboratories to promote the participation of general public.
3. The Scientific Autumns of Barcelona. Online and live activities around a given subject to promote the participation of general public as well as scientific discussion.

Key words: Public Understanding, Science Museums, Citizen participation.

Text

Context

The Scientific Observatory of the Mediterranean City (SOMC) is the program of public communication of Science, leaded from the Science Centres and Museums of Catalunya, using the new technologies of information and communication.

Objective
The SOMC wants to promote interdisciplinary projects to introduce science to all audiences to help science museums to become a reference centre of science learning and interpretation.

Methodology
Different agents of our society- scientists, museum experts, teachers and general public- are encouraged to participate in the projects of the SOMC. The idea is to bring together the new trends in communication and the background experience of the traditional museum, to develop new formats to approach science to the general public. The production of new resources for formal and non-formal education as well as spaces for transversal scientific discussion is also pursued.

Results
Up to now three main projects are already working which have been proved as successful tools to articulate the science communication action from different science centres. The participation of students and general public has fulfilled initial expectations.

1. The online forum in Medciencies (www.bcn.es)
Three different subjects are proposed each year, introduced by short texts and questions by experts. The participation of all internet users visiting Medciencies is the final objective. Up to know five different forums have already been proposed about physics, obesity, Earth's climate, biodiversity and evolution.

2. The laboratories in laTalaia, the digital scientific bulletin
Experimental laboratories to be performed at home or in the colleges are proposed by teachers and educators. The participation of students and general public with science curiosity is the final objective. Up to now 16 different laboratories have been proposed, one at each edition of the digital bulleting, covering all science subjects. The bulletin has already more than 1,500 subscribers, many of them from professionals and people interested in science education.

3. The Scientific Autumns of Barcelona
Online and live activities are proposed, around a different subject each year, to allow the introduction of general public to a given subject as well as the scientific discussion from different approaches. Up to now, two editions have taken place, one about biodiversity and another about evolution. The participation of museums, research and scientific communication groups is achieved by their collaboration in the organization. More than 20 different institutions have participated in each edition and the SOMC is working to increase this number in the coming edition. The participation of general public is achieved by concentring the live activities during the Science Week of the city and through the online services of the Observatory. Around 1000 people have participated in the live activities in each edition and a much larger number in the online activities (taking into account the number of visits of our web portal, more than 140,000 during 2003, a number that has been increasing since the activity of the SOMC started).

Conclusions

The Scientific Observatory of the Mediterranean City has started specific programs to promote the researches and collections of the catalan museums, as well as the researches performed in universities and other scientific centres. Three different projects are already working, which have achieved an important participation of different sectors of the population.

Notes

[1] The web portal of the SOMC can be found at www.bcn.es/medciencies. All the contents have been developed by the team of the SOMC with the collaboration of many scientists, teachers and museum experts (among others). New products and contents are being developed and will enriched this portal in the near future.

SCIENCE IN MUSEUMS, NOTES FROM A PERIPHERAL EUROPEAN COUNTRY

Ana Delicado

Instituto de Ciências Sociais da Universidade de Lisboa, Av. Prof. Aníbal de Bettencourt, 9, 1600-189 Lisboa, Portugal. Te.l: 00351217804700, ana.delicado@ics.ul.pt

Abstract

This paper aims to discuss what connection is there between science production and science communication through museums in a peripheral European country (Portugal), where the development of both science and scientific museums is very recent.

Key words: Scientific museums, Portugal.

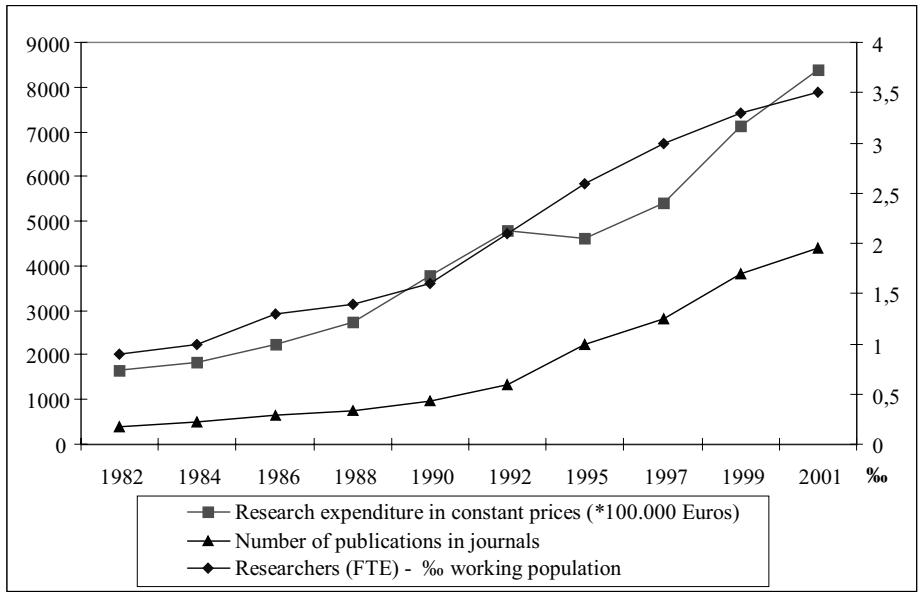
Text

Opening remarks

This paper is partly inspired by an episode that occurred at a workshop on communicating science held in Portugal last year. The session was being chaired by a journalist and his opening words were to this effect: since there is not much science being done in Portugal, the main mission of Portuguese scientists in communicating science is to help us, journalists, translate information about the discoveries and innovations made in other countries.
Though it is true that Portuguese science is far from being in the lead of international R&D and Innovation, it has experienced in recent years a surge of investment and growth that seams to have failed to attract the attention of the public and of the media. What part do scientific museums play (or fail to play) in disseminating information about current research being done in Portuguese institutions?
Drawing on ongoing research for a PhD thesis,[1] this paper attempts to debate this issue, based on interviews to museum and science centre directors and to the head of the national agency for promoting scientific culture, as well as documentary and exhibition analysis.

The growth of scientific research in Portugal

After centuries of neglect (Gonçalves, 2001), Portuguese science has grown considerably in recent years: the number of research centres and research personnel has augmented, government funding and total research expenditure have risen, the research results are



Sources: *OECD, Main Science and Technology Indicators database, 2003; Observatory of Science and Higher Education (Portugal); ISI, National Citation Report for Portugal 1981/2002*

Figure 1 Research expenditure, researchers and publications in Portugal (1982-2001)

increasingly divulged among the world scientific community, through publication in international peer reviewed journals (see Figure 1).

This development has been mainly due to three factors: political change (the transition to democracy thirty years ago, the creation of a Ministry for Science and Technology in 1995), the expansion of higher education (a substantial increase in the number of graduates, the establishment of dozens new public and private universities in the last two decades) and integration in the European Union (which has meant not only access to structural funding but also the need to comply with common policies for promoting research and innovation).

The growth of scientific museums

The late development of Portuguese science has been reflected on the creation of scientific museums (see Figure 2). Before 1970 there were merely a few natural history museums, botanical gardens and zoos. Since then, just three science museums have been created and only one of these is regularly open to the public. However, in recent years, government investment has also reached the area of scientific culture, through a large array of initiatives that have included the creation of science centres scattered throughout the country and some support to more traditional science and natural history museums.

These scientific museums are affiliated either to universities or to the Ministry of Science or to local authorities. Nevertheless, in the majority of cases there is a strong participation of university lecturers and researchers as directors or in scientific advisory boards.
But does this mean that these museums attempt to show what kind of science is being produced in Portugal?

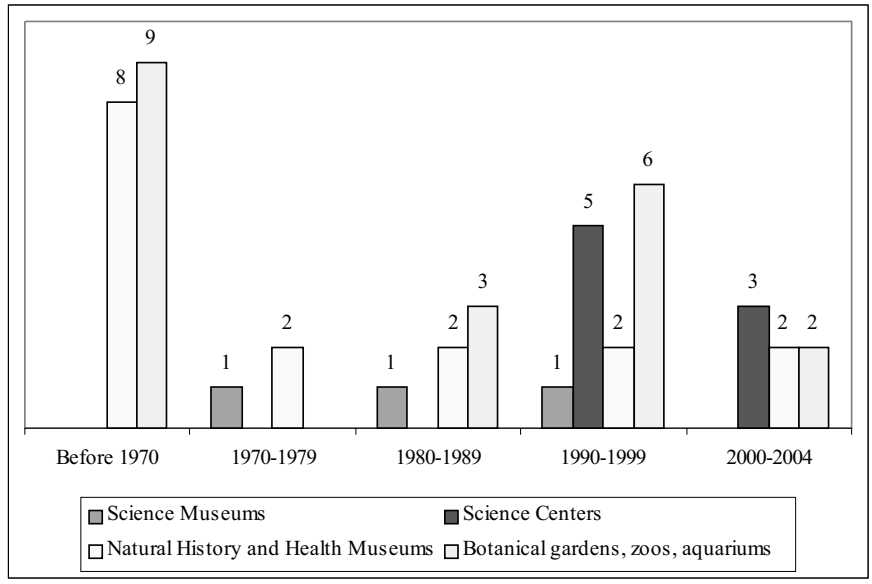


Figure 2 Scientific Museums in Portugal, by type and by first year of opening

Scientific research in scientific museums

Sadly, no. Though there are known difficulties in exhibiting contemporary science (see several articles in the works edited by Farmelo and Carding, 1997, and Lindquist, 2000), most museums make absolutely no mention to current research and to Portuguese research centres and researchers. Partly due to the financial constraints that hinder most of the museums, there is practically no homegrown development of exhibitions: there is still a strong reliance either in traditional historical presentations or in ready-made displays acquired abroad. Since science diffusion activities have very little value in scientific careers, most museums are chaired or advised not by active researchers but by professors approaching retirement. Additionally, one of the science centres, run by an industrial association, had plans to include an area where research institutions could show to the public (and to prospective business partners) their new research results, prototypes and innovations. Yet, this has never been put into effect, given that no researcher has ever shown interest in the initiative.

However, there are exceptions. On the one hand, since most natural history museums also function as research centres, some do include in their exhibitions a few references to their research activities and to the scientific labour that underlies the items on display (this is more common in palaeontology exhibitions). On the other hand, most museums and science centres promote many other activities besides exhibitions in which scientists appear fairly more interested in participating: lectures, debates, live experiences, field visits and guided tours of laboratories.

Though science is by nature universal, if public understanding of science is to be achieved through scientific museums, it seems quite a lot more effort has to be put into exhibiting current Portuguese research.

Notes

[1] The PhD research is being supported by a grant from the Fundação para a Ciência e Tecnologia.

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STRATEGIC PARTNERSHIPS BETWEEN MEDIA AND SCIENCE CENTRES: THE FLANDERS CASE

Erik Jacquemyn

Technopolis, Technologielaan, B 2800 Mechelen. Tel.: +32-15-34-20-20, Fax: +32 1534 20 10, erik@technopolis.be

Abstract

Science centres are among the important actors in science communication. To fulfil their mission, they use different channels. Some of these, print and broadcasting are the core business of the media. To serve large audiences, the media are in search of content. Science centres - having content - look for large audiences. Science centres can deliver high-value content, a chance to physically meet the audience. Media can deliver efficient channels to the public. Technopolis has developed strategic partnerships with different types of media in Flanders :examples prove these to be very successful resulting in a real win-win-win (centre, media, public)

Key words: Science centres, media, popularisation.

Text

Flanders has one science centre, Technopolis. It opened in 2000, and is already one of the international reference centres. Technopolis offers 260 hands-on exhibits, plus temporary exhibitions, shows, demos, an automatic theatre, all interactive and close to everyday life. Next to this Technopolis organises various outreach activities.

But how to reach the target groups?

Marketeers advise to pay attention to the 4P's: Product, Place, Prize and Promotion.
To product, place, prize and promotion, Technopolis adds a fifth P: Partnerships. In order to serve a large audience, the media search for content. While science centres have content, and search for a large audience. Both parties can cater to each other's needs. Science centres can deliver high-value content, an aura of trustworthiness, a place to physically meet the audience. The media can deliver an efficient channel towards the broad public. Both can offer each other a strong brand to be associated with. So why not become strategic partners?
In a well chosen partnership, the science centre finds a series of advantages: an instrument for product placement; a long term engagement with constant repetition of its message and editorial space in stead of advertising space. At the same time one must pay attention not to compromise on the content.
The arrangement is advantageous to the media too: they receive dependable, high quality content; tone up their image and credibility; get a location for recording and broadcasting and get a physical location to organize events. But the public also wins : it is better served,

in an integrated and consistent way. So a strategic partnership in science communication is a Win-Win-Win: both partners are better off, and the public gets better informed.
Technopolis has several of such strategic media partnerships. For instance with the national radio station Radio 1. Technopolis offers visibility and a location for live-programmes and special events for listeners, the radio station offers media space. For a popular radio programme where the public helps answering questions related to science and technology, Technopolis offers content and location, and is present in the programme in an editorial way. The hosts of the programme are godparents of the Technopolis hot-air balloon. When the producers of the radio show wanted to derive a book of it, they got the know-how of Technopolis, and its credibility, in exchange for visibility on the book cover and presence on the air. The book was an instant bestseller. The publisher of the book, Roularta, used a popular exhibit of Technopolis to enliven its stand at an important book fair, while Technopolis used this to "edutain" the numerous visitors of the fair.
The TV show Hoe?Zo! (How's That? That's what!) is shot in Technopolis. Technopolis delivers scientific advise and some content; in return it receives prime time visibility and promotion (during trailers). The show has a market share of 42% and a rating of 8.5/10. When the show was looking for young co-hosts, Technopolis offered the location for the casting. With animation Technopolis made an event out of the casting. In return Technopolis got promotion on screen during the calls for talent, and a large number of young visitors during the resulting Hoe?Zo! day.
The children's television programme Curieuzeneuze (Nosey Parker) on everyday science was launched by Technopolis: a school class asks a question –e.g. why does hair turn grey?– and presents the answer, and their search for it, on TV. Technopolis delivers content, produces the video material and gets back visibility. From the start Curieuzeneuze was the most popular programme on the kids channel. In the meantime, science is promoted as interesting, research as rewarding.
A leading national newspaper, Het Nieuwsblad, made an exhibit with Technopolis: the visitor produces a personalised newspaper front page. Technopolis gets media space in the journal. The journal has a market share of 41%.
Two regional newspapers receive from Technopolis free scientific content for their Questions & Answers column. These newspapers have a market share of 30.5%.
A leading publisher of educational books, Kluwer, used input from Technopolis to enhance the appeal of a school book on technology. Technopolis got product placement, a good link into schools and another channel to deliver its popularising message.
Together with another publisher, Davidsfonds, Technopolis uses its popularisation and scientific know-how for co-editing of a youth encyclopaedia on communication; Technopolis again gets a novel channel and visibility.
The Flemish monthly science magazine Eos gets from Technopolis a location for its events. It offers media space, and free copies of the magazine for Technopolis visitors.
Another publishing company, Averbode, with a market share of 65% in school weeklies, gets from Technopolis content and a location for events; it gives editorial space in return.
The same publishing group runs Kidcity, a leading website for kids. Technopolis brings in the content for the scientific part of the site, and it gets an electronic channel and an audience in return.
In all of the mentioned cases, both partners were better off. Technopolis always pays attention to the balance of offer and return, only partners with strong brands or market leaders and doesn't allow any compromise on the content. Finally the public gets better informed. Win-Win-Win, that's called.

ART AND SCIENCE AT AN EXHIBITION: MUCH MORE THAN SIMPLY PICTURES

Sergio de Régules

Dirección General de Divulgación de la Ciencia. Universidad Nacional Autónoma de México, sregules@universum.unam.mx

Abstract

A new exhibition being created by the Universum science museum and the Mexican National Institute of Fine Arts explores the deeper connection between art and science. It shows how both originate in the human brain and how they are informed by the brain's peculiarities. One section explores how our brains make meaning out of patterns and structure. Another suggests that theory building in science is guided by aesthetic criteria such as parsimony and unity in diversity. The exhibit as a whole suggests that art and science are the same search for structure, a search spurred by the pleasure of creation.

Key words: Art, science, museums.

Text

Introduction

Mysterious as art and science may sometimes seem, their roots lie ultimately in the material processes of the human brain. As argued in Wilson (1999) and Pinker (1999), our brains are machines designed by evolution to solve specific problems. Consequently, the mind is not a blank slate that only experience can mold, but a structure of hard-wired processes that dictate a well defined human nature (Pinker, 2002). Connections are therefore to be expected between everything humans do, particularly between art and science. As Miller suggests (Miller, 2001), "Instead of referring to an 'interplay' between art and science, we must begin to speak of ideas that were developed in common by artists and scientists." A novel approach to presenting art and science in a science center is to explore these ideas.

The exhibition

The exhibition opens with a section on the senses as "feelers" whereby the brain takes in the outside world. By means of tactile enigmas, optical illusions, and musical stimulations, this section suggests that perception is a collaborative effort between the sense organs and the brain.

The second section presents the brain as an interpreter (Gazzaniga, 2002). In order to make sense of the myriad stimuli it must deal with, the brain has evolved to excel in a number of tasks, such as connecting the dots (finding patterns) and reading between the lines (completing missing information –or making it up!). These abilities are important in both science and the arts. In science they are an essential part of theory-building. In the arts, cinema and good writing, for example, convey meaning without tiresome explanations by letting the public connect dots and read between lines.

But why did we evolve these capabilities? The answer is a dictum for fitness in the environment of our ancestors: predict or perish. A knack for predicting the behaviour of nature, or of your neighbours, was adaptive in the Palaeolithic environment where the brain evolved, as indeed it still is.

Pinker (2002) writes: "Organisms get pleasure from things that promoted the fitness of their ancestors" (p. 405). We suggest that the joys of art and science are associated with the pleasure we get when using our brains to seek or create symmetry, order, harmony, structure; in a nutshell, the pleasure of finding form (science) and creating form (art).

The main section of the exhibit explores some of Miller's "ideas developed in common by artists and scientists." The Mexican playwright Bertha Hiriart, in Castro (2003), describes the art of drama as a search for accuracy, order, and beauty. As it turns out, that is not a bad description of science. There are other convergences. Science and the arts share a passion for unity in diversity and for hidden meanings. They also share the need for imagination and acute observation. These convergences are illustrated by examples from both disciplines.

Outlook

From the outset it was decided that the exhibition would not be explicative, but only suggestive, of these ideas. Text was to be kept at a minimum in accordance with the basic tenet that reading between the lines, or supplying missing information from clues, is one of the main adaptive abilities of the human brain and one on which art and science rely heavily. The exhibit does not impose a message on visitors. It proposes stimuli and experiences that point in the general direction of a new assessment of the link between art and science.

One message we do expect our visitors to take away with them is that science and the arts are not the antagonists that common belief makes them out to be. This may help pave the way to a better understanding and appreciation of science as an important part of culture.

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STRENGTH IN DIVERSITY: A NEW SPORT EXHIBITION COMMUNICATES SCIENCE WITHIN A CULTURAL CONTEXT

Jesse Shore

Senior curator, sciences. Powerhouse Museum, PO Box K346, Haymarket, New South Wales 1238, Australia. Tel.: +61 2 9217 0176, fax: +61 2 9217 0355, jesses@phm.gov.au

Abstract

Sport: more than heroes and legends, an exhibition at the Powerhouse Museum in Sydney, Australia, presents science and technology along with the design, culture, history and fashion associated with sport. Diverse themes are woven together and communicated throughout the exhibition using varied display media including showcased objects, interactives and audiovisuals. Although complicated to develop, the resulting exhibition is a varied learning environment which engages a wide range of visitors. I justify the extra effort because I believe the general public grasps a greater appreciation of science when it is presented within a broad and meaningful social and cultural context.

Key words: Sport, culture, diversity.

Text

Approach, messages and audience

The *Sport: more than heroes and legends* exhibition covers the science, technology, design, culture, history and fashion of sport. We interrelate these diverse topics to show many ways that sport and society interact.

Important messages which appear in various guises through the exhibition include: that many women, indigenous Australians, migrants and disabled people are sporting achievers; the role of sport for health; wear protective gear to play sport safely; and a featured section about unsung volunteers and others who contribute to the Australian sporting culture. While the exhibition focuses on Australian involvement in sport it has an international context.

This large and varied exhibition contains a lot for nearly everyone, even for those who think they have no interest in sport. Visitors wander through the exhibition very much in an exploring mode, with various displays capturing and holding the attention of different people and much intergenerational interaction. The interactive exhibits are intended for all users but hold special appeal to children.

The strength of the exhibition is its coherent diversity. More than 60 sports are represented in unexpected and pleasing ways at every turn. Frequently the curious, beautiful or historical content captures a visitor's attention and they are drawn to explore surprising links between disparate subjects. The interactives are mostly science related, engaging to use and encourage the visitor to contemplate some relationship between what they do and the concepts involved.

Fight - an opponent: combative sports area of *Elite and Olympic sports* section
The showcase at rear presents unarmed combat sports of different cultures, protective equipment worn to limit injuries and how boxing has inspired fashions. At nearby interactives, visitors use a scale to find their weight class for various sports, learn how their body is a 'human sport machine' and handle athletic field equipment (far left).

Science and technology content
There are more than 100 stories about and references to science and technology in the exhibition. They cover the past, present and possible future and are often linked to fashion or design topics. Some subjects covered are:

- the evolution of a wide range of playing and protective equipment,
- how the body works to be a 'Human sport machine',
- effects of performance enhancing drugs,
- why it is important in many sports to minimise wind resistance,
- effects of changing technologies on sports, and
- how new materials can even lead to new sports or increase accessibility.

Other content includes eight international and regional fashion stories, numerous examples of design, several cultural topics and many historical references. The exhibition combines more than 700 items (most in showcases), 15 interactive exhibits, more than 30 audiovisuals and many graphic elements.

Science in a diverse context
I believe science and technology becomes more engaging and intriguing to a wider audience when ideas are placed within a broad and meaningful social context. To do this for an exhibition requires researchers with varied subject backgrounds working together. They develop the diverse themes and propose appropriate and varied ways to communicate individual or related ideas - this leads to a multiple-media exhibition. The team must also develop a simple and flexible structure to bring coherence and focus to the rapidly multiplying stories. The exhibition design process balances the content with a variety of experiences and moods throughout the final display.

Exhibition evaluation
An interview-based evaluation of 200 visitors to the Sport exhibition finds that 98% of them would recommend the sport exhibition to others, the highest rating we have achieved for any internally or externally developed exhibition. 95% of those interviewed rate the exhibition as 'good' or better with 19% saying it was 'extremely good'. Visitors' thoughtful comments about 'preferred aspects' of the exhibition and 'learning responses' were encouraging, but there were relatively few specific mentions of science and technology. A more focussed study would be required to determine how many visitors were appreciating the science information.

Organising concepts – first the labels, then the gallery
Verbs, such as 'run', 'jump', 'fight', 'hurl and heave', 'celebrate' and 'kick', are used as a means to organise and unify information. These engaging action and emotion verbs show up in heading and subheadings of most labels. Labels vary from telling stories of individuals or events, to explaining technology and how it has affected the sport, to placing fashion in social and other contexts, to relating scientific concepts to sport.
The verbs are grouped to form five exhibition sections:

1. Elite and Olympic sports: Australians at the world's games.
2. Weekend warriors and watchers: playing the most popular sports.
3. Bats, balls, bows, bullets: and super sports gear.
4. The great outdoors: sports in the elements.
5. Heroes and legends: and your personal best.

Fight – for acceptance: the semi-sweet social science of boxing showcase
A display which explores the relation between sport and social class and skin colour.

Interactive exhibits
Many of the interactive exhibits achieve the challenging goal of being fun to use while making the visitor think about what they are doing. Experiences range from handling athletic field equipment or role-playing while standing on a victor's podium to more complex doing and learning activities involving kicking, jumping, throwing, aerodynamics, physiology, weight classifications, sports media technology, evolution of sports clothing and textiles, biomechanics of diving, surfing and sailing.

Public and educational programs
A wide range of programs complement the exhibition, including for people with a disability.

THE CATALONIAN MUSEUM OF MEDICAL HISTORY AND THE PROMOTION OF SCIENTIFIC CULTURE

Alfons Zarzoso

Museu d'Història de la Medicina de Catalunya, Passatge Mercader, 11, Barcelona 08008, Spain.
Tel.: +34 93 216 05 00, fax: +34 93 216 05 00, azarzoso@museu.comb.es

Abstract

The Catalonian Museum of Medical History is developing a project that involves the move to a new building and the definition of a new museological proposal. The main objective is based on the consideration and value of antique scientific instruments as a means for the promotion of scientific culture. Integrating the understanding of an antique scientific instrument and the experimental practices associated to it is not an easy task. This contribution tries to cope with such a challenge by showing the need of creating team works of historians, teachers and curators in order to develop historical and didactic research projects.

Key words: Antique scientific instruments, science museums, teaching and history of science, technology and medicine.

Text

In the last few years, historians, teachers and curators interested in the history of science, technology and medicine have pointed out the explanatory potentiality of antique scientific instruments.[1] Such a kind of instruments, it has been maintained, holds three remarkable features:

1) its value as a category of historical analysis in order to widen the interests of history of science;
2) also its capability to stimulate a critical reflection as a complementary resource available to science teachers;
3) and finally the opportunity of transforming those museographical objects into tools of science popularisation.

So, this contribution stresses the importance of antique scientific instruments in order to tackle the history of science, technology and medicine, not only as a support for the teaching of science, but also as a means to place science, technology and medicine in the social context of our culture by providing useful materials and elements to school teachers. Not only these objectives would be pursued, but also that of medical education by addressing relevant issues in health and medicine. There is therefore a firm conviction that by resorting to these kind of antique objects, the Museum would become and act as a complementary place to address scientific concepts in context alongside with the promotion and explanation of ideas on a healthy lifestyle.

But this is not an easy task and it seems that the main question is how to put into practice this objective. Such an objective requires the creation of working teams of historians, teachers and curators (and also other kind of professionals, such as physicians, scientists or educators). In our proposal the emphasis on the explanatory capacity of antique scientific instruments, before becoming closed instruments like black boxes, lies in their available information on the theoretical assumptions brought in their conception, design and use.[2] Such a feature becomes an important didactic resource for the teaching of sciences because antique instruments allow showing concepts of scientific research, methodologies and experimental practices hidden in the modern ones.[3]

Our proposal is that the Museum collection of artefacts, submitted to an accurate

museographical plan, becomes instrumental and complementary to the contents and materials previously worked and elaborated in classrooms. There are lots of instruments that allow creating scientific activities that relate our daily life with science and history. It seems important in this way not to take scientific commodities for granted, but to take advantage of every raised question to develop tasks related to methodologies of scientific research and production or features of scientific terminology. It is possible to hold, in an eclectic way, some of the museographical forms of showcase museum exhibits by merging them with key aspects developed recently in science or health centres.[4] So, beyond the aesthetic attraction of antique scientific instruments, the idea would be a museographical combination of *look at this* and *touch this* that permits obtaining first-hand experiences and provoking reflection.

Notes

[1] Bennett, 1997; Taub, 1998; Bragança, 1999; Álvarez Lires, 2000; Cuesta, 2002.
[2] Pinch, 1992.
[3] Bertomeu & García Belmar, 2002.
[4] Wagensberg, J., 2000.

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COMMUNICATING SCIENCE AND TECHNOLOGY THROUGH A TRANSPORT MUSEUM IN SOUTH AFRICA'S DIVERSE COMMUNITIES.

Thulasizwe Mngomezulu
Department of Transport, South Africa

Abstract
The cultural institutions through which science is communicated are reflective of our cultural and historical diversities. Public communication of science and technology will be effective as long as these diversities continue to be reflected. South Africa is most probably among the few countries in the world where these diversities have been enshrined within the context of the modern constitution. The Proposed National Museum of Transport is an attempt to utilize this nationhood through public communication of science and technology.

Parallel session 21

Science Week: evaluating experiences

THE BALEARIC ISLANDS SCIENCE FAIR: A NEW EXPERIENCE OF SCIENTIFIC POPULARISATION

Enric Culat Pascual[1] *and Bàrbara Terrasa Pont*[2]

[1]Journalist, Director of Balears fa Ciència, Última Hora Ràdio, Joan Muntaner i Bujosa, 45, at K. 07011 Palma, Illes Balears (Spain). Tel.: +34 696 910 010, enric.culat@wanadoo.es

[2] General Director of R & D, at the Conselleria d'Economia, Hisenda i Innovació (Ministry of Economy, Finance and Innovation). Department of Biology, University of the Balearic Islands. Ctra. Valldemosa 16, 4t 1ª. 07010 Palma, Illes Balears (Spain). Tel.: +34 971 208738, barbara.terrasa@uib.es

Abstract

The administration of the local government of the Balearic Islands took the initiative to organise a Science Fair for three consecutive years (2002, 2003 and 2004), featuring the participation of the region's many research centres (University, Institute of Oceanography, Meteorological Centre of the Balearic Islands, Astronomical Observatory, Museums, etc.), educational centres of all levels and various companies in the sector of technology.

Held for three days in a tented space in Palma, the Fair offered a wide range of scientific activities. Participants, students and scientists came together in their efforts to display their experiments in an educational and entertaining way, allowing visitors to actively learn and enjoy the different activities.

Prior to 2002, the mass media seldom covered matters relating to the sciences. Information of this sort was virtually always tied to the presence in the Balearic Islands of celebrities from the scientific world. The inauguration of the Fair in 2002, however, would have great impact on the media in this sense. While the event was being held, there was widespread coverage of it in the media. Today, the inclusion of scientific news pieces has become far more common in the Islands.

As a result, from the standpoint of communication, the Fair was a milestone in the Balearic Islands, thanks to which a significant step has been taken towards raising public awareness of science and increasing its presence in the mass media.

Key words: Newspaper, Science, Fair, Young, People.

Text

Background

Society has an ever-increasing need for a certain level of understanding of the new technologies and their effects on people's daily life and future. Initiatives such as *Setmanes de la Ciència* (Science Week events) and science fairs can serve as tools to spur the transmission and distribution of scientific knowledge. The Science Fair is an interactive space, a new medium for communication. Apart from being an educational mechanism, the media also play a fundamental role in the transmission of scientific knowledge, as well as establishing a scientific awareness in society.

The Science Fair is a costly initiative. Thus we are forced to weigh up its success. Is it effective to organise scientific events with the aim of increasing the curiosity, interest and scientific awareness of the society?

Method

On the initiative of the Ministry of Innovation and Energy of the local Government of the Balearic Islands, the 1st and 2nd Science Fairs (2002 and 2003) were organised and held by a commission made up of representatives from the aforementioned local Ministry, the local Ministry of Education and Culture, the University of the Balearic Islands and the Press Department.

The event featured the participation of educational centres, the University, other science and research centres in the Islands, centres from Spain's other autonomous regions that were invited to take part, as well as administrative and business centres. The educational centres prepared an interactive and didactic science project. The research groups brought to the streets a small sampling of the experiments conducted in their laboratories, and together everyone offered a group of experiments targeted at visitors of all ages, ranging from 4 years of age to 100.

The number of participants has gradually increased, with 35 the first year and 58 the second. The Fair lasted for three days, receiving 11,000 visitors the 1st day and 18,000 the second.

For nearly two years (May 2001 to April 2003), we analysed the daily news coverage relating to research, science, innovation and the information society in the press in Palma, Majorca, with a specific focus on four newspapers: *Diario de Mallorca*, *Última Hora*, *Diari de Balears* and *El Dia-El Mundo*. Two different time spans were compared: May 2001 to May 2002, and May 2002 to April 2003. Why such specific periods? Because the news pieces in the above-mentioned media the year before the first Science Fair were compared to those of the same papers during the year following the event's celebration.

Results

Before the first Science Fair was held, between the dates of May 2001 and May 2002, 208 news pieces specifically relating to the sciences were published. Following the first Science Fair, between May 2002 and April 2003, the number of news pieces covering these matters would ascend to 480. The second period analysed ended in April, rather than May, simply due to the fact that the second Science Fair was held a month earlier, in April 2003. Despite a one-month difference in this period, the Science, Technology and Innovation news pieces published during the second period in the *Diario de Mallorca*, *Ultima Hora*, *Diari de Balears and El Dia-El Mundo* almost doubled in comparison with those published during the first period.

Conclusion

The celebration of the Science Fair has played a crucial role in increasing the Balearic Islands' mass media coverage of all matters pertaining to research, science, innovation and the information society. There are two reasons behind such increase in coverage. Firstly, the Science Fair itself has opened the doors to other science- and innovation-related events of all sorts in our Autonomous Region (with the consequential news coverage in the media). Secondly, and no less important, the celebration of an event as far-reaching as the Science Fair has awakened a growing interest in all journalists and of course in newspaper readers, as well as in radio programme listeners and television programme viewers.

CAFÉ SCIENTIFIQUE MANCHESTER: SEASONING A MEAL WITH SCIENCE

Davina Gilmore-Stewart

University of Manchester. Worldwide Universities Network. Co-ordinator, International Office, Oxford Rd, Manchester, M13 9PL. United Kingdom. Tel.: 0161 2758261, dee.gilmore-stewart@man.ac.uk. *
http://www.wun.ac.uk (part-sponsors for this paper)

Abstract

This paper will describe the benefits of the development of *Café Scientifique* Manchester as part of a worldwide movement. *Café Scientifique* is an informal discussion forum giving people the opportunity to gather in bars and cafés all over the world to discuss the great topics in science. The format allows individuals with a curiosity about science research to meet other people over a meal. The watchwords are informality and democracy: the professional scientist describes the issues which stimulate research in their discipline, and the predominantly amateur audience are considered as equals

Key words: Informality, science, café meetings.

Text

Once a month Café Muse,[1] on Oxford Road, Manchester, becomes *Café Scientifique*. It opened in March 2003 with a discussion about "those manipulating molecules" led by Professor Helen Gleeson.[2] The 50-strong audience were nano-curious people from inside and outside the University. By September, working with the North West Science Alliance[3] we hosted an all-day *Café Scientifique* at the Museum of Science and Industry[4] for the opening of the British Association's Science Festival.[5]

My colleague, Lita Denny, Community Support Manager[6] in the Regional Affairs Department[7] and myself established *Café Scientifique* Manchester, but of course it was not our invention. The 'brand' began in 1998 when former science broadcaster Duncan Dallas, inspired by the biography of Marc Sautet, the founder of the French Café Philosophique, decided to experiment with the idea of bringing science back into café culture.[8] Dallas was not aware at this time that what he chose to call *Café Scientifique* had also begun in France with the Bars des Sciences.[9] His first café was a great success and more followed. Support from the Welcome Trust[10] funded two part-time co-ordinators and helped spread the model across the country and beyond.[11] Now Café Scientifique exists in thirty towns and cities in the UK, seventeen across Europe[12] five in America, two in Canada, one in Brazil, one in Australia, and one in Singapore[13] (see Figure 1).

Fig 1. http://www.cafescientifique.org

Fig. 2 http://www.cafescientifique.man.ac.uk

At *Café Scientifique Manchester*[14] (see Figure 2) no formal lecturing takes place, the emphasis is on developing a discussion. The purpose is relaxed communication between an expert and an involved audience who want to listen and debate, while relaxing in congenial surroundings. Topics covered during the past year include reintroducing wolves to Britain; brain disease; e-Science; genes, evolution and psychology; time psychology; levitation, and sunburnt DNA.

We identified potential benefit to the University in the areas of interdisciplinarity and public understanding. The meeting of nanotechnologists and poets, philosophers and chemists is the sort of cross-disciplinary activity which does not always happen naturally. A new route of access to the University is enabled which allows ordinary tax-payers to engage with contemporary research.

We found a venue which had the right ambience and good catering, and which, importantly, wouldn't charge us anything. We then asked around, locally at first, to identify academics who are comfortable talking about their work to non-academics. When we had *20 possibles* we asked them a) would they speak in an open bar, using minimal aids and b) would they do it for free!

A challenge, but 90% of the people we approached said yes. Stage one was complete. Next we had to find the audience. Using every community and business e-mailing list we could find, we sent flyers to libraries, the local media, youth clubs, schools, professional groups, church clubs, the WI, 'urban village' web-sites, and of course to University staff and students. We asked people intending to come to confirm by phone or e-mail, so that after the first event we had a mailing list of seventy names. Now we send details of forthcoming topics and speakers, with a link to our online booking system, to everyone who has expressed an interest, creating a Café Scientifique network that grows monthly. Our expert speakers can be understandably keyed up about speaking to such a broad audience, but so far all have said that the evening was stimulating and worthwhile. Afterwards presenters provide us with some follow-up details to put on our web-site along with contact details and links.

The Manchester café is of course modelled on Duncan Dallas' original.[15] From 6.30 pm people arrive, order food and drinks and find a table the presenter then talks for about twenty minutes. There's a natural break then to allow visits to the bar and discussion of issues raised. The presenter then takes questions (in Manchester we provide slips for people who prefer not to ask direct questions) and discussion takes place for as long as it does, we finish and several people stay afterwards to talk to the speaker.

In 2004 *Café Scientifique* continues to develop. Duncan Dallas has built on an existing French model to develop Junior science cafes.[16] The British Council brought together groups in Mumbai, Delhi, Chennai, Belgrade and Kuala Lumpur[17] via web-based cafés scientifiques. In Manchester we may use Access Grid[18] technology to host virtual cafes across the 18 international research-led partners in the Worldwide Universities Network,[19] following the British Council model.[20] *Café Scientifique* Manchester has contributed to a University drive to make public engagement with science more cohesive across campus, and the building of a Public Engagement Portal.[21] *Café Scientifique* takes the public understanding of science and makes it comfy, convenient and tasty.

Notes

[1] http://www.kro.co.uk/museum/index.htm
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[5] http://www.the-ba.net/the-ba/Events/FestivalofScience/
[6] http://www.man.ac.uk/community/staff.html
[7] http://www.business.man.ac.uk
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[15] Café Scientifique, Duncan Dallas, Bars des Zincs Conference, Paris 2003.
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Fig. 3 http://www.wun.ac.uk

[17] http://www.britishcouncil.org/science/cafesci/documents/KLCreport.doc
[18] http://www.sve.man.ac.uk/Research/AtoZ/AccessGrid/
[19] http://www.wun.ac.uk, see fig. 3.
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WHAT IS THE IMPACT OF A SCIENCE FESTIVAL ON ITS VISITORS?

Laura Grant[1]

[1] Science Communication Unit, Department of Physics, University of Liverpool, Liverpool L69 7ZE, United Kingdom. Tel.: +44 151 794 6795, fax: +44 151 794 3444, L.Grant@liv.ac.uk

Abstract

In order to try and understand the impact that a Science Festival has on its visitors, a detailed evaluation of Cheltenham Festival of Science was conducted in 2003. Results showed that the Festival was a success according to its visitors, who tended to be those whose existing attitude towards science was positive. However, Festival events led to positive shifts in the cognitive and affective domains of visitors. This paper summarises the results of the survey of opinions, and raises questions about how to evaluate the impact of such a diverse event.

Key words: Science Festival, evaluation, impact.

Text

A number of Science Festivals take place each year in the UK. Each is different, but they typically consist of a diverse range of talks, debates, demonstrations and other events brought together by focusing the activities around a specific location. Cheltenham exploded on to the Science Festival scene in 2002, directed by two UK experts in Science Communication, Professors Frank Burnet and Kathy Sykes. Their vision was to create a compact, edgy Festival with an emphasis on dialogue.

Methodology
Using interviews, questionnaires, electronic voting, observation and media tracking, data was collected from over 700 Festivalgoers as well as speakers, sponsors, science communicators and media representatives. The survey largely excluded the schools events and their visitors. A follow-up survey was also conducted 6 months after the Festival.

Results
The second Cheltenham Festival of Science took place from 4-8 June 2003. Over 13,000 tickets were sold for talks, debates and other structured events, and many more visitors took part in the free hands-on activities in the Discover Zone.

Festivalgoer Demographics
Over half of the survey respondents were over the age of 45, although all age groups were represented. The gender balance was equal, and half of Festivalgoers were from the ABC1 demographic, with significant proportions being retired, or students. Festivalgoers were found to have a higher than average level of education, and were likely to read broadsheet newspapers and listen to Radio 4. A large majority of Festivalgoers were found to have positive opinions on Science before attending the Festival.

Festival Impact
The Festival generated a large amount of media coverage, with 27 articles in the national press, and 30 articles in the local and regional press. Most Festivalgoers spent more than one day at the Festival, with around a quarter spending four or more days. The Festival was successful at both entertaining and educating its visitors, and it was generally felt that events were pitched at the right level scientifically – although some visitors felt that the Festival was aimed primarily at children. A significant proportion of Festivalgoers felt that their attitude towards Science had changed after attending the Festival, and all of the shifts in attitude were positive. Interestingly, results indicated that individual talks or events were seen to have educational value, while the "Festival Experience" as a whole was likely to lead to shifts in attitude towards Science.
The talks and debates were well received, with a number being sold out. The Discover Zone (which had no entry charge) was the most-visited part of the Festival, and was most popular with visitors who had not booked tickets in advance. The results also showed that this group of visitors were more likely to have a neutral or negative opinion of Science, so the Discover Zone seems a good way to encourage their engagement.
The Science Cafés were an excellent means of engaging Festivalgoers in discussion of Scientific issues in an informal and non-intimidating environment. A number of respondents who had never taken part in similar discussions said they felt comfortable getting involved in the debates. The "Evolving Art" project, where Festivalgoers coloured in the individual pixels to make up a mural, also provided a setting for impromptu discussions between Festivalgoers.
Overall, the majority of respondents said that they would be continuing to discuss the issues raised at the Festival once they had left, and a vast majority (97%) were keen to attend future Science Festivals.

Conclusions
Responses to the Festival were overwhelmingly positive, and it was found to be a high quality, focused event. The venue helped the public gain confidence in accessing Science,

as both the Town Hall and Everyman Theatre were public spaces with no link to Science. Small improvements to the venues, such as air conditioning, would improve the Festival experience for visitors.
The Festival had limited success in attracting inattentive audiences, however Science Communicators felt it fared far better than some other Science Festivals. The Festival also succeeded in attracting audiences who had previously engaged in the Arts via other Cheltenham Festivals.
Members of the Science Communication community involved in the survey were unanimously impressed with the Festival.
Members of the follow-up sample had positive opinions about the Festival and Science in general. Many (79%) could recall the names of talks and debates attended, and the majority (78%) could remember discussing particular issues that were raised at the Festival afterwards. Over half of the follow-up sample (52%) said that attending the Festival had prompted them to actively seek out more information about Science, especially by buying books and using the internet.

Discussion
It is clear that the Festival was viewed as a success, and the results of the follow-up survey indicate that it motivated some visitors to become further engaged with Science. Is this, however, enough to justify the existence of Science Festivals, or would resources be more effectively spent on different Science Communication activities, for example role model schemes or media campaigns? Is a regionally focused Science Festival more or less effective than a nationwide Science Week? Before these questions can be answered, it is necessary to consider the way that the impact of different activities can be measured and compared.

EUROPEAN SCIENCE WEEKS: FROM EUROPEAN PERSPECTIVE TO LOCAL ACTION

Jordi Mas

Catalan Research Foundation. Pg. Lluís Companys 23. 08010 Barcelona (Spain).
Tel.: 34 93 268 77 00, fax: +34 93 315 01 40, jordi.mas@fcr.es

Abstract
The model of science events is diverse among European countries suggesting that each country has different objectives. Although a European perspective is necessary to align the general strategy of science awareness with the research and cultural policies, localization is a must in order to achieve the best results towards citizens. Science weeks should be organized, managed and promoted locally by local organizations that work close to the main target audiences. This implies that associations such as EUSCEA are relevant to coordinate and promote the local and national initiatives providing an added value to such events.

Key words: Science weeks, European perspective, target public, local initiatives.

Text
The European Commission has launched the Science and Society Action Plan in order to bridge the gap between European science and European citizens. Among other activities, one of the main issues of the plan is supporting projects scheduled for the European

Science and Technology Week (8-14 November 2004). Through its sponsorship of Science Week activities, the European Commission is determined to forge closer ties between the world of science and the lives of European citizens. One may imagine that the Science and Society Plan lays at the base of the European Research Area to assure the flow of human resources and public interest for its development. Moreover, the new kind of governance that arises from the deployment of the knowledge society asks for providing high-quality and readily understandable scientific information as well as increased access to scientific culture. Progress in science and technology can then be democratically understood, evaluated, studied and debated. Although this approach must be structured within a European perspective and based on traditional shared values of justice and solidarity, it is not fitted for action. Cultural diversity and local sensibilities cannot be programmed at the European level. Diversity in local cultures, languages, social structures, organizations, governance particularities, and so on, make it difficult to achieve the desired results using the top-down approach. European perspective is desirable but local action is essential.

Beyond every science week event lays a communication strategy. Ideally a single message should be send to a single target audience through a single channel. When you focus your target and message you have higher chances of success. Because of the many features that intervene in the social, political and organizational environment, focusing can only be undertaken at the local level. All sets of details such as school calendar, local languages, local holidays, specific traditions, can influence the performance of science events as a communication phenomenon. As an example, it is hard for a European newspaper, radio channel, or TV to succeed because it is hardly impossible to attract public attention with a wide defocused European content. Local initiatives are much better in planning, managing, monitoring and evaluating communication events such as science weeks. The requirement by the European Commission that projects must have a European angle to qualify for EU support adds barriers to the desired outputs. Local initiatives have closer views of the needs and the attitudes of citizens than any European program may have.

A better approach to design activities fitted to specific audiences is to promote local initiatives instead of forcing the European dimension of the events. The European Science Events Association (EUSCEA) is an association of European organizations, who produce science communication events like science weeks, science days or science festivals (www.euscea.org).

It gathers the interests of European organizers of science weeks and provides added value to the events through sharing experiences, maximizing resources, benchmarking and collaboration. Such association guarantees the maintenance of the cultural and local identities of European citizens.

Within the framework of EUSCEA, by the analysis of the events organized by the member organizations, one may detect the factors that make the local dimension so important. Classifying such factors following the scheme of any communication event (origin of the communication, message to transmit, channel of communication, and target audience), one may identify the following items:

- Origin: kind of organization (administration, university, foundation, association, etc.), culture of the organization, territorial dimension (local, regional, national), financial structure of the event, sponsoring entities, etc.
- Message: terminology of the event (science week, science days, science festival, science forum, etc.), subject (general or specific), scope (fun or academic), etc.

- Channel: calendar, schedule, frequency, venue of the event, format (exhibitions, shows, lectures, games, visits, excursions, workshops, Internet, etc.).
- Target audience: local culture, general public, specific targets (scholars, teachers, politicians, press members, local community, etc.).

As a conclusion, public awareness of science and technology has two approaches. First, a European perspective that provides everyone with general prospects should be undertaken by the European administration. Second, local action and associations of local (regional, national) organizers are essential to address the right message to the target audience using the best channel available.

COMMUNICATING SCIENCE TO SCHOLARS THROUGH ACTIVE PARTICIPATION

Jordi Mas,[1] Montserrat Llobet,[2] Enric Garrell[1] and Rosa Ma. Palacios[2]

[1]Catalan Research Foundation. Pg. Lluís Companys 23. 08010 Barcelona (Spain). Tel.: +34 93 268 77 00, fax: +34 93 315 01 40, jordi.mas@fcr.es

[2]Departament d'Educació, Generalitat de Catalunya, Via Augusta 202-226. 08021 Barcelona (Spain). Tel.: +34 93 400 69 00, fax: +34 93 400 69 80

Abstract

Based on the experience of the authors in organizing activities for the Catalan scholars within the framework of the Catalan Science Week, the key factors in communicating science to scholars are presented. With the aim at fostering the interest of children in science and also at communicating basic scientific knowledge, two main events have been organized recently: earthquake and sound intensity measurements. Taking into consideration that a science event follows the scheme of a communication process, the key factors presented are classified into four categories: origin, message, channel and target audience.

Key words: Science for scholars, earthquake, sound measurement, key factors.

Text

Within the framework of the Catalan Science Week, the Catalan Research Foundation (FCR) and the Departament d'Ensenyament of the Generalitat de Catalunya (DE-GC) together with other institutions such as the Institut d'Estudis Catalans (IEC), organize annually a science event aimed at fostering the interest of Catalan scholars in science and at communicating to them basic science knowledge. Recently, two main activities have been designed, planned and managed regarding earthquakes and the measurement of sound intensity.

Salta per la Ciència! (Jump for science!) was organized in order to communicate the students the basic knowledge about earthquakes, its origin, measurement and effects. The participating schools prepared its own hand-made seismographs using simple materials. The activity consisted in a simultaneous jump of all the participating scholars that could be recorded in the school seismograph and supposedly in the different official seismographs located in different parts of Catalonia. Although positive data recording is not the main objective, scholars were taught on the basic knowledge about plate tectonics, Richter and Mercalli scales, transmission of vibrations through the earth, effects of earthquakes, and so on.

The second large activity was related to the measurement of sound intensity. *Crida per la Ciència!* (Shout for Science!) consisted in gathering the participating scholars in their playground and let them shout at the same time. Sound intensity was recorded in the microphone of a PC and the data was sent to an Internet server that collected all data of the schools, made an average of counties (*comarques*) all over Catalonia and displayed them in a web page in a map of colors depending on the intensity. Some other issues such as sound pollution (excess of music, noise in a city by vehicles, etc.), physics of sound transmission and effects of sound on the human body were incorporated as subject of the activity.
The key success factors of a science communicating activity designed for scholars were derived from the analysis of the two experiences. Taking into consideration that such activity could be considered as a communication event we have classified such factors following the scheme: (i) origin of the communication, (ii) message to transmit, (iii) channel of communication, and (iv) target audience. The origin of the communication event is based on the objectives of the organizing institutions and in the general aim of the Science week. Also a secondary issue has to be considered as it is the lack of interest in young students for scientific disciplines (in schools and later in universities) and the low proportion of scientists and researchers in the workforce. The core competencies of both institutions are science (for FCR and IEC) and schools (for DE-GC) and the synergies and complementarities of both scopes have shown great potential.
The message to transmit has to be related to the life of the students and be attractive enough to drag their interest towards the activity. Social interest is crucial. Sound and noise effects in an urban metropolis such as Barcelona are everyday issues. Sound can be measured and treated scientifically. Earthquakes are not frequent, but their impact in the media is high when they happen. Knowledge about the natural forces that drive such important phenomena can send the message that everything (in the material world) has a cause and an effect. An essential factor, regarding the message, is that its content should be part of the scholar curriculum of the student. The subject must be part of any of the disciplines during the course. This helps a lot in defining the subject and relating the information to the normal functioning of the school.
The channel is in this case the same school. Normally, in order to assure as much participation as possible the playground is the best place to conduct any activity. Time and place of the activity have to be compatible with the normal development of a school day. The materials used have to be cheap and easily available. Supporting printed material is necessary to give the basic concepts in which the activity is based. Complementary information on the Internet and other activities using web technology are recommended. Teachers play a crucial role in the process. Probably they are the most important key factor in transmitting the message to their pupils. Previous working sessions to give them information and tricks for performing the activity are highly advisable.
The target audience of course is the students. Different categories could be established depending on the age and the activity itself. Primary and secondary schools may have very different operational strategies due to the expected response by the children. The activity should be programmed to foster their active participation. An indirect target audience is the mass media. Such activities with scholars are highly appreciated by the press and proper documentation (press kit) and layout should be taken into account.
Among all science events, those involving kids are the more rewardable and interesting. Not just because the effect of such activity could be determinant in the future scientific careers of the kids, but because their amplifying effect towards their families, relatives and friends opens up widely the public reached by the activity.

WORLDWIDE DAY IN SCIENCE –STUDENTS' SNAPSHOT ON THE WEB

Will Rifkin, PhD, and Debbie Lim

World-Wide Day in Science Project, Science Communication Program, Faculty of Science, BSB-BABS, University of New South Wales, Sydney, NSW 2052, Australia. Tel.: +61 2 9385 2748, fax: +61 2 9385 1530, wwds@unsw.edu.au

Abstract

On 15 April 2004, student reporters from Australia to Spain captured events in the world of the science in their locale. The scheme worked in 2003 with eighty-one university students in Sydney, Australia, so why not pilot the effort worldwide? Students learn about the daily life of a scientist, the global reach of science, and of their own ability to tell a tale of science, one good enough for publication. The website demonstrates how non-scientists can contribute to the appreciation of science through the use of stories. An audience of high school students learns about where a career in science might take them.

Key words: Global science event, World Wide Web.

Text

A New Way to Engage Young People with a Career in Science?

Science is a world-wide endeavour of increasing importance, yet enrolments in science at universities are declining. Arguments about as to why insufficient information about career paths, aliennating ways in which science is taught, an overly restrictive science curriculum, or perhaps, the practice of science just does not seem sufficiently interesting to the young. Science communicators in a variety of settings –research institutes, government, industry, science centres, museums, outreach programs, universities– are labouring to dispel misconceptions and a lack of information reaching young people about science and scientific careers. What more can be done with the limited time and resources available to science communicators and their scientist collaborators?

For the past two years, development has been under way on a global activity to reveal the day-to-day charms scientific work to university students. The university students will relay what they see to an audience of high school students who are considering different career paths. The project incorporates the drama of capturing a single day's events, the scope of the world wide web, and the allure to students of working in multi-media to tell the stories that they capture. The undertaking is designed to make the university science curriculum more engaging and more *relevant* for science students. Though being initiated with university students, the project might ultimately involve contributions from school children and scientists, accounting for their own science experiences on the project's focal day. This activity is the World-Wide Day in Science. This paper is an invitation to science communicators to help stimulate participation in the World-Wide Day in Science. The accompanying dialogue in the conference session can address first –and second-hand accounts of experiences of students in two of this year's participants– Pompeu Fabra University's postgraduate science communication program and the University of New South Wales's undergraduates in advanced life science.

What is the World-Wide Day in Science?

Did you assign your university students to watch a scientist on 15 April 2004, becoming part of the World-Wide Day in Science? Your students would have then needed to mould that day's observations into short, appealing, multi-media stories and mount them on a website, a site that on 1 June 2004 links such observations from around the world. It is that simple.

This effort engages science students in a range of *best practice* learning strategies – problem-based learning, use of global networks of students, and multi-media. The students get a taste of where a career in science might take them. They build the professional skills that are in demand, according to surveys of employers and recent science graduates (*eg*, by the Centre for the Study of Higher Education at the University of Melbourne) –oral and written communication, teamwork, and managerial abilities.
A local pilot, 'A day in the Life Sciences in Australia', has been successfully completed by eighty-two second-year science undergraduates at the University of New South Wales in Sydney. Students report: "The project seemed quite overwhelming at first, however it turned out to be a thoroughly enjoyable experience", "Reflective assessments were helpful. I will have fond memories of this course", "A great experience. It really gave me a 'preview' of how things might be in the future. It also gave me a rough idea of what to expect and how to deal with teamwork at my future workplace. I will fully encourage anyone to take the course". The course coordinator states, "It was the easiest course I taught. The students did all the work." Hundreds of copies of the resulting CD-ROM have been distributed to high schools as a career guide. An online version of the students' product (*sans* video due to download times) can be seen at: www.scom.unsw.edu.au/life/index.htm.
Students engaged in the World-Wide Day in Science work much like the photographers capturing events for the book, *A Day in the Life of India*. Our multi-media format, however, permits photos and text to be accompanied by voice and video. The resulting website reveals to an audience of high school students how scientists the world over comb the wilderness for lizards, grow microbes in the laboratory, and scan the heavens.
The World-Wide Day in Science process, as a whole-class project, begins when students nominate for roles, whose duties the students need to discover for themselves. Planners and team managers have to guide student reporters, producers, editors, and technical 'post production' staff. Basically, the reporters and producers develop multi-media stories that the editors and post production staff then tailor for addition to a local website that gets linked to the international, World-Wide Day in Science website.
The students learn how to work in teams, hierarchies, and production lines; how to handle concrete deadlines; how to communicate effectively and delegate responsibility; and how to deliver a professional product for public consumption. The challenge is daunting for some – wrestling with unanswered e-mails, missed meetings, ignored guidelines, and a lack of preparation. For most, it is an exciting window into what a botanist, psychologist, or astrophysicist does all day. When their stories go online, all then have the opportunity to become part of a worldwide network of scientists-in-the-making, and they can share their experiences and insights.
The international pilot of a World-Wide Day in Science has been occurring February-June, 2004. Universities from Spain, the Middle East, South and North America, and Australia threw their hats in the ring (as at May 2004), with participating coordinators, lecturers and science communicators, coming from fields ranging from astrophysics and chemistry to food science and microbiology. Further participants and broader involvement are sought for 2005. Coordinators can allocate a semester to the project or just a single writing assignment. Experience in problem-based learning gives coordinators the fortitude to let the students make mistakes. Guidelines for coordinators and materials from our pilot, 2003, local *Day in Science* are now available online at: www.science.unsw.edu.au/worldwide/wwds_index.asp.

THE CHALLENGE OF THE REGIONAL GOVERNMENT OF MADRID: THE SCIENCE OF CITIZENS

Almudena del Rosal

Supervisor for the Scientific Culture and Citizen Participation Programme. Dirección General de Universidades e Investigación (General Directorate for Universities and Research). Consejería de Educación (Educational Council). Alcalá, 30-32, 3ª planta. 28014 Madrid (Spain). Tel.: 91 720 04 19, fax: 91 720 00 94, a.delrosal@madrid.org

Abstract

The Regional Government of the Madrid has begun a Scientific Culture and Citizen Participation Programme essentially based on two events: the Madrid Science Fair and the Madrid Science Week, each of which bring together 120,000 citizens every year.

The success of these projects lies in the meticulous planning and the creation of networks with the scientific community: educational centres, universities, museums, research centres and companies.

The main goal is to bring science and technology closer to citizens and at the same time provide tools that enable them to understand where science fits into society.

Key words: Scientific Culture, Madrid Science Fair, Madrid Science Week.

Text

Scientific culture and citizen participation Programme for the Region of Madrid (www.madrimasd.org/culturacientifica)

Why has the Regional Government of Madrid decided to launch a programme of Scientific Culture through the General Directorate for Universities and Research?

The answer to this question was clearly given by Philippe Busquin, European Commissioner for Research, who stated, "In a knowledge-based society, democratic governance must ensure that citizens are able to make an informed choice from the options made available to them by responsible scientific and technological progress".[1]

The following aims of this programme were defined in 1999 after seminars with teachers, directors, scientific museum curators, journalists and researchers.

- Work in each of the events, involving assistants in the actions.
- Create networks: Universities, Museums, Educational Centres, Research Centres and Companies.
- Match the efforts of the practitioners of scientific culture: the student, the teacher, the researcher and the businessman.
- Confer and transmit passion and credibility in the management of the Scientific Culture and Citizen Participation Programme on the part of the Administration.
- Communicate that science is not something unintelligible, that it can be fun, appealing and interesting in everyday life.
- Attempt to furnish citizens with the tools to enable them to see how science fits into society.
- Improve access to scientific information.
- Enhance scientific and technological culture.

Madrid Science Fair (www.madrimasd.org/madridporlaciencia)

Over 4 days, from 10am to 8pm, at a venue covering 17,000m², 2,000 "young teachers" from 4 to 18 years of age and more than 200 researchers tirelessly showed more than 400 experiments to 122,400 visitors (see figure 1).

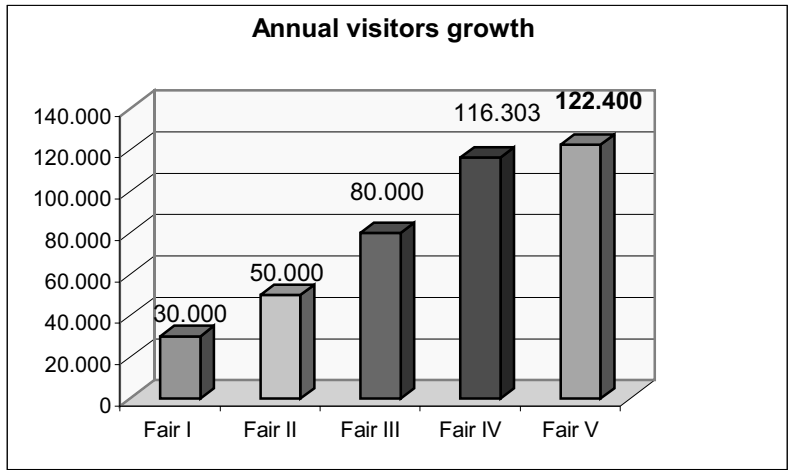


Figure 1 Annual visitors growth

The fair congregated all those who wanted to contribute and had something to say about science in Madrid, with a global conception that in a single week brought together all the segments of society that can impart science, all with the same goals, all together:

- 66 educational centres, from infant, primary and secondary schooling.
- 18 research centres.
- 10 universities.
- 8 museums and scientific dissemination centres.
- 5 royal societies.
- 8 Councils of the Regional Government of Madrid.
- 7 representatives of Public Administration.
- 16 companies related to science.
- 3 exhibitions.
- 1 auditorium holding scientific displays, conferences and films.

But the numbers do not tell the whole story. To enable science to be shown in a single physical space and providing equal conditions for young college students, university professors and scientists from renowned research centres, is almost unthinkable in a society as hierarchical as ours, yet this was the reality of the Fair with all participants doing their thing side by side one another.

Madrid Science Week (www.madrimasd.org/semanaciencia)

While the Fair brought together the whole scientific and business community at a venue over 4 days, the Science Week showed the rich scientific/technological reserve over 14 days, opening up research projects to the Region of Madrid. 140 public and private entities coordinated by the General Directorate for Universities and Research of the Regional Government of Madrid (see figure 2) organised 736 activities (see figure 3); a remarkable achievement in the panorama of scientific dissemination. “Who said there was no interest in science?”.

- 182 open doors and guided tours.
- 326 round tables and conferences.

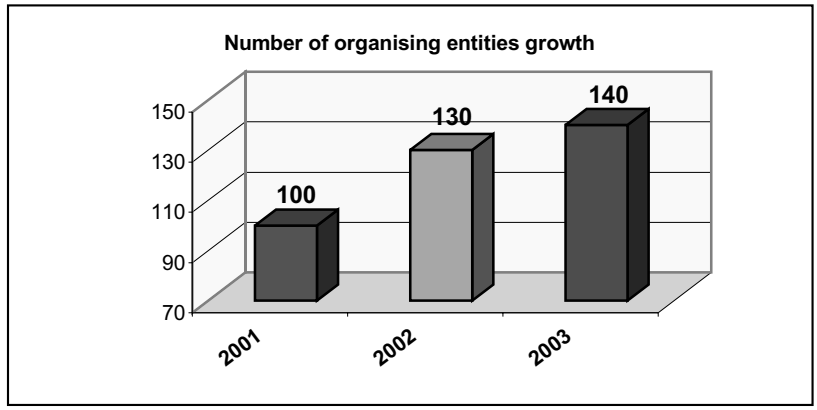


Figure 2 Number of organising entities growth

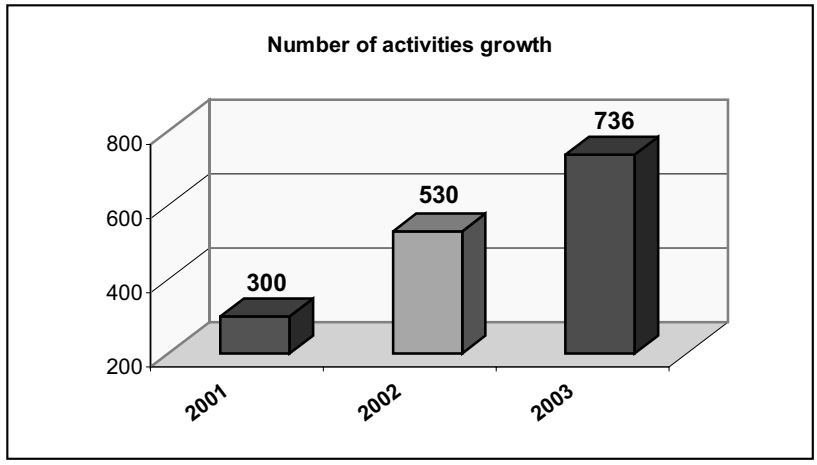


Figure 3 Number of activities growth

- 116 courses and seminars.
- 31 didactic itineraries and excursions.
- 48 exhibitions.
- 33 films, awards and similar activities.

The next Regional Research Plan (2005-2008) continues to consider the two events due to their important social impact. But the Government of Madrid considers it necessary to take a step forward and in addition to continuing to promote scientific education and culture, its objective is to draw up scientific policies that bring science closer to the citizens, strengthening the principle of responsibility and the ethical basis of scientific and technological activities.
Public Administration should take into account the social commitment to science.
The crux of the matter is getting the civil society to take part in the process of decision making, promoting full integration of women and stimulating discussion of issues regarding our future.

Notes

[1] The European Commission. Science and Society Action Plan. http://europa.eu.int/comm/research/science-society/action-plan/action-plan_en.html

SCIENCE ON THE SUMMER HOLIDAY MENU

Rosalia Vargas

Ciência Viva - National Agency for Scientific and Tecnological Culture, Portugal

Abstract

"Every summer, Ciência Viva organizes field activities for the general public, in collaboration with research institutes, universities, associations and local authorities. Astronomy in summer, Biology in summer, Geology in summer and Science in the lighthouses are now part of the Portuguese cultural agenda in July and August.

We believe these activities promote public awareness of science, providing opportunities for personal contact with science specialists and institutions in the different fields. These initiatives are free and open to all, with a focus on practical activities, providing active observation and interaction with specialists from the relevant fields. They are intensely publicized on the media (newspapers, radio, TV), bringing science, in an informal and lively way, into the citizens' holidays."

PUSHING SCIENCE TO THE PUBLIC IN THE STREET AT 63°N – A TEN YEARS' PERSPECTIVE

Sigmund Grimstad

Information Division, Norwegian University of Science and Technology NTNU, Trondheim, Norway

Abstract

Norwegian universities are required by law to communicate their research to the public. The Information Office of our university has a "two-tiered" approach to this task. The first step is encouraging and helping scientists with the infrastructure, the second is providing suitable arenas for the interaction between the scientists and the public.

One annual event using this approach is the one-day "Science Market" in the city centre every September since 1994. Here some 100 scientists display popularized, often hands-on activities connected to their research. As most scientists have no training in this kind of communication, the event is preceded every spring by a short introductory course, addressing the special communications skills needed. The event has annually attracted some 7000 youngsters in the age group 8-15. The concentrated, central location profiles both the scientists and the university to the community.

We will address the criteria basic to the successful performance of the event, from the inspiration of the scientists, via the practicalities of the physical settings to the co-operation with local schools. We will also look at the development of additional activities. Last year's main new effort was an outreach activity involving "bussing science" to local communities all over the county. This is also an example of getting the most out of the money and time invested for such a single day's event. In addition to making the event more cost-effective, the future depends on incentives for the scientists to participate, for instance: How may a culture among doctoral students to regard science in public as part of science itself be developed?

Parallel session 22

Public perceptions of GMO's

DIFFERENCES IN PERCEPTIONS OF AGRICULTURAL BIOTECHNOLOGY: A COMPARISON STUDY BETWEEN GERMANY AND THE UNITED STATES.

Helen L. Aquino,[1] MS. and William K. Hallman, PhD[2] and Food Policy Institute

[1] Research Analyst & Project Coordinator, Food Biotechnology Program, Food Policy Institute, Rutgers University, 3 Rutgers Plaza, New Brunswick, NJ, 08901, USA.
Tel.: 732 932 1966 (x3102), fax: 732 932 9544, aquino@aesop.rutgers.edu, www.foodpolicyinstitute.org

[2] Associate Professor of Human Ecology and Director of the Food Biotechnology Program, Food Policy Institute, Rutgers University, 3 Rutgers Plaza, New Brunswick, NJ, 08901, USA. Tel.: 732 932 1966 (x3103), fax: 732 932 9544, hallman@aesop.rutgers.edu, www.foodpolicyinstitute.org

Abstract

To understand differing attitudes, knowledge and opinions about GM food, 29 qualitative interviews were conducted in Germany and the United States. Individual cognitive maps were created to examine relevant constructs. The findings suggest differences exist related to the perceived consequences of the technology. While Americans largely focus on the potential impact of GM food on their own lives, Germans focus much more on the potential impacts to the environment. These findings have important implications for understanding the differences in how GM is perceived in each country.

Key words: Public Opinion, Public Understanding of Science, Risk Communication.

Text

Context

Differences in opinion about agricultural biotechnology are substantial between the American and European publics. In addition to distinct public policy approaches, there may be inherent underlying perceptual differences that influence the perceived acceptance of the technology. Considering these differences may be useful in guiding policy makers

and in shaping communications relevant to the global debate about genetically modified foods.

Objective
To determine what underlying differences exist between how Germans and Americans perceive GM food related risks.

Methods
Fifteen qualitative, face-to-face interviews focusing on knowledge, opinions and attitudes concerning genetically modified food were conducted in Germany and 14 were conducted in the United States. High school teachers were recruited as a convenience sample by phone and e-mail from both countries. Interviews in both countries were conducted in English. Using a conversational format, participants were asked to tell what they knew about genetically modified food. After this initial conversation was exhausted, follow-up questions were used to probe the constructs produced by the respondents. Interviews were recorded, then transcribed verbatim and coded for common themes. Interviews were conducted with 11 males (4 American & 7 German) and 18 females (10 American & 8 German) and averaged 31.5 minutes overall. Participation fees were paid in cash at the end of the interview ($25 USA & 30euro Germany). From these analyses, individual cognitive maps were created to examine the constructs used by participants to elucidate what they know and feel about genetically modified food.

Results
Overall awareness and knowledge of GM food seemed to be greater for the German participants then for the Americans. The German respondents were able to consistently provide more complete and elaborate arguments related to the pros and cons of the technology. In general there was also a greater sense of passion apparent in the German interviews than in those conducted in the US.
The defining constructs used to describe GM food also differed between the United States and Germany. Within each interview a dominant theme emerged. While health concerns were expressed in both countries, the German respondents were much more vocal about the possible environmental effects associated with the production of GM foods. Nine of the 15 teachers interviewed in Germany focused their conversations about GM food most heavily on their concerns about the environmental risks posed by producing agricultural biotechnology crops.
In contrast, 12 of the 14 American interviewees focused their concerns on the risks of GM foods for their own or their family's health. Only 4 Americans voiced any environmental concerns whatsoever
Themes within the German interviews reflected the perception of an ominous threat of "unintended consequences" or that the "long term effects are still largely unknown" for the environment. Of particular note were issues related to potential cross-contamination caused by gene flow from air pollinated plants such as corn and the possible ramifications of such cross pollination on the balance of the ecosystem. Many referred to the "unbalance of natural habitats" or the "upset of the ecological balance of nature" due to the introduction of "manufactured genes with the potential to change nature permanently on the genetic level." Others expressed the idea that evolution would somehow become unbalanced due to the effects of "monocultures reducing the gene pool." One interviewee

surmised the environmental threat as the ever-present "danger in constant change and the human influence on our food". Several of the German interviewees had recalled hearing about specific environmental threats to wildlife such as to caterpillars, birds, and ants.
In contrast, few of these themes emerged for the Americans. Of the four American respondents who mentioned environmental concerns, these were typically expressed as the need for long-term studies that would evaluate the possible effects on the environment. In only two interviews were concerns expressed about the possible effects to the "balance of the ecosystem."
For the Americans, the primary health concerns were related to the perception that GM implied something artificial added to their food. These concerns were seen as analogous to the perceived food health risks related to the addition of hormones and antibiotics, particularly in animal production. Other concerns focused on the uncertain unintended consequences of consuming these foods over the long term. These included ideas that eating GM foods might lead to cancer or other diseases, or acute or chronic threats to human health.
Participants in both countries stressed a need for clear information regarding food safety risks that could be made available to consumers by objective sources. Most said they did not want this information from industry or government but instead would prefer and trust a source without any economic interests or ties to the biotech industry. For most, the subject of information sources was broached unaided and highlighted within a framework of past experience with BSE for the Germans and hormones/antibiotics for the Americans. The "mad cow" experience seems to have put Germans on a heightened awareness about food safety issues.
While agricultural biotechnology was understood by almost everyone in both countries as having great potential, for the Germans, this awareness was over-shadowed by the possibility of "risky biological dangers". Many in Germany were skeptical about industries strong economic motivations taking precedent over sufficient environmental impact considerations. There was an understanding that agricultural biotechnology has the capability to reduce world hunger but this was interpreted as problematic for the Germans since, "people who are hungry won't even think about the risks or damage that could be done."
Perceptions of an adequate time for testing to determine these possible risks were expressed within a range of 30 to 100 years for the Germans. Americans also stressed a need for long-term studies related to implications for human health but offered a much shorter time frame of 10 to 50 years. In contrast, while their health concerns were paramount for the American interviewees most said if they received information that GM food was safe then this would alleviate these fears.

Conclusions

Based on this small sample of respondents in the United States and in Germany, there may be clear differences in the primary concerns of consumers about GM foods in each country. Information materials, public debate, and policy decisions about the potential risks and benefits of GM foods should take these differences into consideration.

UK GM DIALOGUE: SEPARATING SOCIAL AND SCIENTIFIC ISSUES

Fiona Barbagallo and Jill Nelson

The BA (British Association for the Advancement of Science), Wellcome Wolfson Building,
165 Queen's Gate, London SW7 5HE, United Kingdom.
Tel.: +44 20 7017 4938, fiona.barbagallo@the-ba.net and jill.nelson@the-ba.net

Key words: GM consultation, social issues, dialogue.

Text

Background

In 1996, GM soya and maize were imported into Europe from North America. At this time, general public awareness of the new GM foods was low. During 1998 and 1999 there was extensive coverage in the UK of the controversy surrounding GMOs in the media, some of it involving HRH Prince Charles, Dr Pusztai (the scientist researching GM potatoes), the UK Prime Minister Tony Blair, the Minister of Science Lord Sainsbury and the supermarket chain Iceland. Over the next 5 years GM crops and produce were also destroyed by activists, numerous legal actions were taken by organic farmers and supermarkets removed GM foods from their shelves.

The UK was still getting over the BSE crisis and in 2001 another agriculture crisis erupted with the Foot and Mouth epidemic exposing some less than hygienic agricultural practices. Thus the arrival of GM food into the UK occurred at a time of decreasing confidence in agricultural procedures and in the safety of food.

The UK government responded slowly to the growing concerns surrounding GM foods, waiting at least four years after the controversy surrounding GM food was in the public domain, announcing the launch of the consultation in mid-2002. But not only was the timing late in terms of public controversy, the public consultation occurred a few months *before* the scientists conducting the GM field trials were to announce their findings.

GM consultation – the three strands

The government accepted the advice of its strategic advisory body on biotechnology issues affecting agriculture and the environment and announced that it would promote a broad national debate where all voices could be heard.

The national dialogue on GM had three stands: the science review (led by the Office of Science and Technology, OST), a costs and benefits study (led by the Prime Minister's Strategy Unity) and a public debate (conducted by an independent steering board). Each strand was to focus on its remit however it was stated by government that each strand would interact and feed into each other.

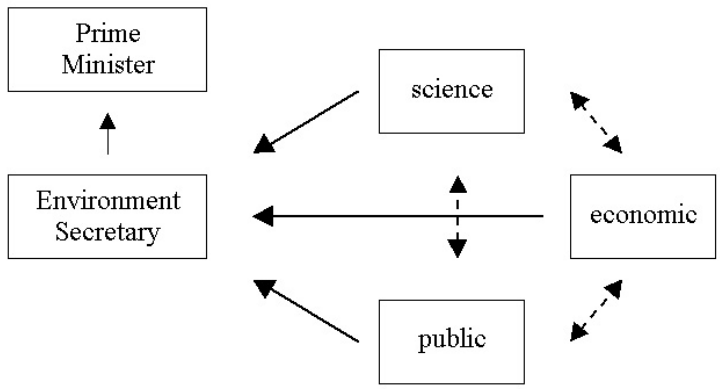
The BA's involvement – the science review strand

The BA was commissioned by the OST to organise the open meetings as part of the GM science review strand. The aim of the science strand was to review the current scientific knowledge on GM. The review was led by the government's Chief Scientific Adviser, who worked with a panel comprised of 25 prominent scientists in their field from a variety of backgrounds. The open meetings and the science strand website provided other scientists, and non-scientists, to raise scientific points of view.

From the outset of its involvement the BA indicated its preference to not separate the social and scientific issues, but this was not the remit of the science strand. As expected, social issues such as economics, politics, regulation, justice and consumer choice, were

raised at the open meetings, however, these points were not discussed further by speakers or panel members.
Each of the open meetings addressed a different area of science (food safety, biodiversity, horizontal gene flow, and future applications). The open meetings consisted of 3 or 4 speakers who were questioned by up to 4 of the science review panel members. Members of the audience were also invited to ask questions or make comments.

Observations
The GM dialogue was the largest public consultation on a science issue undertaken in the UK and has been promoted as an innovative procedure as well as criticised for its poor timing and implementation.
It was reported that "the activities of the [three] strands were different but closely related"[1] and that the other two strands would feed into the science strand, including the open meetings that the BA organised. However the science open meetings were not held in parallel with the other two strands and as a result there was minimal interaction.
In a Statement of Relationships it was reported that "each strand will report separately"[2] feeding directly to the Environment Secretary where 'a decision would be reached'. The diagram below represents this model.



Although the Statement of Relationships outlines the interaction of the three strands, there was no clear indication of these relationships when the BA was organising the open meetings, nor how the information gathered during the consultation would be used to make a decision.
The independent evaluation of the GM public strand concluded that there was a "lack of cross-fertilisation with [it and] the science and economic reviews".[3]
At the outset the government stated that the public consultation would be open and transparent. And in many ways it was, the meetings were held in public, minutes were available on the websites, public views and opinions were gathered. However, one of the most important elements to public consultation, how it will feed into the decision-making process, was not apparent from the beginning of the process.
Further, separating the scientific elements from social issues restricted the interaction of scientists, stakeholders and members of the general public. The BA has observed over the past 3 years that scientists, as well as members of the public, benefit from face-to-face

communication. Sometimes this has to be approached in stages to reach a common language, but separating public and scientific dimensions does not progress public engagement with the future of scientific developments.
The decision to separate the dialogue into three strands was taken at a high level at the outset and the whole exercise was constructed on that basis.
One positive outcome of the separate science strand was that scientists were able to discuss the level of uncertainty of current technology in public, albeit among a fairly expert set of people. In our experience this rarely happens when scientists are placed in the position of having to defend their research once an issue becomes controversial.

Notes

[1] http://www.gmsciencedebate.org.uk/default.htm (accessed on 9 May 2004).
[2] http://www.gmpublicdebate.org.uk/docs/StatementOfRelationships.pdf (accessed on 9 May 2004).
[3] A Deliberative Future? An independent Evaluation of the GM Nation? Public Debate, Understanding Risk programme (a major research initiative based at the University of East Anglia and involving researchers from Cardiff University, Brunel University and the Institute of Food Research at Norwich. February 2004.

THE PLACE OF POLEMIC: THE NEED FOR POLITICALLY-ENGAGED SCIENCE COMMUNICATION RESEARCH

Felicity Mellor

Humanities, Imperial College London, SW7 2AZ, United Kingdom. f.mellor@imperial.ac.uk

Abstract

Over the past decade, the UK has experienced several periods of intense media debate about the development of GMO's. Concerned at the possible effects on public perceptions of GMO's, scientists and politicians alike have criticised this coverage as hysterical and sensationalist. Academic studies of the media coverage have reached more complex conclusions. Yet in some ways these studies are also framed by the values of the dominant actors in the controversy. In this paper, I hope to open up a space for science communication scholars to examine the assumptions which are often embedded in research in this field and to reflect on the political dimension of our work.

Key words: Media, Research, GMO's.

Text

Studies in the sociology of science have demonstrated the ways in which science is informed by the wider culture. In this view, science is a social structure shaped by particular politico-economic conditions: science, politics and industry are not distinct spheres but overlapping and entangled activities. This is particularly apparent in the case of biotechnology. Experiments to develop herbicide-resistant crops or field trials into the ecological impact of such crops simply would not take place if it were not for an industrialised system of agriculture able to generate large profits from such technologies. The very concept of GMO's is predicated by the socio-economic culture in which it has emerged.

Yet the dominant players in scientific controversies frequently appeal to a view of science and society in which science is seen as an "objective" enterprise entirely distinct from political or commercial interests. In a period of intense UK media coverage of the GM controversy in 1999, Prime Minister Tony Blair stated that: "the worst way to proceed would be to raise fears in the public mind before the evidence is put to the people." The best way forward, he said, was "on the basis of scientific evidence" (*The Sunday Times*, 14 February 1999, p.16).

At one level, this is entirely sensible advice. But at a deeper level it implies that the concerns raised by the public are irrational fears, that the only issues at stake are technical ones, and that the relevant evidence can be generated without reference to public concerns. In other words, it assumes a strict demarcation between science and politics. It delegitimises social responses to questions such as what constitutes a sustainable approach to agriculture or how we can safeguard food security worldwide, and instead promotes technically-framed questions about how to grow cash crops most efficiently without jeopardising public health. Blair's demarcation of science from politics and his prioritisation of a technical framework was repeated by many other actors, including scientists and journalists, in the media coverage of the debate.

We might expect academic analyses of the media coverage of the GM controversy to expose implicit assumptions such as these. Yet several significant studies have failed to adopt a critical position. For instance, Durant and Lindsay's analysis of the 1999 media coverage, which was extensively cited in the influential Lords' Report on Science and Society (House of Lords, 2000), found that certain newspapers explicitly decided to campaign on the GM issue. Durant and Lindsay concluded that this "was a decision to politicise coverage of GM food" (p. 21). Like Blair's statement, this assumes a prior state in which GM food is unpoliticised; a time in which the science and politics of GM were clearly demarcated.

Further, Durant and Lindsay reproduce the concerns of dominant actors about "sensationalist" headlines (p. 47), failing to discuss instead the ways in which such headlines draw on humour and intertextual references to caricature events; they refer to the acts of environmental protestors as "vandalism" (p. 10); and they problematise the increase in media coverage rather than the media compliance which suppressed coverage of earlier events.

Durant and Lindsay's report is not without merit. Their content analysis shows that certain events triggered an increase in media coverage and that certain papers played a leading role in the subsequent debate. But, like other content analyses, they do not present any close reading of the actual contents of the texts they analyse. In failing to do so, they are unable to reveal the ways in which the debate might have given voice to a deep-seated (and entirely legitimate) public unease about corporate influence, the globalisation of food supply, and the reliance on technocratic approaches to farming. Even the impressive longitudinal study of European media coverage of biotechnology co-ordinated by Durant, Bauer and Gaskell (1998) suffers from similar problems. The identification of media frames, such as "progress", "economic" and "global", suggested by the media texts themselves, eclipses the frames which are absent altogether. Such an approach accepts the dominant framing and looks at variations within such framing, rather than challenging the framing itself and the implicit demarcations upon which it is based.

All analysis is an act of interpretation. In content analysis, the interpretative act is hidden behind a screen of numbers which conjure an aura of objectivity. When science

communication researchers aspire to objectivity, they mimic the positivist claims of science – the very thing they should be exposing. As scholars we have a duty to use our intellectual resources to uncover the ways in which our conceptual landscape is delimited by dominant powers. We must expose the ideological forces which structure the institutions of science and the media and we must be aware of, and honest about, the ways in which our own work is ideologically informed. Collecting numbers is not enough. We must produce rational evidenced arguments which challenge injustices and protect the things we care about. We must be political.

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BIOTECHNOLOGICAL CULTURE IN SPAIN: SITUATION AND TENDENCIES

M.A Quintanilla,[1] M. Escribano,[2] R. Fernández[3] and M. Guerrero[4]

[1]Instituto de Estudios de la Ciencia y la Tecnología. Universidad de Salamanca. Paseo de San Vicente, 81, Sala número 3. 37007 Salamanca (España). Tel.: +34 923 29 48 34, fax: +34 923 29 48 35, maquinta@usal.es

[2]Genoma España. Rosario Pino, 14-16, 7ª planta. 28020 Madrid (España). Tel.: +34 91 449 12 50, fax: +34 91 571 54 89, mercedes.escribano@gen-es.org

[3]Instituto de Estudios de la Ciencia y la Tecnología. Universidad de Salamanca. Paseo de San Vicente, 81, Sala número 3. 37007 Salamanca (España). Tel.: +34 923 29 48 34, fax: +34 923 29 48 35, pararosaes@terra.es

[4]Instituto de Estudios de la Ciencia y la Tecnología. Universidad de Salamanca. Paseo de San Vicente, 81, Sala número 3. 37007 Salamanca (España). Tel.: +34 923 29 48 34, fax: +34 923 29 48 35, msgsela@hotmail.com

Abstract

The results of a report made for Genoma España on the biotechnological culture in Spain are presented. The report covers the period 1994-2002 and is based on data from different public opinion surveys and the analysis of the archives of the electronic versions of Spanish newspapers, and the Spanish News Agency EFE. There is a relatively optimistic vision of the biotechnological culture in Spain and the public interest in biotechnology has increased (the presence of these subjects in mass media tripled 1994-2002), focusing on new hot subjects related to research into stem cells and genetically modified foods.

Key words: biotechnological culture, biotechnology, Spain.

Text

Context

During 2003, Genoma España elaborated the report *Avance del Estudio Estratégico de la Biotecnología en España* that integrates all the information available on the Spanish Biotechnology sector, using a series of numerical indicators from the Biotechnology OECD definition (OECD, 2003), classified in three areas: Science and Technology Companies; Venture Capital; Sociocultural and Public Understanding. In this paper the main results of the Sociocultural and Public Understanding section are presented.

Objective
The objective has been to measure the biotechnological culture in Spain. We have analyzed and processed surveys of public perception of biotechnology in the EU, the electronic archives of two Spanish newspapers (*El País* and *El Mundo*) and the state news agency (EFE), from 1994 to 2002.

Methods
We have summarized and commented available data from the following surveys of opinion on public perception of biotechnology:

1) The Eurobarometers "The Europeans and biotechnology" (1991, 1993, 1996, 1999 and 2002. European Commission).
2) Centre of Sociology Research Survey, "Spanish Opinions and attitudes on biotechnology" (1996 and 2001).
3) Advances on results of other recent surveys (not published): "The Spaniards' Opinions and attitudes on biotechnology" by Milward Brown for Ulled, (2003), and "European Study on Biotechnology by the BBVA Foundation" (2003).

For the content analysis of mass media we used the following methodology:

1) Automatic and manual processing of the electronic archives of the media
2) Constructed week sampling techniques to reduce the quantity of information.
3) Comparative study of the national newspapers (*El País* and *El Mundo*) and the state news agency (EFE).

We used the *"constructed-week"* method to select a sample of the texts of the newspapers (editions 1994-2002) and the Agency EFE's news (editions 1994, 1999 and 2002) to be processed. To select relevant texts, a double procedure was used: keywords were used in the search of the electronic archives, followed by a manual review to discard those texts that were not relevant. A total of 931 newspaper texts were selected and 666 texts by the Agency EFE.

Results
Conclusive data of the opinion surveys are the following:

1) Spaniards maintain a doubtful general attitude towards biotechnology and its applications, but are more optimistic than other Europeans.
2) They value medical and environmental applications more than food and agricultural ones.
3) The positive valuation is sometimes combined with negative attitudes concerning personal use of the biotechnological applications.

The main results of the media analysis are:

1) The subjects related to the biotechnology occupy an important place in analyzed mass media, on practically a *daily* basis.
2) The media's interest in biotechnology is increasing because of the sector's rapid expansion. References made to biotechnology have *tripled in 8 years*.
3) The news published are fundamentally reports from international events and sources, but the number of national news has increased.
4) Unlike the observed in previous studies, we note a deep transformation in the way biotechnological subjects are integrated in the culture through mass media. A *greater complexity and intensity* in the presentation of biotechnological data was detected.

News on *scientific policy and its social impact become more important*, as opposed to more traditional scientific reports. All this indicates a change with respect to the traditional weak interest or participation of the Spaniards in the biotechnological subjects of public interest (Muñoz, E., 1998, 2002a, 2002b).

5) The evaluative tone transmitted in the analyzed media is predominantly neutral or positive, despite the controversial character of many of the events and subjects.
6) Biotechnology is mostly organized in three areas in the media: human health or medicine, clonation and transgenic foods. In addition, human, animal or vegetable genetics are generally associated with generic references to science and technology. The media interest has moved from the traditional medical subjects (cancer, genetic therapy, etc) to subjects related to clonation and transgenic foods.

Conclusions

The predominantly optimistic attitude of the Spaniards in relation to the biotechnology has traditionally been interpreted as resulting from the modest development of this sector in Spain (Gasquel, 1997). Other data and opinions (Lujan and Todt, 2000) indicate that the collected data of the Eurobarometers do not reflect the true position of the Spaniards regarding the biotechnology and that this position is better reflected in other surveys (CIS, 1996, 2001). More refined analyses are needed to process the complex information on biotechnology (Muñoz, 1998). However, the data that we have obtained from the analysis of the media allows us to draw the conclusion that the Spanish biotechnological culture is undergoing a transformation, which can be resumed in the following terms:

1) The biotechnology plays an increasingly important role in the scientific culture of the Spaniards.
2) The interest is moving from the subjects related to the medicine (prone to a greater consensus between the population), to the subjects related to the reproduction and human clonation and with the transgenic food production which raise more controversial questions.
3) These transformations will probably change the Spaniards' perception of the challenges faced by the biotechnological culture, in a context that will probably be more polarized, with a more controversial content and with general attitudes approximating those of other Europeans.

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PUBLIC CONCERNS TOWARDS GM FOODS ARE NOT DRIVEN SOLELY BY CONCERNS ABOUT THE TECHNOLOGY, BUT MORE STRONGLY BY CULTURAL DIFFERENCES

Janine Young[1] and Craig Cormick[2]

[1]Biotechnology Australia, GPO Box 9839 Canberra ACT 2601 Australia.
Tel.: +61 2 6213 6386, Janine.Young@biotechnology.gov.au

[2]Biotechnology Australia, GPO Box 9839 Canberra ACT 2601 Australia.
Tel.: +61 2 613 6805, Craig.Cormick@biotechnology.gov.au

Abstract

Public concerns towards modern biotechnology, particularly GM foods, are not driven solely by concerns about the technology, but are strongly influenced by cultural differences.
Much has been made of the contrasts between European and American acceptance of GM foods. Scientists and industry have advocated increased acceptance through public "education". However, this approach is not fully effective because it does not acknowledge that many attitudes are based on cultural traditions which drive acceptance of new technologies.
Further, decisions about acceptance of biotechnology applications are underpinned by personal and cultural ethics, which need to be understood to effectively address attitude change. Information and education on GM technology alone does not, therefore, address attitude formation fully.

Key words: Cultural attitudes, GM foods, public concerns.

Text

It is clear even to casual observers that there are substantial differences between European and American attitudes with respect to any number of issues. These differences are especially stark when considering attitudes to biotechnology in general, and GM foods in particular. Indeed, Robert Zoellick, the US Trade Representative has called the EU's stance "Luddite" and "immoral" (when discussing Zambian rejection of US food aid in 2003). David Byrne, the EU's health and consumer protection commissioner countered that the EU's position on GM food "is that it is as safe as conventional food".
While this is official EU policy, it is clear that consumers and some member state governments do not agree. Indeed, politicians have won office after campaigning to ban 'Frankenfoods'.

When considering the debate about GM food, gross generalisations such as that of Robert Zoellick's are unhelpful. There are distinct, embedded differences between the cultures and beliefs of the EU and the USA, which need to be considered when discussing their opinions. These differences appear stereotypical, but are absolutely underpinned by distinct different cultural drivers.

One important distinction between Europe and the USA is in their relationships with food. There is a general European food culture, with emphasis placed on food origin and taste, whereas this is not so prevalent in America, who are large consumers of new and convenience foods. Many Europeans buy their fruit, vegetables, dairy products and meat from farmers' markets, whereas most Americans shop at grocery stores stocked with products from large food suppliers. Europeans tend to be more aware of how their food is produced than Americans, who are generally removed from farms and have less understanding about food production. Europeans also tend to put priority on safe and proven foods, whereas Americans place more faith in food science. Americans are generally unaware that there is a high proportion of GM ingredients (approximately 70%) in their food and are not overly concerned if they do. Canadian firm Environics has shown that attitudes towards GM foods are driven more by attitudes towards food and food safety than towards gene technology (Figure 1).

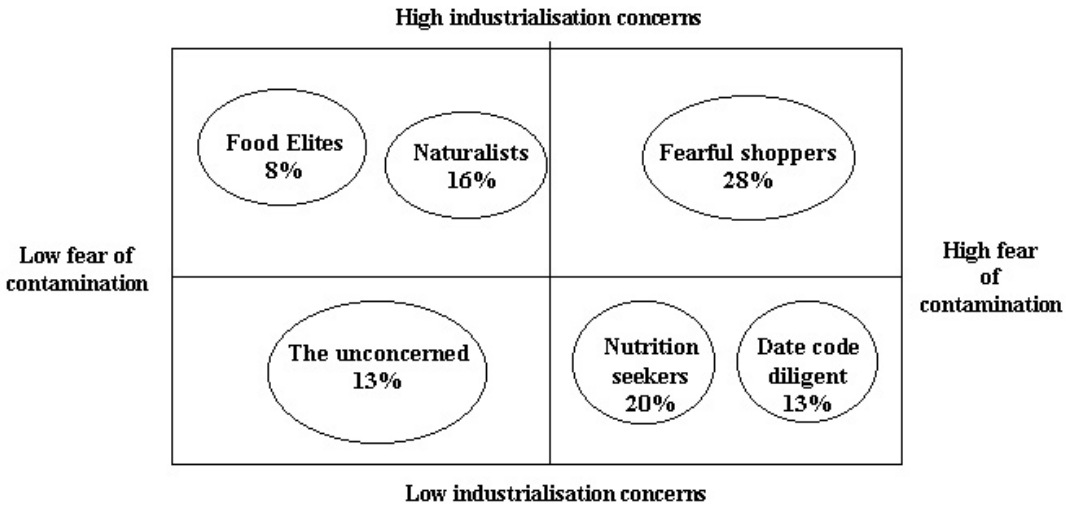

Figure 1 Food concerns segmentation map (Environics International, 2001).

These issues over food are exacerbated by differing attitudes towards authority, leaders and regulation. Americans generally have reasonably strong faith in federal food regulation and science in general. British and European handling of several food safety issues in the 1980s and the BSE outbreak led to a significant lack of confidence in government and regulation; consequently progress of GM foods through the regulatory system has been slowed, with development of more stringent and transparent legislation to address the management of potential risks and concerns. In the wake of a recent range of food-related scares, most US consumers are still expressing a reasonable level of confidence in the safety of their food supply (Slagle, 2004).

Europeans place a higher priority on environmental concerns than Americans and are sensitive to campaigns by environmental organisations. Aligned with this is European suspicion and distrust of large multinational companies, which is largely the reverse to that of the USA. Europeans (and indeed many other cultures) are also strongly resistant to the influence of American culture.
It is interesting, however, to look at concerns towards GM foods across cultures in the context of other food-related issues. Figure 2 illustrates that concerns about pesticide use and food poisoning are, in fact, slightly higher in Australia than the UK, and GM food concerns were the lowest among food concerns in all three countries. A recent University of East Anglia opinion poll found that GM food was relatively positively evaluated (particularly when compared to climate change and radioactive waste), although it is noteworthy that a substantial minority still felt that GM food is a bad thing. Nevertheless, most appeared neutral by indicating that GM food is neither good nor bad (Poortinga and Pidgeon, 2003).

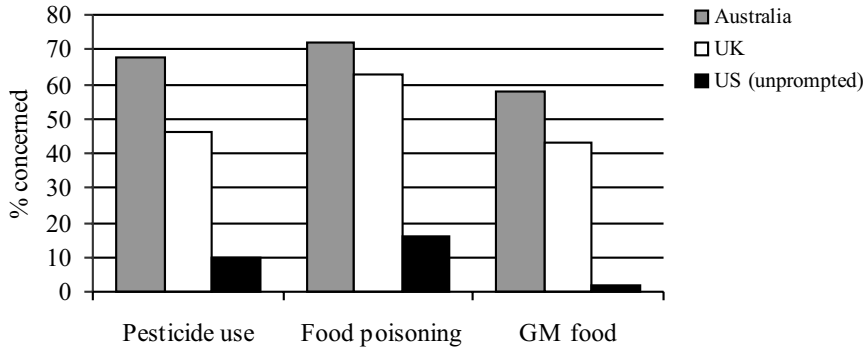

Figure 2 Relative food concerns by country.

This illustrates that context is extremely important for the consideration of attitudes to GM foods, and even more so when considering different cultures.
Another contextual issue in cultural decision-making is that of ethics. Ethical decisions made by individuals, regardless of the country they live in and culture that surrounds them, will also vary across a wide spectrum of opinion. A person's intrinsic (that cannot be altered) ethics can drive opinion more strongly than extrinsic (moveable, context-dependent) ethics. In making these decisions, reasons for food being modified can be as important as it being modified at all. Our research shows that communities are discriminating about individual applications of biotechnology and make decisions on the basis of the reason for the modification, who benefits or is harmed and who has undertaken the work.

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GENETIC ENGINEERING AND SOCIAL DEBATE

Oliver Todt
CSIC

Abstract
The present debate in many European Union (EU) member states on genetically modified organisms (GMOs) highlights the influence that social groups can exert over technology. Social actors which were not directly involved in the development of a technology but affected by it can successfully influence that technology's trajectory.
The article analyzes the influence which social actors not directly involved in regulation or product authorization exerted on the development and adoption of GMOs in Spain, one of the EU member states. Especially in the area of GMO regulation, non governmental organizations reached decisive influence, forcing the regulators to radically change the basic philosophy for regulation as well as adopting the role of a nexus between civil society and the biotechnology industry. The results obtained from the analysis highlight the importance of trust in the decision makers as well as the entire decision making process.
The results which will be presented in this paper are based on an analysis of pertinent documents as well as research interviews with key actors related to the social conflict about genetically modified (GM) crops and foods in Spain. Among them were the members of the respective regulatory bodies, especially from the Spanish National Biosafety Commission, as well as representatives from non-governmental organizations, the biotechnology and agro-food industry, the scientific community and trade unions.
However, an easy solution to the problem of decision making appears difficult, since the actors' arguments stem from their underlying visions about technology and its place in current society. Despite those fundamental limitations, more participatory decision making processes would allow for improved communication and understanding between actors. That way, preferences and values of different social groups could be better taken into account and help steer policy and product development towards socially accepted goals.

GENETICALLY MODIFIED PLANTS DEBATE IN THE SPANISH PRESS: POPULARIZATION OR PERSUASION?

Cristiane Cataldi dos Santos Paes
Universidade Federal de Viçosa, Brasil

Abstract
In the last few years, the information about genetically modified (GM) plants in the daily press has generated a widespread public debate about benefits and risks related to this technology. The different actors related to the development of this biotechnology use various lexical-semantic naming strategies to refer to transgenic plants. Taking this communicative reality into account, the aim of this presentation is to analyse, within a discourse analytic framework, the variation of names used in the daily press. This resource is used in the representation as well as in the popularization of the knowledge about 'transgenic plants'. The various names used depend on the social, economic, legal and geographic contexts of press discourse. Using a computer program, DiScientia Transgénicos, this discourse analysis is based on a systematic analysis of the contents of the articles on transgenic plants in the Spanish newspapers *El País* and *La Vanguardia.*
The analysis of the lexical-semantic characteristics of naming shows that the representation and the popularization of knowledge about genetically modified (GM) plants has an instructive and persuasive purpose. The instructive purpose is related to the objective of providing scientific information to the general public. The results of our analysis show that the origin of the information in various social domains (science, industry, politics, NGOs, etc.) determines the naming variation and defines the persuasive characteristics of science communication.

Parallel session 23

What are we talking about when saying "public dialogue"?

TOWARD A "PALAEONTOLOGY" OF PUBLIC REPRESENTATION OF SCIENCE

Yurij Castelfranchi

School in Science Communication – SISSA-ISAS (International School for Advanced Studies), Trieste, Italy, and LabJor – Laboratório de Estudos Avançados em Jornalismo. UNICAMP, Campinas, Brazil.
Tel.: +55 19 3432 89 20, castel@sissa.it

Abstract

Classical studies in Public Perception of Science mainly focus on the declarative aspects of interests and attitudes about S&T. We propose here an approach to investigate less explicit, underground aspects of public representation of science, which can play relevant role in public dialogue. We analyse, within a historical framework, qualitative data coming from semiotic analysis of focus groups with children and science images in the media. We show that at least three pre-scientific "sediments" are present, charged with mythical connotations about knowledge, and three modern ones about S&T, which interact today contributing to the construction of public representation of science.

Key words: Public Perception of Science, history of ideas, public dialogue.

Text

Context and objectives

International surveys on Public Perception of Science, as well as comments by several scholars, showed that the social representation of science tends to be di-polar (Miller *et al.,* 1998; OST, 2000). Science is painted at the same time as magic, esoteric and as a source of a logic, objective, democratic knowledge about the world. It touches our lives intimately, but at the same time is "not for us". Scientists, in the fiction and in the news, are depicted as clear-headed and absent-minded, mad and rational, passionate and with no sentiments.

Such di-polarity, bizarre or embarrassing to someone, was interpreted in the classical context of the "deficit model" (Wynne, 1995; Bucchi, 2004) as a mere consequence of an insufficient level of scientific literacy (what we don't understand, scares us).
Nevertheless, it can be viewed also as a symptom of the fact that science is so deeply rooted in culture and social life that it assumes some mythical connotations. An accurate study of these levels can be important to understand what public dialogue can be today.

Methods and results

We used data from two our precedent works, integrating them in a historical framework to put in evidence the "sedimentation" of elements in social representation of science. One data set was based on focus groups and semiotic analysis of drawings by children of age 8 in 6 Italian locations (Castelfranchi & Manzoli, 2004). Other data came from a preliminary study about scientific metaphors and images in the Brazilian propaganda.
Our analysis stressed out the presence of at least six symbolic "sediments", whose origins can be traced back in history. Three of them are clearly linked to pre-scientific images about knowledge and rich in di-polar patterns which are characteristic of stories with mythical connotations (Propp, 1996; Lévi-Strauss, 1960).
Since early times, knowledge was associated to at least three correlated but different "dilemmas", characterised by a positive pole (marked by fascination, enthusiasm, excitement) and a negative one. All of them are strongly present both in fictional and non-fictional representation of science, as well as in children perception of S&T:

- a "forbidden fruit dilemma": the search for knowledge can represent a violation of social, natural or religious kind and, as such, be punished. Myths or legends in almost all cultures re-invent this level in several forms (the biblical one, Prometheus, Ulysses are just some examples);
- a "Sorcerer's Apprentice dilemma": knowledge is power and power must be controlled. The risk of losing control is always present;
- a "Golem dilemma": knowledge is transformation of nature. The barrier between different living beings or even between the living and not-animated can be violated;

Pygmalion, the homunculus in.Goethe's *Faustus*, *Dr. Frankenstein* are just examples of how these 3 elements can mix and interact to form new stories, in ways similar to those described by Levi-Strauss for myths (Castelfranchi, 2000; Turney, 1998).
These connotations about knowledge are not just typical of general public perception. Scientists use them too. J.B.S. Haldane describing (in *Daedalus,* 1923) the scientists as a Prometheus, or Nobel prize Walter Gilbert comparing Human Genome Project to the "sacred Grail" are just two examples.
Other sediments in this stratigraphy of public representation of science are typical of modernity. We individuated at least 3 different levels:

- "wunder-kammer", or Renaissance level: science as new worlds, new knowledge, new technologies, wonder and novelty;
- industrial revolution (or "Baconian") level: science as a rational method both to explain the world and to dominate nature for practical goals;
- "Enlightenment" level: science as the "light of reason", as truth, freedom and democracy.

Conclusions

A significant part of the mediatic discourse, both fictional and non-fictional, tells us a double-faced story about science and scientists: a "positive pole", euphoric, official, visible, lives side by side with a negative one, scared, pessimistic, in which science can be a violation of natural or divine order, and scientists can be "mad" or dangerous.
These apparent contradictions of science's image in society are, however, proofs of the vitality and deepness of the roots of science in society. Science is culture: it propagates not only in the form of concepts and claims about the world, but also by means of metaphors, dreams, "underground" representations in which ambivalence is a clue for mythical connotations (Sperber, 1996). The study of these connotations, which appear to be stratified and formed by ancient images, can play relevant role in the analysis of public engagement obstacles and in planning dialogue strategies.

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AN EXPERIMENT IN TWO-WAY, DIRECT COMMUNICATION BETWEEN SCIENTISTS AND THE PUBLIC IN PORTUGAL

Ana Godinho Coutinho,[1,4,5] Sofia Jorge Araújo,[2,5] and Mónica Bettencourt-Dias[3,4,5]

[1] Instituto Gulbenkian de Ciência, Apartado 14, 2781-901 Oeiras, Portugal.
Tel.: +351 21 4407936, fax: +351 21 440 79 70, acoutin@igc.gulbenkian.pt
[2] Institut de Biologia Molecular de Barcelona, Parc Científic de Barcelona, Spain.
Fax: +34 93 403 71 09, sarbmc@ibmb.csic.es
[3] Department of Genetics, University of Cambridge, Downing Site, CB2 3EH- Cambridge, United Kingdom.
Tel.: +44 1223 766701, fax: +44 1223 333992, mbcd2@cam.ac.uk
[4] Associação Ciência para o Desenvolvimento, Portugal. www.sciencefordevelopment.org, info@sciencefordevelopment.org
[5] Associação Viver a Ciência, Portugal. www.comunicar-ciencia.org, info@comunicar-ciencia.org

Abstract

We have assessed whether science communication in Portugal can evolve from being one-way and indirect, to becoming two-way and direct. We organized a pioneering weekend conference between scientists of a Portuguese research institute and the public of the local town, based on the Danish model

of the consensus conference. The lay panel set the agenda for the conference, guided the proceedings and prepared a consensus report that was assessed by the scientists' panel. The evaluation and outcomes of the weekend conference suggest that two-way, direct communication between scientists and the public is possible. Its findings shall be used to introduce public dialogue in science in Portugal.

Key words: Two-way communication; conference.

Text

Context

A movement to increase the scientific culture in Europe has developed and expanded, over the last two decades (Miller *et al.*, 2002). In Portugal, too, since the late 1990s, a concerted effort has been made to raise the public's awareness of science through science sections in daily newspapers, science programmes on television, science museums, popular science books, institutional open days, science weeks and public lectures (Miller *et al.,* 2002).

Yet science communication in Portugal is, almost invariably, one-way –from the scientist to the public– and indirect –mediated by journalists, museum curators, etc. In fact, scientists in Portugal rarely discuss scientific issues directly with the public, and hardly ever get feedback as to their communication efforts. Even in recent controversial scientific matters all communication between the public, the scientists and the decision makers occurred via the mass media, thus withdrawing any possibility of dialogue between the players (Gonçalves, 2002).

Objective

The aim of this study was to evaluate whether science communication approaches in Portugal can evolve from being one-way, and reliant on mediators, to becoming two-way, with direct interaction between scientists and the public. A weekend conference with scientists of the Instituto Gulbenkian de Ciência (IGC) and the public of the local town was organised and evaluated. The weekend conference was designed very much based on the Danish model of the consensus conference – a model medium for two-way science communication (Farmelo, 1997; Joss and Durant, 1995).

The results of the weekend conference may be used to promote greater engagement of the Portuguese public in science and technology, through two-way communication strategies.

Methods

Lay panel members were recruited via advertisements in the local press and posters placed in town. The lay panel members received information on the IGC, before the conference. Each lay panel member suggested two topics for discussion at the weekend conference. Based on theses topics, seven IGC researchers were invited to be on the scientists' panel.

The conference was held over the weekend of 6,7th September 2003, at the IGC. Its structure was very much based on the structure of a consensus conference: on Saturday, the invited scientists presented and discussed their field of expertise; on Sunday morning, there was an open debate with both panels and the audience, to address more general issues; on Sunday afternoon, the lay panel prepared and presented their final consensus report. Short questionnaires were used to evaluate the weekend conference.

Results

The lay panel was made up of five women and three men, aged between 18 and 65, from different professional backgrounds. The reasons for taking part in the conference included: to get to know the institute, to discuss specific topics, to meet scientists and better understand their lives, to make contacts and to learn about the structure of science in Portugal.

The scientists' panel was made up of seven group leaders and post-doctoral researchers. The scientists agreed to take part in the conference to promote the IGC, because they had been invited, to promote science in society, to gage the impact of their work on the public and to gain experience in communicating with the public, amongst other reasons.

Several life science research topics were discussed, as well as more wide-ranging topics: the scientists' driving force, basic versus applied science, science policies in Portugal and elsewhere, funding of science and science education.

The lay panel members felt that they had gained more from the conference than from a book, newspaper or documentary; that their attitude towards science had improved and that they would be more alert to science news.

Both panels felt that such conferences should be used as a form of public assessment of science and technology and as a contribution to defining science policies.

Conclusions

This pilot experiment suggests that such two-way communication is feasible and appealing to both scientists and the public.

The conference could easily be extended to other fields of science, beyond the life sciences, such as physics and mathematics, to discuss specific science-based topics which have perceived social and ethical implications.

At present, the participation of Portuguese citizens in science-based debates is usually very poor (Serrão, 2003), due, largely to the unstructured form of these debates. We propose that fora for dialogue, should come to replace this current mode of public debate in Portugal so that the consensus opinions of the citizens involved could serve as a reference for the institutional debate.

Such conferences are also an ideal form of dialogue between the public and scientists, and a excellent fora for raising awareness and engaging the Portuguese public in scientific matters.

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HOW PUBLIC OPINION COULD BE MANIPULATED THROUGH SCIENCE ON BIG ECOLOGICAL DISASTERS

Carlos Elías

Departamento de Periodismo. Universidad Carlos III de Madrid. 28903 Getafe, Madrid (Spain).
carlos.elias@uc3m.es

Abstract

This study wants to prove how politicians surround themselves with adjacent scientists in order to endorse their explanations under a certain scientific point of view, in many cases hard to believe, when they try to explain some decisions politically and socially unacceptable. In order to explain it, we have chosen two ecological disasters: the toxic waste in natural reserve of Doñana, the most important one in southern Europe (April 1998) and the Prestige's catastrophe (November 2002) the oil waste spilt over Spanish northeast coast.

Key words: Scientific journalism, Doñana, science manipulated.

Text

Context

Usually big ecological disasters make people increase a reasonable social alarm as well as the political system tends toward to be criticised for a lack of conscience in environment affairs. Politicians barely have credibility. However, science still maintains a bit of objectivity that makes people respect any kind of decision if it has ensures by scientific point of view. It has been consulted six Spanish newspapers (*El País, El Mundo, ABC, Diario 16, El Periódico de Cataluña* and *La Vanguardia*) to know how they kept on informing four months later of disasters. After a qualitative analysis of sources used by them, it has been noticed that the one they used the most was The Superior Board of Investigation Scientist (Consejo Superior de Investigaciones Científicas - CSIC), a political organisation created by Spanish dictator Francisco Franco that, according to opening speech in 1940, it pointed to exposure scientist knowledge to political will. At present times, the chairman of CSIC is still chosen by the government. Quantity investigations carried out in six months from February to July 1998 show us that the 48.1% of 1,458 scientist news in those newspapers named to CSIC when it only produces 16% of total scientist news.

It shows how media ignore Spanish universities when it proves they produce 77% of scientist discoveries.

Free down of teaching at Spanish universities is a fact since the monarchy returned in 1975; therefore, its final researches are not under political pressures. Nevertheless, the government keep control of some state research organisations. Things like that happen also in others democratic countries. Last Robert Kennedy's book, Crimes against nature (2004), show us how in a country like United States, the oldest democracy in the world, political handling on environment issues grows every day.

An example of this policy is the appointment by President George Bush of John Graham as a Administrator of Office of Management and Budget office. As Kennedy said in his book, "Graham received huge amounts of money from the most polluting people on business like Dow Chemical, Du Pont, Mosanto, Exxon or General Motors, everything before his arrival to Bush administration".

Also, Bush take on journalist Frank Luntz in order to disguise rhetorically attacks against environment. He carried out two projects: "clean skies" and "healthy forest"; the first one

allowed to coal industry to keep polluting; the second one made possible to cut down indiscriminately thousands of trees from natural reserves.
In addition, Luntz was the one responsible for a big campaign of intimidation against some scientists who were not agree with Bush's administration. It is worth to emphasize James Zhan's case; he was forced to leave his job as a microbiologist at US Agriculture Department and to "bury" his studies on antibiotics effects in meat industry.
In addition, scientific Robert Watson, former Director of Science Division at NASA, had to resign pressed by some American energy lobbies for proving with scientific facts the global warming theory.
Kennedy's book finally alerts against many pseudoscientific who works just for money for multinational companies trying to twist science world. "We are getting back to clouds times" he ended.

Results

As it can be seen, the parallelism between Spanish dictatorship is obvious. In 1940, former dictator Francisco Franco expelled from Spain to many independent republicans Scientifics after the civil war. A few months later, Jose Ibañez was appointed Secretary of State for Education and, at the same time, first president at CSIC; he made a speech that even today looks like a flagstone in Spanish science: "We should forget and despise those who deify human knowledge. From my position, I remind to intellectuals their duties with the science. Silly happy times when science was a free and voluntary are over".
Back to present times, this study reveals that during Doñana's affairs, our particularly Spanish Frank Luntz was Javier Fernandez Carvajal, CSIC's editor in chief, and Spaniard copy of John Graham was Cesar Nombela, president of CSIC appointed by former Prime Minister Jose Maria Aznar.
From April to May we analyzed 454 pieces of news and it found out that 246 (which mean 53%) pointed at CSIC as a primary source. However, from April 26 to June 30, the busiest news time, 407 pieces of news were published and exactly 224 (55%) mentioned CSIC; in this last period Nombela was named in 74 times. Scientifics from universities or independent academies barely were mentioned by mass media.
CSIC massive influence over press during Doñana's affairs was so intensive that even some universities complained about it to media.
In the *Prestige*'s affairs (november, 2002) happened the same politics manipulations through science. But in this case the government considered Rolf Tarrach, president in 2002 of CSIC, as a person who couldn't be trusted and replaced with Emilio Lora-Tamayo, considered a scientist closer to the Spanish government and son of one Franco Minister who closed five universities and used police repression against students and teachers who asked for free down.

Conclusion

Politicians intend to control some scientists who are open to interact as journalistic sources. These selection methods remind dictatorship times. This study shows up that, in case of big catastrophes, journalists choose these types of politicized scientist sources instead independent scientists of universities or academies.

EXHIBITION TO PROMOTE PUBLIC PARTICIPATION IN INFORMED SOCIAL DEBATE ON THE USE OF EMBRYOS

Rosina Malagrida,[1] Laura Valls[2] and Carla Vazquez[3]

[1] Head of Communication at the Barcelona Science Park. University of Barcelona. Baldiri Reixac, 10-12, 08028 Barcelona (Spain). Tel.: +34 93 403 45 53, fax: +34 93 403 90 60, rmalagrida@pcb.ub.es

[2] Laura Valls, Grup de Difusió de la Ciència. Universitat Autònoma de Barcelona. Despatx G5-146, Dept. de Didàctica de la Matemàtica i les Ciències Experimentals, Facultat d'Educació. 08193 Bellaterra. Tel.: +34 93 581 26 39, fax: +34 93 581 11 69, gr.dc@uab.es

[3] Carla Vázquez, Communication Department, Barcelona Science Park. University of Barcelona, Baldiri Reixac, 10-12, 08028 Barcelona (Spain). Tel.: +34 93 403 46 82, fax: +34 93 403 90 60, cvazquez@pcb.ub.es

Abstract

The use of embryos in research opens up an array of therapeutic applications and generates intense social debate on the ethical and legal issues involved. Congresses held on the use of stem cells often highlight the need to establish social dialogue; however, there are few mechanisms available with which to facilitate this interaction.

This project arose in response to a lack of communication channels to encourage informed social debate. In this regard, an exhibition named "Embryos and Medicine in the 21st Century" was designed in a format that is both interactive and easy to understand, covering the ethical and scientific issues related to this question and the opinions of distinct sectors of society.

Through several interactive tools, this exhibition aimed to encourage the general public to participate in the debate on the use of embryos for obtaining stem cells.

An evaluation was performed while this exhibition was held in the UB, where it received 2,700 visitors. The evaluation showed that approximately 80% of the visitors who expressed an opinion defended the use of embryonic stem cells for research purposes. These results were cited in *Science* (Vol. 299, February 2003).

Consequently, this project is a unique and innovative tool with which to establish true and informed dialogue with the public. The design of future communication initiatives aimed at stimulating public participation should consider the evaluation and the methodology used in this exhibition.

Key words: Citizen participation, ethics, exhibition.

Text

Context

The use of embryos in research opens up an array of therapeutic applications and generates intense social debate on the ethical and legal issues involved. Congresses held on the use of stem cells often highlight the need to establish social dialogue; however, there are few mechanisms available with which to facilitate this interaction.

This project arose in response to a lack of communication channels to encourage informed social debate, which was perceived when the Observatory on Bioethics and Law (OBD) of the University of Barcelona (UB) published their Document on Research with Human Embryos.

Objectives and methodology

In this regard, an exhibition named "Embryos and Medicine in the 21st Century" was designed with the scientific assessment of Maria Casado, director of the OBD, and Josep Egozcue, professor of cell biology at the Autonomous University of Barcelona. This exhibition aimed to encourage the general public to participate in the debate on the use of embryos for obtaining stem cells.

Balanced information

To facilitate debate with an informed background, the exhibition shows, in a format that is both interactive and easy to understand, the ethical and scientific issues related to this question. In response to public interest and the need to establish an unbiased communication channel, it presented the most objective concepts while subjective information was provided by figures such as scientists and politicians (see Figure 1). In addition, the exhibition presented opinions in favour and against research with embryos, expressed by distinct sectors of society (see Figure 2). Also, proportional information was given on stem cells obtained from distinct sources, and the advantages and disadvantages of each source were described.

Figure 1 Panel explaining that adults can be a source of stem cells. The researcher specialised in stem cells, Catherine Verfaille, is shown giving her opinion. She states that although adult stem cells appear to be more promising than originally thought, research with other sources should be performed

Encouraging public participation

The last area of the exhibition was devoted to reflection and recorded the opinions expressed by visitors. For this two mechanisms were designed. The first consisted of two tubes where the visitor could read: “Which has most weight?”. On one it said “The ethical issues derived from the use of embryos” and on the other “The possibility to develop new therapies”. Visitors were requested to place a ball into the cylinder that best reflected their opinion, and they could also observe the opinions expressed by others (see Figure 3). Finally, the second mechanism was through virtual discussion forums in which the public could state their position in more depth. These opinions were shown periodically on the exhibition website (www.pcb.ub.es/expoembrions).

Results

An evaluation was performed while this exhibition was held in the UB, where it received 2,700 visitors. It showed that approximately 80% of the visitors who expressed an opinion defended the use of embryonic stem cells for research. These results were cited in *Science*.

Figure 2 Interactive panel in which scientists, politicians, actors, people of distinct creeds, etc express their opinion on the topic

Figure 3 Interactive panel through which visitors can express their opinion by dropping a ball into one of two transparent tubes and the opinion of other visitors can be observed

Conclusions

Consequently, this project is a unique and innovative tool with which to establish true and informed dialogue with the public. The design of future communication initiatives aimed at stimulating public participation should consider the evaluation and the methodology used in this exhibition.

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POPULAR RESPONSE TO SCIENCE AND TECHNOLOGY ISSUES IN BRAZIL: CONSEQUENCES OF THE LACK OF PUBLIC ENGAGEMENT

Luisa Massarani[1] and Ildeu de Castro Moreira[2]

[1] Museum of Life/Casa de Oswaldo Cruz/Fiocruz, Brazil, and SciDev.Net/Latin America (www.scidev.net). Av. Brasil, 4365, Manguinhos, Rio de Janeiro, RJ, Brazil. Tel.: +55 21 3865 2155, fax: +55 21 3865 2155, lumassa@coc.fiocruz.br

[2] Institute of Physics and the Interdisciplinary Group on Epistemology and History of Science and Technology, Federal University of Rio de Janeiro, Brazil. Instituto de Física, Bloco A, CT, Cidade Universitária, UFRJ, CEP 21945-190, Ilha do Fundão, Rio de Janeiro, Brazil. Tel.: +55 21 2275 8168, ildeu@if.ufrj.br

Abstract

In this paper we analysed three study cases in which conflicts were raised as a popular response to governmental actions involving science and technology issues in Brazil: the first attempts for introducing the decimal metric system in the country in 1860s/1870s; the 'Riot against Vaccinations', in the beginning of the 20th Century; and the contemporaneous GM crops controversy. We discuss also some consequences of the absence of public engagement in science and technology issues that have a significant social impact.

Key words: Public participation in science and technology, public engagement in science and technology, popular response to science and technology.

Text

The objective of this paper is to historically analyse the dinamical process in the relationships between science, technology, and public in Brazil. We focused on cases in which can be observed complex social processes as result of the introduction of new systems, equipments and behaviours linked to scientific and technological advances with a significant social impact. The attitudes, th participation and the eventual reactions of the public toward governmental actions involving science and technology has been barely studied in Latin America.

In this study, we are especially interested in situations in which controversies are raised resulting from the gap between the proposals formulated by scientific or political elites, and the interests, expectations and demands of other sectors of the society. The study of some of these cases can support a deeper understanding of the social relations and of the factors, impasses, challenges, and implications related to the processes in which the use of science and technology are deeply imbricated. In our presentation we will discuss also some consequences in Brazil of the absence of a public engagement in science and technology issues that have a significant social impact. We studied three of these cases in which conflicts were raised as a response of the public to governmental actions involving science and technology issues.

Initially we considered the episode for introducing the decimal metric system in the country in 1860s/1870s. Many scientists and intellectuals participated of the campaign for the adoption of this system, which was turned obligatory by law from 1872. However, the public administration didn't held properly its informational and educational function and there was not any attempt for engaging the public in the process. As consequence, a violent riot began in the Northeast region featured as a cultural resistance to a technical novelty, imposed no considering the social, economical, and cultural context. The resistence began in November 1874, mainly with the participation of small farmers and oweners of small trades. The background context was the miserable situation of

the population, the bad economical situation in the general scenario, religious-related issues, and obligatory military recruitment. The simbolic action of the revolters was the destruction, in public squares, of the new measure system standards – that's why the event is known as 'Revolta dos Quebra-Quilos' ('Ryot of the Broke-Kilos'). The distrust and resistance exhibited by the population, as well as the general acceptance of the traditional system of weight and measure system, hindered the quick acceptance of the new system.

Another event that exhibits the complexity of the relationships involving science, technology, culture, beliefs, scientific and technological conceptions, and power happened in 1904, with the so-called 'Revolta das Vacinas' ('Riot against Vaccinations'). It is linked to the important work of the Brazilian scientist Oswaldo Cruz for eradicating several transmissible diseases. The ryot was held in Rio de Janeiro and its tragic final result, after eight days of confronts between military forces and the revolted population, was about 300 deaths and 100 wounded people. Besides, about 1,000 people was put in the jail, half of them deported. The ryot began as a reaction of sectors of the population against a legislation aimed to obligate the vaccination against smallpox. The multifacetal causes of this event have been discussed by several authors and include aspects such as legitimate defense of civil rights; political, ideological and moral issues; violence attitude from the people responsible for vaccinating the population; disrespect of cultural traditions; reaction of sectors of the population against the accelerated urban transformation.

The third study case refers to the present state of the affairs on the public engagement concerning to GM food and crops, which has been growing considerable controversy in the last years. Since 1998, attempts to produce GM crops on a commercial scale have been made but growing and selling GM crops have been prohibited. By 2003, the controversies were especially significant: In February it was found that major proportion of Brazilian soya crops were transgenic due to illegal planting in Southern states. Shortly after an announcement to maintain the ban, the government decided to allow the sale of GM soya for animal and human consumption, sparking protest within the government and from environmental groups, as well as in sectors of the population. The decision was initially limited to the 2003 harvest. Last February, a new biosafety legislation was approved by the Chamber of Deputies, which broadened the permissibility for the sale of transgenic soya to the 2005 harvest. The legislation, which remains to be approved by the Senate, evoked a new wave of protests.

These three study cases show the Brazilian authoritarian tradition, several times supported by a excluding perception of many scientific community representatives, hindered a larger participation of the public in science and technology issues.

One general aspect that clearly comes forth of the analysis these cases is the high level of exclusion of the local population from the discussion on the fundamental issues involved in the process. Besides, the local population is often kept without information and outside the decision process and of the search and implementation of alternative solutions. Very often, the population only receive information –in a very limited way– in the moment in which they are directly reached by the process. The absence of a public engagement in science and technological issues, confirmed by the inexistence of efficient mechanisms for popular participation in Brazil, has been constant throughout the Brazilian history.

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Proposals and initiatives for "public dialogue"

DIFFUSE EXHIBITION AS A WAY OF TALKING ABOUT SCIENCE AND ENVIRONMENTAL ISSUES. DESIGN, EVALUATION AND CONCLUSIONS

Marta Colomer Salarich, Teresa Escalas Tramillas, Núria Güell Esquius, Maite Buil Blasco

Professors, researchers and teacher trainers at the Autonoma University of Barcelona. Research Group for Dissemination of Science and the Environment. Didactic Department of Experimental Sciences. Institute of Environmental Science and Technology. nuria.guell@uab.es, teresa.escalas@uab.es. http://dewey.uab.es/_ce_difusio

Abstract

Building up a dialogue between municipality agents and citizens regarding issues, which affect us such as science, technology and the environment, requires new tools. This study puts forward an expository model, which works towards reaching this communication through three target objectives: informing, creating new attitudes and promoting dialogue.

The model is shown through an example of a municipality residue plan where the involvement of the community and the exchange of opinions among the participants are pursued. At the same time, the model presents the elaboration and application of an evaluation pattern, specially designed to further analyse its functioning and effectiveness.

Key words: Participative diffuse exhibition: a model for exhibition that tries to educate in knowledge, values and attitudes on a particular subject and, at the same time, collects proposals and opinions from participants. It is called diffuse because it is divided into territories according to the affinities of the territory with the subject of the various panels or parts of the exhibition.

Text

Context

The exhibition that is presented took place in the municipality of Viladecans (Barcelona), in the context of the diffusion of the Municipal Plan for residues.

Objective

General objectives

- To advance in the construction of an educational exhibition model on an environmental subject.
- To advance in the construction of model for evaluating educational exhibitions on an environmental subject.

Specific objectives

- Propose and prepare a specific case of an educational exhibition on an environmental subject applied to a real situation following the model proposed.
- Prepare the evaluation of the exhibition mentioned using the evaluation model that is proposed.

Methods

The techniques used in the interactive components are specially designed to make connections among the local community and between the community and the municipality agents. In this way, not only a mere interest in the surrounding area, but also a real collective implication is promoted. The evaluation system is conceived as a way of analysing the exhibition. The exhibition's impact as well as its overall functioning will also be taken into account in order to improve future actions. The evaluation's methodology is based on the application of both qualitative and quantitative techniques such as: recounts, inquiries, guided observations, image analysis and coherent methodological analysis.

Results

The evaluation results provide conclusions about the use and the application of the new model and have rendered possible the detection of its strengths and weaknesses, which will be key to bringing about proposals for improvement.

Conclusions

The exhibition presents two innovating characteristics:

- It is diffuse. Citizens encounter it in their itineraries.
- It contains elements geared towards a type of participation, which stimulates bi-directional communication.

Diffuse exhibitions are not only accessible to citizens, but their use is valued very highly by the local communities, especially due to two elements: on the one hand, due to the interactive aspects they entail, and on the other hand, due to the possibility they give citizens to directly discuss with the municipality agents in charge of the environmental issues in their area.

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THE UK GM DEBATE: HOW TO ENGAGE THE PUBLIC IN SCIENCE POLICY MAKING

Chris Edwards

Centre for Science Education, Open University, Walton Hall, Milton Keynes, MK7 6AA, United Kingdom.
Tel.: +44 (0)1908 659816, fax: +44 (0)1908 659816, c.h.edwards@open.ac.uk

Abstract

In the UK there has just finished an extensive public debate on genetic modification. How effective was this and what can be learned from the process? Are there differences between the responses of the public in the UK to those of the public in other countries that engage in participatory approaches to decision making? This paper will discuss the conclusions that can be drawn from the evidence available, including previous work on the effectiveness of public awareness of science initiatives and consider the future of this form of engagement with the public over issues of science policy.

Key words: Public awareness of science, policy making, science communication, public engagement in science.

Text

Introduction

GM Nation? is the most concerted effort to take the debate to the public in the UK. Following public protests and unease with this form of scientific research and technology, this was perhaps, in part, an attempt by politicians to wrest back some form of control over proceedings. Whatever the sub-text there was a clear intention that this should be seen to be independent and open.

'Margaret Beckett has said that the government wants a genuinely open and balanced discussion on GM.'[1]

'GM Nation? The Public Debate' is a programme of public deliberation with the issues for debate framed by the public. The debate is being conducted at arm's length from Government by an independent steering board.[2]

Overview of the process

The GM Nation? public debate was one of three information gathering strands. The Government also commissioned two reviews: an economic review, and a scientific review.

In addition, the Farm-Scale Evaluations (FSEs) were expected to report during the debate. GM Nation? began with the Foundation Discussion Workshops designed to help formulate the framework for the main debate. The public debate then lasted 6 weeks. It consisted of three tiers of meeting where participants were self-selecting. There was also a separate 'narrow-but-deep' study with invited participants.
Soon after the events were announced it was realised that neither the report of the FSEs, nor the reports on the scientific and economic evaluations would be ready to inform the debate. One very curious remark is made in the Public Debate Steering Board's (PDSB's) report about this timing of the FSE's report.
'…we did not think the public should be made to wait for one more piece of evidence whose significance could not be foretold.' (p.15).[3]

Discussion
From the documentation, several reasons emerge for the perceived failure of the GM Nation? public debate.

Timing
It is widely recognised that due the debate could not be informed by the reports of the science and economic reviews and the FSE results.(4) but no allowance is made for this.

Duration
The UK debate itself lasted 6 weeks,[5] compared to over a year for the New Zealand debate.[6]

Budget
COI were responsible for recommending the original budget of £250,000 later described by the EFRAC as 'paltry'.[4]

COI
In both the Defra[7] and GeneWatch[5] reports it is clear that there were tensions between the PDSB and COI. Whilst there were pragmatic reasons for selecting COI, their lack of experience and inflexibility was certainly a significant factor in the failings of the debate.

Make-up of meetings
Every report comments on the apparent imbalance of participants at meetings.
Government not committing to outcomes
The final report noted that many of those who took part believed a decision had already been taken and that this was merely an empty PR exercise. They felt the Government would ignore whatever the findings of the debate.

High levels of suspicion and mistrust
It was also noted in the final report that many were suspicious and mistrusting of the Government – BSE had raised doubts in minds that the decisions finally made would really represent the public's interest over that of producers. Many also felt that the Government had already ignored the will of the people in its action over Iraq (p. 43).[3]
The Government claims the tight timeframe was due to the external constraints set down by the EU, which also determines much of the legal framework. Therefore, the UK Government is not at liberty to offer an open commitment to adopting the recommendations of the public debate.[4]

Closing comments

There are positive aspects to the debate and such an activity would not pass without criticism. However, as one reflects on GM Nation? it seems only likely to increase general levels of cynicism and mistrust. Taverne in a very recent article holds up the public discussion over stem cell research as an example of an effective consultation. He describes the atmosphere as non-adversarial and notes there was no hijacking of the process by green organisations.[8] There appears to have been no attempt to learn from the experiences of public engagement in other countries.

Perhaps debates should be managed at the European level and built into the overall decision and law making processes, with a commitment to act on the outcomes as stated by the people.

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SCIENCE AND SOCIETY. TWELVE CLICHÉ QUESTIONS AND FORTY-EIGHT CONTROVERSIAL ANSWERS

Teresa Escalas Tramullas, Maite Buil Blasco, Marta Colomer Salarich and Núria Güell Esquius

Professors, researchers and teacher trainers at the Autonoma University of Barcelona.

Research Group for Dissemination of Science and the Environment. Didactic Department of Experimental Sciences. Institute of Environmental Science and Technology. nuria.guell@uab.es, teresa.escalas@uab.es, http://dewey.uab.es/_ce_difusio

Abstract

At a moment when public participation is a must for the progress of science, we are faced with an open debate about new challenges, which have an impact on scientific communication. Changes, diversity and complexity have put forward new ideas leading to the adoption of different attitudes.

Scientific communication has undergone a transformation caused by the deep changes experienced by society, communication and pedagogy. In this sense, scientific communication has gone from being explanatory, to being active and, finally, to demanding participation.

Communication contains a wide range of contexts due to the fact that the scientific community participating in the different tasks goes from creating scientific knowledge and collaborating in resource management, to being critical analysts or trainers of new scientists. It also entails complexity stemming from its own nature and from the new ways of understanding the world.

The analysis of the present situation has given rise to twelve questions aimed at determining the key

factors needed for the progress of scientific communication, as well as at providing the answers to each one of the set questions from different scopes. That is, preserving the level of knowledge acquired avoiding clichés, presenting knowledge in a way which is easy to understand for an audience which does not necessarily belongs to the scientific community, making people eager to get involved in science-building through different activities, favouring apparently contradictory positions and different degrees of confidence regarding the contribution of scientific discoveries to the common good, and putting forward a dialogue conceived as a site for gathering the social perception requested to achieve the needed feedback to enhance the progress of knowledge.

Key words: Science Communication, public participation, Public Understanding, Scientific Literacy.

Text

Nowadays, we find ourselves amidst an open debate on the new challenges to scientific communication that is due, on one hand, to abundance of knowledge and, on the other, to the need for including participation within scientific communication.

In reference to knowledge and research subjects, the increases in interdisciplinarity and the introduction of complexity have made science advance beyond compartmentalised disciplines. It is now possible to interpret, foresee and plan many of the events that occur in our world under a broad perspective. Some of these subjects such as ecosystems, genetics, exploration of the universe and many others are of great interest for society.

With regard to communication, we have reached a point of profound transformation due to the changes that relationships have experienced within society and the contributions of pedagogy and the new ways of communicating in the last few decades. Science's methods for communicating, which were initially expositive and had the objective of informing and making known, have been transformed into active methods that allowed the public to intervene in the acquisition of information and in the building up of its knowledge. There is a new challenge facing us now at the beginning of the twenty-first century: it is that dealing with participation. It requires the scientific community to make new contributions. Once again, it is necessary to renew the methodology for achieving new objectives that have made it possible for citizen's to be involved in the great project of science.

In the new scientific communication, different professionals carry out diverse tasks such as the building up of knowledge, running things, the upholding or critiquing of decisions undertaken, training of new scientists and dissemination of information within society that, with the new challenge of participation, includes the task of collecting citizen's perceptions and contributions.

Conclusions

The analysis of the situation, in this communication, has given rise to twelve questions that focus debate on the points on which we need to advance in scientific communication. The answers given to each one reflect different positions towards the subject: maintain the level of knowledge (thereby avoiding a vulgarisation), expose a more or less ignorant public to intelligible facts, make people favourable to science by using surprises and activities, stay on the sidelines of science since it is an area that pertains to specialists, maintain different positions ranging from absolute confidence all the way to distrust in regard to scientific contributions to the common good or establish a dialogue in which a way of collecting social perception is proposed so as to achieve feedback that facilitates the advance of knowledge.

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PUBLIC PARTICIPATION IN CLIMATE CHANGE KNOWLEDGE PRODUCTION. AN ASSESSMENT OF COMMUNICATION MODELS

Joana Díaz Pont

Universitat Autònoma de Barcelona. Sociology phd Program. Postal address: Carretera Nova, 98, 08530 La Garriga, Barcelona. Tel.: +34 3 841 81 53, joana.diaz@terra.es

Abstract

Recently, there have been experiences of public participation in the debate on climate change, despite the "invisibility" and scientific complexity of this environmental problem.

The study of public participation in climate change knowledge production from primary scientific sources provides data to draw and assess a communication model based on public dialogue.

The understanding of climate change knowledge production on which the present paper builds is based on the data collected through interviews to climate change scientists and participant observation during their fieldwork at the Ny-Ålesund International Arctic Environmental Research Station.

The science-society participation mechanisms identified and studied follow a regular pattern concerning its effectiveness in terms of communication. The patterns identified have been used to test a primary model of systemic environmental communication that works as a tool to understand the role of communication, information, and public participation in governance for sustainable development.

Key words: Communication, public participation, climate change.

Text

Context

Public environmental behaviour is influenced by many factors (both internal and external to the individual) and especially by cultural infrastructures. The media, the educators, policy-makers or scientists and experts are enrolled in setting the agenda of the environmental debate and they all play a decisive role in determining social behaviour towards sustainability.

Information received by the audience raises awareness but it does not necessarily involve the public in the identification and implementation of a joint solution. Public involvement in environmental problem solving goes beyond perception and awareness and it is a matter of many actors. On their side the media contribute to making environmental problems visible to the public. They contribute to setting the environmental agenda but they cannot be made accountable for social behaviour. Sustainable behaviour is the result of the interaction between the media, the audience, sources of information and the different actors of the problem.

Structured and systematic interaction of the audience with the information they receive

and with the sources can influence the contents of this information. Such interaction generates a different knowledge that holds not only the vision of policy makers and scientists (primary producers of knowledge) but also that of the public in their capacity as citizens and consumers. The phenomenon of interaction of the public with information contents, and thus their participation in knowledge construction, has been studied in the field of public understanding of science and technology and especially in the environmental field. Climate change poses an additional challenge given its invisibility and scientific complexity.

Public participation in climate change knowledge production

The understanding of climate change knowledge production on which the present paper builds is based on the data collected through interviews to climate change scientists and participant observation during their fieldwork at the Ny-Ålesund International Arctic Environmental Research Station (July-August 2001, 16 climate change research projects studied. 27 interviews) Content analysis of communication materials published by these researchers has also been used as well as further research and documentation on their subjects of study and the link to communication and public participation.

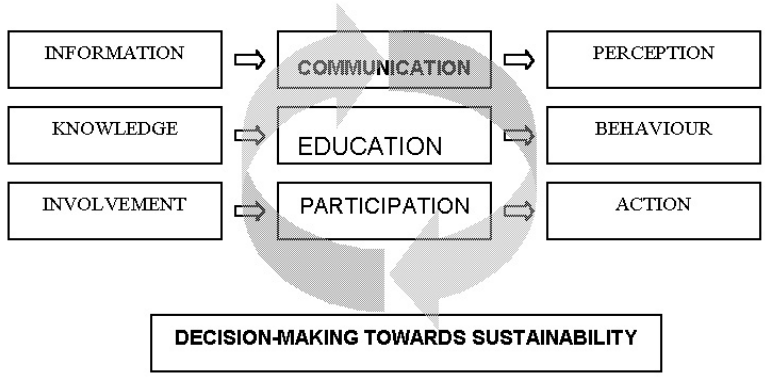
Examples of direct contributions of the public to the process of knowledge production could be identified where public involvement resulted in better design and better understanding.

The science-society mechanisms identified and studied follow a regular pattern concerning its effectiveness in terms of communication:

- Social networks share a common understanding of climate change as an environmental problem. This understanding has been facilitated by a common identity and shared knowledge.
- The linkage to science has been built upon the idea of joint construction of climate change knowledge.
- In more mature mechanisms there is a formalisation of the means of co-operation.
- When these mechanisms are functioning they are proved to become powerful communication tools. They can also become governance systems used for policy making.
- These mechanisms define a new kind of communication professional that plays a triple role in communication, education and participation.

Changing communication models: the role of new communication actors

Environmental communication cannot be a lineal process of information transmission from the sources to the audience. Lineal communication limits the real capacity of the public to change their behaviour towards sustainable action. Effective environmental communication for sustainable decision making is an information-action cycle. Information is used not just as a tool to improve quality of what is known, but to serve to the specific objectives of an actor that can take multiple forms (a journalist, an NGO, a company, a scientist, etc.). The actor modifies the contents of information to make it useful for his/her final purposes. Information is not merely representing external data. Instead, it is enriching the knowledge of the actor, thus guiding and facilitating action.



This systemic model of environmental communication defines a group of *New Communication Actors* (NCA). NCAs emerge when communication involves action-information. When dealing with another type of information the main actors are, in general, mass media. In this case, information is modified and enriched by the actor through interaction with external data. The final user is not involved in the definition of the contents, or at least not to the extent of being able to decide what contents have to be released. On the contrary, action-information is based on interactivity between supply and demand of information.

NCAs co-operate actively in the process of environmental communication. They can be producers, transmitters and receptors. There is a tacit co-responsibility between NCAs to build together the means by which decision-making is made compatible with sustainable development: the media can be both delivering and retrieving information; society can be both learning from and educating the experts; scientists are providing knowledge that is built upon the experience of the public. There is an intricate interdependency between NCAs that results in a joint construction of knowledge.

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DARWIN CENTRE LIVE – USING LIVE WEBCASTS TO CREATE DIALOGUE BETWEEN NATURAL HISTORY MUSEUM SCIENTISTS AND THE PUBLIC

Emma Freeman

Science Communicator, Darwin Centre Live, The Natural History Museum, South Kensington, London.
Tel.: +44 207 942 5860, fax: +44 207 5175, e.freeman@nhm.ac.uk, www.nhm.ac.uk/darwincentre/live

Abstract

Darwin Centre Live is a daily public programme at London's Natural History Museum. Together with trained science communicators, Museum scientists openly discuss their work with Museum visitors and online audiences. The aim is to encourage dialogue between scientists and the public about current science issues and opens up public access to Museum science and the national collections. The programme uses new multimedia technology to broadcast live to the Web and events are archived on the Museum's website. Darwin Centre Live is part of the Natural History Museum's latest development, the Darwin Centre, which houses 22 million zoology specimens and provides working areas for the Museum's zoology scientists.

Key words: Scientists, dialogue, webcast.

Text

The Darwin Centre

The Darwin Centre is the newest building at London's Natural History Museum. Opened in September 2002, the centre was completed at a cost of over 20 million pounds. Initially it was designed as a collection and research facility to replace the outdated 'Spirit Building', housing 22 million of the Museum's zoology collections and providing laboratory and working areas for the Museum's zoology division. In its final form, the Darwin Centre also features a public floor and a public "offer" consisting of daily behind-the scenes tours, displays of some of the Museum's historical material, a suite of information touchscreen kiosks through which Museum visitors can find out about Museum's collections and research, and Darwin Centre Live – a public programme featuring the Museum scientists themselves.

The aims of the Darwin Centre's public offer are:

- To provoke a sense of wonder at the scale, diversity and nature of the life science collections.
- To give visitors an understanding of the cultural and scientific importance of all the collections, including the current and future value in the UK and world-wide.
- To show that the collections are actively conserved, curated and managed, used and added to.
- To show how museum scientists undertake research, using the collections, to investigate specific issues relating to the natural world.
- To give insight into the type, scale and relevance of the research projects the Museum is undertaking.

Darwin Centre Live

The public programme is a daily series of events in which Museum scientists discuss their work with the public.

Within the borader context of our Public Offer aims, the programme aims are to:

- Showcase Museum science.
- Provide Museum scientists with opportunities to disseminate their work beyond their peer group.
- Demonstrate the daily use and active conservation of Life and Earth.
- Sciences collections and other Museum archived materials.
- Promote live and on-line communication between scientists and their publics.
- Embrace themes of temporary relevance.
- Be intellectually rewarding, stimulating and scientifically credible.

Darwin Centre Live is a mixture of daily 30 minutes sessions (12.00 and 14.30) and longer, monthly evening events, developed between a trained Science Communicator and one or more of the Museum's 350 scientists. The Science Communicator hosts each session to ensure clarity of content and facilitate dialogue between scientists and audience members. All events are recorded and archived on the Museum's website www.nhm.ac.uk/darwincentre/live. Currently 3-5 events per week are webcast live.

Dialogue

The emphasis in Darwin Centre Live is on discussion and dialogue rather than presentation. In order to achieve dialogue, we aim to ensure that:

- Museum scientists and members of the public can have a conversation with one another about science and science issues in which they are interested.
- Everyone is seen as equal. No one at these events is seen as an expert, rather the participants are seen as a mix of different types of people with different experiences that they can bring to bear on the discussion.
- All participants feel comfortable with sharing their own experiences, thoughts and opinions.
- Everyone feels their own contributions to the discussion are as valuable as anyone elses.
- Everyone gains something from the experience whether it is new factual knowledge or enlightenment about the thoughts and opinions of others.

Are we achieving dialogue?

After running for 18 months, we have found that the evening events are much more successful at achieving dialogue than our day-time events. This is for two main reasons. The first is that the majority of our day-time audiences are made up of 'drop-in' visitors who come into the Darwin Centre as part of their visit to the Natural History Museum. They may not have come specifically to participate in that day's Darwin Centre Live discussion and, while they are content to sit back and listen to the event, they may feel less prepared to participate. Secondly, our 30 minute day-time slots have less capacity for in-depth conversation.

Evening events, in contrast, allow for in-depth discussions with lots of dialogue. Topics for recent events include bio-prospecting, colonising Mars, the future of Antarctica and the possibility of a future apocalypse. Rather than 'drop-in' visitors, our evening audiences consist of directed, purposeful visitors who are coming because they have an interest in the discussion topic. Often people come with friends as a social occasion. We therefore try to retain this informal feel, providing wine and refreshments and generally making visitors feel comfortable in the space and among the audience. This helps engender a lively conversational feel.

Overall

Overall the visitor's experiences of Darwin Centre Live has been positive. In preliminary evaluation studies, 88% of respondents thought that the Darwin Centre offers something different from the Museum's usual exhibitions and 74% felt they had learned something new about the Museum during their visit.

Although the day-time sessions are less successful at creating true dialogue, they are a valuable tool in communicating Museum science and people have responded positively to the opportunity to meet scientists/experts in a conversational setting.

SOCIAL PARTICIPATION FORUMS DEALING WITH SCIENTIFIC AND ENVIRONMENTAL ISSUES. PROPOSAL OF A FORUM MODEL AND OF A METHOD AND TOOLS OF ANALYSIS. THE CASE OF THE FIRST PUBLIC FORUM OF THE CATALAN ENVIRONMENTAL STRATEGY FOR ENVIRONMENTAL EDUCATION

Núria Güell Esquius, Teresa Escalas Tramullas, Maite Buil Blasco and Marta Colomer Salarich

Professors, researchers and teacher trainers at the Autonoma University of Barcelona. Research Group for Dissemination of Science and the Environment. Didactic Department of Experimental Sciences. Institute of Environmental Science and Technology. nuria.guell@uab.es, teresa.escalas@uab.es, http://dewey.uab.es/_ce_difusio

Abstract

Scientific and environmental communication are facing new challenges, which demand participation in order to promote new attitudes for a democratic society. To achieve this goal, new methods and tools are a must. The participation forum, where different experts meet to discuss and contribute to the progress of science, is one of them. However, the participation model used is not enough to guarantee the true participation of society in the environmental sciences arena. This is why this study presents not only a new participation model of forum, but also an evaluation model built upon the same participation principles. The system of analysis presented is based on the ASI-TIE method. The Participation Evaluation Panel is the tool designed to ensure dialogue and participation throughout the evaluation process. From the forum design and implementation, as well as from its analysis and evaluation of the analysis, strengths and weaknesses are determined, which will be taken into account in future forum participation evaluations.

Key words: Participative forum: open participation process in which different people and/or experts meet to make specific proposals on a particular subject. Evaluation / Participative evaluation: type of evaluation that collects the opinion of all parties involved in the process that is being evaluated and gives them the opportunity to share and discuss their different points of view.

Text

Context

Analysis is made of The First Public Forum on the Catalan Strategy for Environmental Education (ECEA). It is promoted by the Department of the Environment of the Autonomous Government of Catalonia [Generalitat de Catalunya]. The objective of the forum was to decide and prioritise activities to improve on the short- and mid-term education on the environment in Catalonia.

A series of informational sessions and working groups were programmed.

Objective

The purpose of the design of the participative forum, and the analysis of it, is to establish a model of participative analysis of forums and to prepare recommendations for future participative forums.

The purpose of the evaluation of the system of analysis is to prepare recommendations for future analyses of participative forums. To do so, evaluation is made of the attainment of certain objectives for the analysis system.

Methods

System of analysis of the forum

The ASI-TIE method, is proposed. It consists of: concretion of what one wants to analyse in Aspects – concretion of the aspects in Sub-aspects / Indicators – choice of the Techniques of analysis of the certain aspects – design of the Tools – determination of the Evaluators.

Intra-method triangulation methodology is performed in this investigation, as well as the application of various techniques and evaluators to analyse some of the aspects. Quantitative and qualitative tools are combined (questionnaires, recording of observations, analysis cards of documents, audio recording of the conference, a script of the evaluation meeting with the Technical Commission of the ECEA) and participative elements (Participative Evaluation Mural, PEM. See Figure 1).

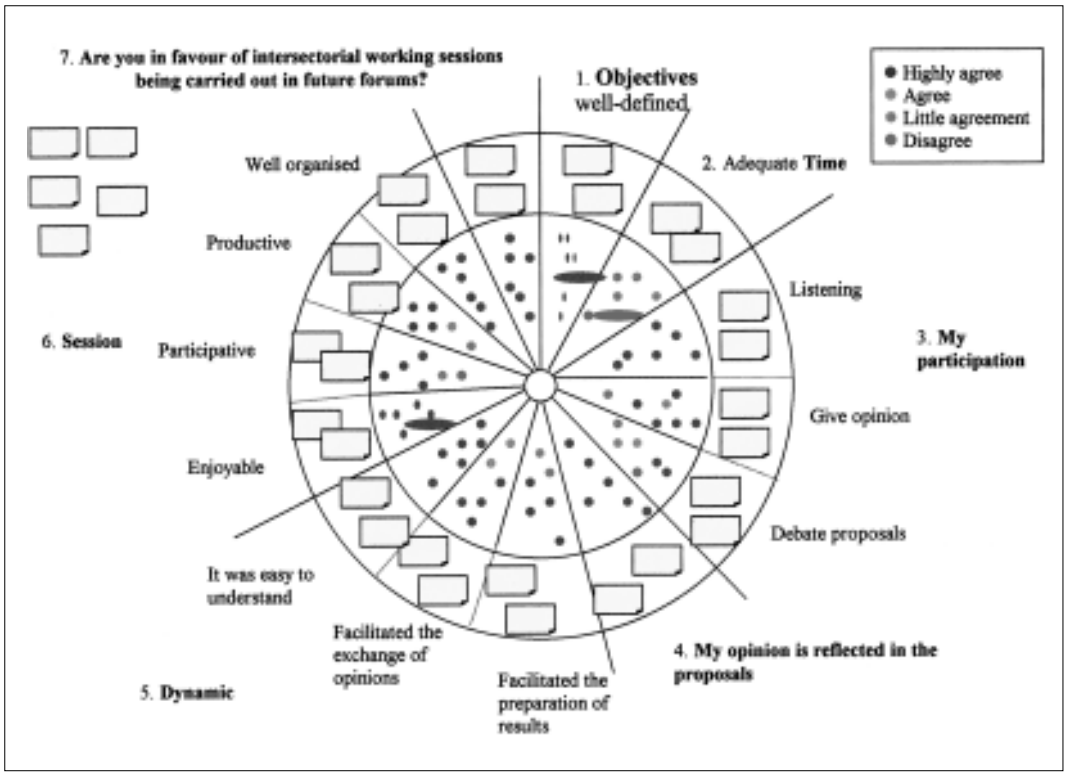

Figure 1 Participative Evaluation Mural (PEM) of the intersectorial working session (completed)

Application procedure of the PEM
Firstly, the items to be evaluated are read out loud and participants and facilitators put up the four different coloured stickers in accordance with their level of agreement or disagreement with the items proposed. Then, the assessments made are commented on out loud and opinions and proposals are collected by using Post-it notes.
System for evaluating the system of analysis of a participative forum
The OASI-TIE method is applied, which corresponds to the ASI-TIE method. Prior to this, the Objectives of the analysis that will be evaluated are defined.

Collection of data
The analysis tools were applied at various times in the Forum. The analysis of documents was done afterwards.

Results

Data handling
Statistical treatment was performed (Excel) on the quantitative data, and the speeches given by the participants were transcribed.

Conclusions

With regard to carrying out participative forums, the proposals are: in the first place, times of training, discussion and proposals (with the appropriate dynamic tools) should be alternated to achieve total participation. Secondly, those in attendance must feel like protagonists debating and proposing, as the interchange and debates between heterogeneous participants is the most positively valued part. Thirdly, to make the participation and operability compatible is one of the main challenges. Finally, to establish commitments and ensure that the work done has importance even beyond the Forum is fundamental to maintain the confidence and motivation of the participants.
With regard to the system of analysis of participative forums, the proposals are: to incorporate participation as a fundamental aspect; to analyse the operation and the participation of the forum; to be consistent with the process that is analyzed; that the results represent opinions and proposals of the participants; that it is perceived positively; to prepare novel and participative tools that facilitate dialogue and joint reflection and that are engaging and enjoyable; to facilitate the understanding of the results by displaying them in visual form. The system of analysis, the ASI-TIE method and the Participative Evaluation Mural (PEM), in this investigation, are valued positively and are presented as a model of analysis of participative forums.

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SCIENCE COMMUNICATION AS COMMUNITY ENGAGEMENT: A CASE STUDY IN REGIONAL AUSTRALIA

Catherine Pitkin[1] and Anne M Leitch[2]

[1] CSIRO Social and Economic Integration. Queensland Bioscience Precinct, 306 Carmody Rd, St Lucia Qld 4067. Tel.: +61 7 3214 2905, fax: +61 7 3214 2308, Cathy.Pitkin@csiro.au

[2] CSIRO Sustainable Ecosystems. Queensland Bioscience Precinct, 306 Carmody Rd, St Lucia Qld 4067. Tel.: +61 7 3214 2905, fax: +61 7 3214 2308, Anne.Leitch@csiro.au

Abstract

Communities are increasingly being recognised as a vital partner in the development of sustainable scientific solutions. In supporting this partnership science communicators have a key role to play in the development of community engagement processes that go beyond public relations and education and give communities greater ownership and control over research outcomes.

The 'Catalyst' Project, based on the NSW central coast, provides an example of effective community engagement processes in action. Using this project as a case study we will discuss the principles, benefits and challenges of undertaking community engagement processes as an integrated part of scientific research and how these principles align or clash with traditional organisation communication approaches.

Key words: Communication, Community Engagement, Dialogue.

Text

The world in which science operates is changing. Public scepticism of the value and impact of science developed in isolation from the social context in which it will be applied is driving demands for a new approach. According to Gibbons et al (1994) there is a growing shift away from discipline centred approaches where knowledge production is hierarchical and separate from application, and problems are largely determined by the scientific community towards a new interdisciplinary approach where research is carried out in the context of application and 'value' is determined according to the beneficial impacts that are derived. This shift is described as a transition between 'Mode 1' (traditional) science and 'Mode 2' (transdisciplinary and contextual) science.

For science communicators working with and within research teams this shift has also driven a parallel change in their role. Table 1 outlines the changing focus and drivers for science communication in this new context, in particular the transition from what can also be categorised as 'Mode 1' (traditional) communication that predominantly emphasises promotion, education and linear processes to select stakeholders to 'Mode 2' (community engagement) where communication is an embedded component of the research process playing a key role in facilitating dialogue, building interpersonal relationships, supporting skills and knowledge transfer, managing expectations and conflict and evaluating project outcomes.

There are many ways that communication can support community engagement, facilitating dialogue processes, relationship building, supporting the transfer of skills and knowledge between researchers and communities, managing expectations and conflict and monitoring and evaluating project outcomes.

While some important communication functions such as the translation of complex scientific knowledge into an accessible format, generating awareness and excitement in science and monitoring impact aligns easily within both modes there are many areas where this new way of operating can clash and cause tensions.

As communicators we have been taught that maintaining control of the process and message is essential to maximising opportunities for positive organisational exposure,

Table 1 Changing role of science communication

MODE 1: TRADITIONAL	MODE 2: COMMUNITY ENGAGEMENT
1. marketing/ positioning	supporting contextualisation of information and knowledge
2. primary input at beginning and end of research process	integrated part of research design, implementation and succession planning
3. single issue focus within defined boundaries	managing multiple issues across diverse organisational, geographical and community boundaries
4. organisational control of message and process	joint responsibility for process and decision making, community control
5. translating 'our' message, linear process	creating and facilitating two way dialogue, participatory process
6. what we think and want you to know	what do you need, what do you want to contribute
7. 'our' knowledge	combined knowledge of all stakeholders including researchers
8. researchers/ communicator in privileged position to community, 'experts'	working in equal partnership with stakeholders
9. focus on information delivery, education	focus on networking, information and process accessibility, equity and capacity building
10. branding, issues management	providing framework for knowledge exchange, evaluation and relationship management
11. rationalist, deficit model	recognised value of lay knowledge
12. objective, separate, defined boundaries	acknowledges values, aspirations and power, flexible boundaries

effectively managing issues and ensuring the 'right' message is received by the 'right' people. Indeed most communication structures, processes and timeframes within organisations are designed to specifically achieve this end.

However a whole new set of complexities and challenges arise when we relinquish this control and work in partnership with communities, at their pace, across multiple and sometimes conflicting interests, and with a commitment to incorporate local knowledge and act on outcomes.

Maintaining relationships, research quality and brand value in changing and often politically charged environments can indeed be a juggling act but there are many benefits to be gained by organisations, researchers and communicators in adopting community engagement principles. These principles offer a useful framework for the development of good relationships with all stakeholders, ensuring the right questions are being asked and addressed, and fostering the ownership and uptake of research outcomes. All of which are important for maintaining public confidence and support in science and science organisations.

In this paper we describe science communication in the Catalyst project (New South Wales, Australia) to illustrate how 'Mode 2' or community engagement style of science communication can operate.

Scientists from Australia's national research agency, CSIRO, are trailing a new and innovative framework, the Regional Development Futures (RDF) Framework,[1] which is based on a 'whole-of-community' approach to chart, realise and monitor a community's desired development pathway. Through the project Catalyst[2] they aim to enable the decision makers for the Central Coast region of NSW to develop strategies (and test their consequences) for the future of sustainability of the Central Coast Region.

The Central Coast of NSW

The Central Coast region is located about 90 kilometres north of Sydney and covers an areas of 1854 square kilometres. With an estimated population of around 300,000 residents, the desirable lifestyle, natural environment and proximity to the Sydney employment market means that this is one of the fastest growing regions in the state.

Government agencies, local groups and the community are grappling with how to handle this population growth while retaining the values that attract people to this region.

The Catalyst Project – a bright future for the Central Coast, NSW Australia

Using the four phases of the RDF, CSIRO's multidisciplinary research team is working in partnership with the community to:

Facilitate a series of specialist and community workshops and forums in the region - these forums will explore the different emphasis placed by groups within the Central Coast region in the broad areas of social, governance, and environmental and economic considerations.

Create a database of the factors, visions and strategies to explore the similarities and differences amongst the government, business and community groups – and begin to work towards a shared vision for the future of the region.

Develop resources and tools and transfer these tools and skills to local people to ensure that they can help the community manage change in the future.

Centralise as much information as possible from previous and existing studies in the region so it links, rather than repeats, things that have already been done in the area.

CENTRAL COAST Catalyst

The emphasis for science communication within this 'Mode 2' or community engagement framework is working as part of the research team to ensure an inclusive process in which the right questions are being asked and addressed and the capacity for uptake of research outcomes is being built through the project. Table 2 outlines how the key principles of community engagement play out through the activities of the Catalyst project.

Table 2 Catalyst activities as an example of 'mode 2' communication

Mode 2: Community Engagement	Catalyst Activities
Supporting contextualisation of information and knowledge	Development of Communication plan in consultation with project team and key stakeholders – used to guide community engagement activities
Integrated part of research design, implementation and succession planning	Communication plan is not a stand alone document but is broken up and individual components of communication plan fed back into project team work plan
Managing multiple issues across diverse organisational, geographical and community boundaries	A range of specialist and community forums across different topics. Theme champions drawn from high profile residents and key stakeholders targeted to attend
Joint responsibility for process and decision making, community control	Project officer is a local resident and is the main conduit between the researchers and the regional groups
	Continual checking of process and ideas with management or 'reference' group
Creating and facilitating two way dialogue, participatory process	Careful consideration given to community forums – location, timing, wording of publicity to maximise participation
What do you need, what do you want to contribute	Long led time in project development to ensure that the regional partners play a large role in scoping the project and its aims and outcomes
Combined knowledge of all stakeholders including researchers	Multidisciplinary project team in which communication discipline is strongly represented and incorporated
Working in equal partnership with stakeholders	Continual checking of project process and ideas with management or 'reference' group
Focus on networking, information and process accessibility, equity and capacity building	Strategies employed to build relationships across the region through group work in forums, to actively seek input from groups traditionally omitted in these types of processes (eg indigenous, youth), to build capacity through training workshops in systems thinking
Providing framework for knowledge exchange, evaluation and relationship management	Research agency identity is largely 'lost' in the process

Figure 2 Regional Development Futures Framework?

Although this style of research can be 'messy' with aspects of control handed over to the community, the results are more relevant and more enduring: which is important for maintaining public confidence and support in science and science organisations.

Notes

[1] The RDF framework was developed by the Urban Regional Futures team of CSIRO – Paul Walker, Gail Kelly, Guy Barnett, Michael Doherty, Bob Smythe, and Russell Gorddard.

[2] The Catalyst project brings together a number of regional agencies with community and government stakeholders and includes CSIRO, Central Coast Area Consultative Committee, NSW Government, Business Central Coast, Central Coast Tourism and Gosford and Wyong Councils. It also receives funding from the Regional Assistance Program funded by the Commonwealth Department of Transport and Regional Services.

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Parallel session 26

Interactions between science communication and science policies

SCIENCE INFORMATION NEEDS OF U.S. POLICY MAKERS

Rick E. Borchelt[1] *and Melissa L. Withers*[2]

[1] Office of Communications and Public Affairs, Whitehead Institute for Biomedical Research. 9 Cambridge Center, Cambridge, MA, USA 02142. Tel.: +1 617 258 5183, fax: +1 617 258 8848, borchelt@wi.mit.edu

[2] Office of Communications and Public Affairs, Whitehead Institute for Biomedical Research. 9 Cambridge Center, Cambridge, MA, USA 02142. Tel.: +1 617 258 5183, fax: +1 617 258 8848, withers@wi.mit.edu

Abstract

Science policy leaders heavily rely both on traditional print and online versions of the same or similar media. Although science policy leaders report using a wide array of information sources, they have differential levels of trust in various sources. For example, reports from the U.S. National Academy of Sciences or articles in *Science* or *Nature* are widely trusted. In contrast, science policy leaders report a low level of trust in news reports on CNN or a network news show. There is a strong trend toward the use of online resources for finding and obtaining policy-relevant information.

Key words: Policy, communication, internet.

Text

While working for the Office of Science at the U.S. Department of Energy (DOE), the corresponding author commissioned a study of information needs of science policy decision makers and policy makers. This paper explores a few of the principal findings of that study, the 2002 National Science Policy Leadership Study, conducted via contract with Professor Jon Miller at Northwestern University. The overall methodology of identifying science policy leaders and decision makers is more fully explained by Miller (2003).

For the formulation of science policy, the number of primary decision-makers rarely exceeds 100 (Miller and Prewitt, 1982). A second level of policy involvement is a collection or network of non-governmental policy leaders, including leading scientists and engineers active in research universities and selected corporations; the leadership of major universities, corporations, and organizations active in scientific or energy-related work; scientific, engineering, and other professional societies relevant to science and engineering; and the leadership of other relevant voluntary associations

In 2002, these two groups comprised approximately 7,946 individuals. A smaller sample of 633 leaders was selected and each individual received a letter describing the study and asking for his or her cooperation. A total of 331 science policy leaders completed a questionnaire on paper, online, or in a telephone interview, producing a cooperation rate of 63%. The survey addressed, among other items, information-seeking behaviors related to science policy.

Nearly 80% of the policy leaders studied a newspaper every day and an additional 14% read a newspaper most days. Ninety-five percent of science policy leaders reported that they read one or more magazines or journals regularly to obtain science information. 66% of science policy leaders reported reading one or more books relevant to science policy during the last year. By any measure, science policy leaders are well connected electronically. Virtually all science policy leaders reported using an office computer for e-mail and Internet searching.

Each science policy leader included in the smaller study group of the 2002 study also was asked to assess the level of confidence they would have in science information from a set of major information sources. The results again display a high degree of discrimination. Science policy leaders expressed the highest level of confidence in a report from the U.S. National Academy of Sciences. On a zero to 10 scale, science policy leaders gave a report from the NAS a mean score of 8.6 (see Tables). An article in *Science* or *Nature* was the

Table 1 Sources of Information about Global Warming or Climate Change, 2002

	Two major sources used in last year	**Source of additional information**
Professional journals	49%	15%
Internet and online sources	41	49
Newspapers	23	1
Colleagues, personal conversations	17	12
Magazines (other than professional journals)	16	1
Books and reports	14	5
Non-governmental organizations (including firms)	6	2
Libraries	5	4
Television (including news and documentaries)	3	0
Government agencies (including national laboratories)	2	2
Radio (including NPR)	2	0
Number of leaders	**331**	**331**

Table 2 Confidence in Selected Science Information Sources, 2002

	Mean	Median
A report from the National Academy of Sciences	8.6 (.07)	9
An article in Science or Nature	8.4 (.07)	9
A report from a national laboratory	7.5 (.09)	8
An episode of the television show Nova	6.5 (.11)	7
A story in the New York Times	6.2 (.12)	7
A report from the Environmental Protection Agency	6.2 (.12)	7
A report from the Federal Department of Energy	6.1 (.12)	6
A story in the Wall Street Journal	5.9 (.12)	6
A report from a Congressional committee on science & technology	5.8 (.12)	6
A story in Time or Newsweek	4.7 (.12)	5
A report from the Sierra Club	4.6 (.14)	5
A story on CNN	4.2 (.12)	4
A story on a network television news show	3.3 (.11)	3
Number of leaders	**331**	**331**
( ) = standard error of the mean		

second most trusted source. A report from a national laboratory was the third most trusted information source. The three most trusted sources all are characterized by a high level of expertise and a tradition of independence from short-term partisan causes.

Science policy leaders reported a moderately high level of confidence in Nova, the *New York Times*, an EPA report, a DOE report, the *Wall Street Journal*, and a report from a Congressional committee on science and technology, with mean scores in the 5.8 to 6.5 range.

Science policy leaders express markedly less confidence in information from the mass media and from advocacy groups. Science policy leaders expressed the lowest level of confidence in information from a network television news show, with a mean rating of 3.4. This is especially ironic since 90 seconds on the evening news has long been the cherished dream of information officers in government, universities, and industry.

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A HURRICANE OF CHANGE REDEFINING THE GOALS OF PARTICLE PHYSICS RESEARCH

Neil Calder

Director of Communications. Stanford Linear Accelerator Center. 2575 Sand Hill Road, MS: 58. Menlo Park, CA 94025. Tel.: 650 926 8707, neil.calder@slac.stanford.edu

Abstract

For the last to decades the goals of frontier high energy physics research have remained the same. This paper outlines the initiative to redefine the goals of the field in response to new understanding of the structure of the universe and the need to build new, very expensive, research installations. The challenge was daunting. The physicists themselves had to be convinced to alter their perception of their own field and policy makers and funding agencies had to be convinced of the excitement and worth of the research.

Key words: Particle physics, policy, communication.

Text

Context

For over 20 years the main aim of frontier high energy physics has been the discovery of the Higgs boson. Billions of dollars have been spent on the Large Electron Positron Collider at CERN, the Superconducting Super Collider planned in Texas, Tevatron Run II at Fermilab and soon the Large Hadron Collider at CERN. The Higgs remains elusive. There is international agreement that the next major installation should be a 30 km linear collider costing some $6 billion. Can funding agencies be persuaded to spend this money using the same arguments as have been used over the last 20 years? I doubt it.

Concurrently, in a development that some have compared to Copernicus's recognition that the earth is not the center of the solar system, the quest to answer the most basic questions about the universe has reached a singular moment. As the 21st century begins, physicists have developed a commanding knowledge of the particles and forces that characterize the ordinary matter around us. At the same time, astrophysical and cosmological observations of space have revealed that this picture of the universe is incomplete—that 95% of the cosmos is not made of ordinary matter, but of a mysterious something else: dark matter and dark energy. We have learned that in fact we do not know what most of the universe is made of. A hurricane of change is blowing through particle physics.

Understanding this unknown "new" universe requires the discovery of the particle physics that determines its fundamental nature. Powerful tools exist to bring the physics within reach. With astrophysical observations, we can explore the parameters of the universe; with accelerator experiments we can search for their quantum explanation. Energies at particle accelerators now approach the conditions in the first instants after the big bang, giving us the means to discover what dark matter and dark energy are –and creating a revolution in our understanding of particle physics and the universe.

Objective

The communications challenge is first to convince the physics community of the need for change and to produce a manifesto of this revolution to convey the excitement to policy makers and funding agencies. The style and level of content of this document would be crucial to its success.

Methods

After several presentations at physics conferences[1] by Neil Calder and Judy Jackson, the High Energy Physics Advisory Panel HEPAP formed a committee to prepare a report on the scientific challenges facing particle physics. The Committee was made up of leading American physicists and cosmologists, and in the recognition of the importance of the document in communicating to policy leaders, the heads of communication of Fermilab and SLAC, the two major U.S., particle physics laboratories. The aim of the whole group was to produce something different – a scientific report written at a level that non physicists can not only understand but also be enthused by. The final report Quantum Universe2 revolved nine basic questions grouped in three themes, that are very different from those asked 10 or even 5 years ago.

Einstein's Dream of Unified Forces

Are there undiscovered principles of nature: new symmetries, new physical laws?

2. How can we solve the mystery of dark energy?
3. Are there extra dimensions of space?
4. Do all the forces become one?

The Particle World

5. Why are there so many kinds of particles?
6. What is dark matter? How can we make it in the laboratory?
7. What are neutrinos telling us?

The Birth of the Universe

8. How did the universe come to be?
9. What happened to the antimatter?

The layout, graphic design and illustration of Quantum Universe are also very different from traditional science reports. There is a coordinated program to now present Quantum Universe to the leading policy makers within the United States and to give talks on the report at the world' leading physics laboratories.

Conclusion

There has been a major communication initiative to make policy makers aware of the excitement of this new era in particle physics. The Quantum Universe[2] experience has set a new precedent in involving communication specialists in the preparation of policy documents from their inception.

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[1] Calder, N. (2003): *What's it for?* High Energy Physics Advisory Panel, Washington: www.interactions.org/pdf/whatfor.pdf.

[2] Quantum Universe is available on line: http://www.interactions.org/pdf/Quantum_Universe.pdf.

PUBLIC POLICIES FOR SCIENTIFIC CULTURE – WHEN MATURITY BRINGS ABOUT EVALUATION

Ana Correia Moutinho

Centro de Investigação sobre Economia Portuguesa, Instituto Superior de Economia e Gestão, Universidade Técnica de Lisboa, Rua Miguel Lupi nº 20, 1200 725 Lisboa (Portugal).
Tel.: +351 213955745, fax: +351 213967309, acm@iseg.utl.pt

Abstract

In developed countries significant investments have been made to improve the scientific culture of populations. Public initiatives include the recruiting of the scientific community and a panoply of out-of-school resources designed to engage people with science. The system develops at different paces according to the socio-economic scenario and political commitment of governments. UK and Portugal provide two examples of promoting structures, Copus and Ciência Viva.

Key words: Scientific culture, policy, evaluation.

Text

PUS comes of age

Public understanding of science –or whatever expression is used in each language– has finally made it to adulthood. It means it became a policy issue within S&T systems, comprising an agenda, a budget and a responsibility.

Scientific culture is a public affair and a matter of the state, although we can argue for the increasing participation of the so-called science communication industry. The implementation of policies is a long-term enterprise, requiring transversal measures to intertwine formal and informal schooling.

There is a rhetoric associated with public programmes that translates political intentions. Figure 1 summarises the basic rationales underlying the design of PUS policies. Top-down or bottom-up approaches are often discussed, whether i) the action is driven by science professionals, with the focus on cognition, supported by the belief that the feeding of information generates knowledge and support, or ii) departs from the public, focusing on specific issues while addressing people's attitudes and practices.

Equally important is the organisational nature of promoters and the extent to which these activities relate to others. If a vertical system is more easily put forward and maintained than networks, especially when resources are limited and benefits are scattered, the anguish of verticality is to promote transferable activities and avoid being limited by its own resources. Truly horizontal initiatives require the acknowledgement of different actors and the capacity of coordination in the long run, being typical of progressive societies where public participation methods are standardized.

Copus, the rise and fall of a British pioneer

The Committee on the Public Understanding of Science was a lobbying organisation for PUS launched in 1986. A triumvirate of the Royal Society, Royal Institution and The BA, run new schemes of engagement of scientist with the public. Meanwhile the scenario changed, with the research councils and medical charities committing to PUS along with the development of an active industry of science communication.

In 1999, COPUS underwent a revision. From an acronym it became a brand name and in its council included representatives from different sectors of science communication. The objective of this revamped structure was to act as a support organisation for science

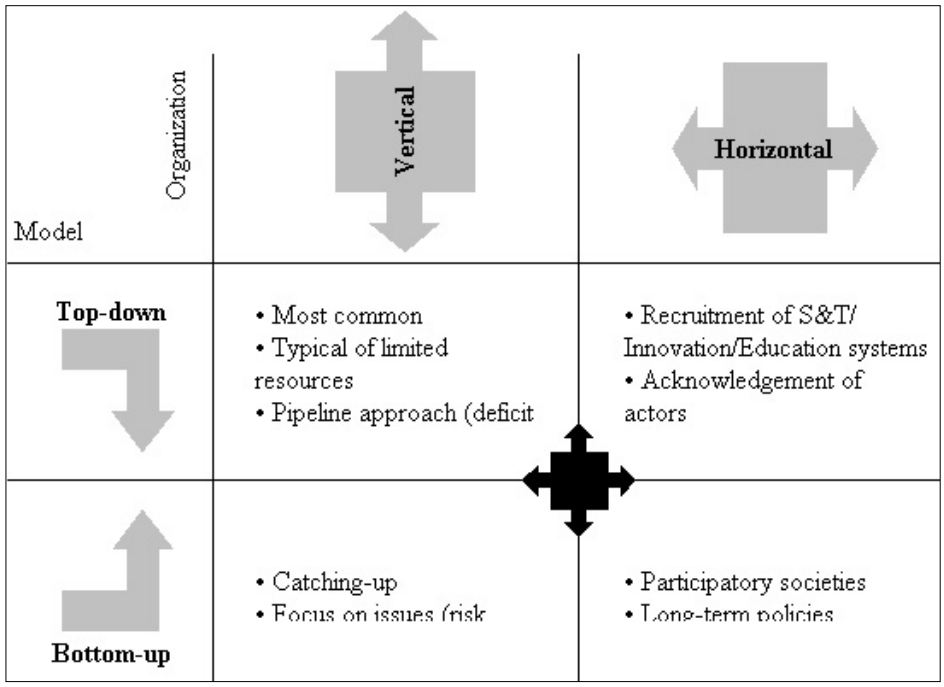

Figure 1. Rationale for public policies
Each society has to find the most appropriate position (✥) according to the policy conceptual model and organizational structure.

communication in the UK, since the vertical promotion of PUS activities was flourishing but there was no horizontal interconnection between institutions. Despite the consensual agreement for the need of an umbrella organisation Copus was extinguished by the end of 2002.

Ciência Viva, the Portuguese flag for PUS

In 1995, when Portugal had science and technology levered to the category of ministry, scientific culture definitely entered the political discourse. The major effort of catching-up of the Portuguese S&T system, nurtured by European funds, included the promotion of scientific culture among a traditionally illiterate population. Ciência Viva started as an operational unit of the ministry and grew into an agency by 1998. Moreover, this commitment to PUS materially translated into a sound 5% of the national S&T budget. The CV program focused on the experimental teaching of science and the promotion of scientific education in schools, while launching a network of interactive science centers and scientific awareness campaigns.

Learning by evaluating

Evolving from a teenage tentative affirmation and pocket money, PUS matured into an accountable grown-up. The problem is evaluating it. In fact, given the multiplicity of inputs in the lifelong process of apprehending a scientific culture, it is virtually impossible to establish a direct link between activities and long-term quantifiable impacts. Nevertheless, if causality is difficult to establish, it is possible to identify additionality –

the extent to which an activity is undertaken as a result of being supported by a certain policy and expenditure.
If the first step for evaluation is benchmarking, regular surveys can provide normalized sets of data for longitudinal analysis. The problem is that common literacy surveys still assess fragmentary knowledge, unrelated to operative skills. Also, the public's practices are underrepresented.

Homo scientificus
If we were to depict the evolutionary scale of science and society relationships, a pictionary vision might emerge as Figure 2.

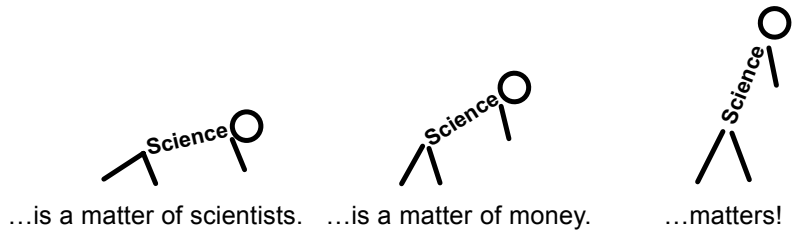

Figure 2 Homo scientificus

No doubt science is a matter of scientists. They fight for research funding, sanctioned by the lay public, and easily assume the role of tutors engaging in a top-down approach (exemplary pursued by Copus and quite present in Ciência Viva).
The realising of science's potential as a competitive economic advantage makes it a matter of money. In the knowledge economy there is emphasis in the skilled workforce and competing markets for R&D.
By the time the informed citizen becomes a stakeholder, echoing health, environmental and consumer concerns, science finally matters. As for the promotion of scientific culture, indicators of maturity include i) the development of support institutions – including science communication offices in Universities and R&D firms, consumer associations and regulatory bodies, like the recently created Food Standards Agency in the UK, ii) diversity in public hosting and funding of science communication activities and iii) a blooming industry with regular media coverage.

SCIENCE AND SOCIETY: A DIALOGUE FOR THE FUTURE

Pilar Tigeras Sánchez and Jaime Pérez del Val
Consejo Superior de Investigaciones Científicas. Coordinación Institucional en la Comunidad de Madrid. Serrano 113. 28006 Madrid (España). macael@orgc.csic.es and j.perez@orgc.csic.es

Abstract
If we admit the importance of the scientific advances in the development of society we have to conclude that society itself must participate in the decision making. Thus, in Spain it would be very convenient that the parliament would approve a Spanish Plan of Science and Society, with similar objectives to those of the European one but adapted to the Spanish reality.

A detailed analysis of the actual situation of the Spanish system of science and technology will not be carried out in this presentation; however some references will be made and some solutions for the short and long term will be provided.
The objectives are the promotion of a scientific culture and education, to bring together science to the citizens and to analyse the ethical dimension of science and the new technologies. This is why the idea of a dialogue has been included in the title, a democratic, sincere dialogue, free of any "a prioris" to be held between the scientific community, the social agents, the state administrations and the political parties.
The different studies performed by the European Union, the OCDE, and other institutions indicate that our system presents considerable deficiencies mainly linked to a low level of investment and expenditure in public and private R and D, which results in a deficient technological level, a scarce number of patents and in the insufficient development of the information society.
There is still a long way to go, but there are positive elements to propose a Spanish Plan of Science and Society, working seriously on particular aspects and coming to important agreements with the citizens.

Key words: Science Policy, Civil participation.

Text

Science Policy

Science policy considered as the formulation of avenues to transfer new knowledge for the improvement of society is nowadays more necessary than ever, since it is becoming increasingly more important for the well being and progress of a country. The main objectives pursued by the acquisition of scientific knowledge should end up in achieving greater life expectancy and a better quality of life in our societies.
Spain had a late start in the development of modern science, and it was only in the early 80´s when a totally new system of science and technology was finally structured with the approval of the Law of Science and Technology, of the National R and D Plan and its corresponding budgets. Unfortunately, the initial push lasted less than a decade and we are still in the last positions within the 15 EU countries, in what concerns R and D expenditures, with a 1.03% of GDP compared to the EU mean of 2% and almost a 3% of GDP investment in the US.
The European Commission, who is aware of the disadvantage of the EU relative to the USA, has proposed the goal of investing 3% of its gross national product by 2010, and has demanded a considerable effort from the member states. Therefore, there is a need for a sustained, large increase in investment in R and D in Spain which would also allow an increase in the number of researchers in our country.

Impact of Science on Social Development

Scientific and technological advances have a strong impact on society, and therefore it is paradoxical that, in Spain, the science and technology system is not sufficiently taken into account. It appears that we think only about researchers in those cases in which the media focus on public disasters such as the Aznalcollar mine spill in Doñana, the Prestige, the "mad cow disease", or the controversies on the effects of electromagnetic radiations on public health and the experiments with stem cells as a new therapeutic strategy. It is then when we turn to them demanding immediate solutions, without having previously developed and facilitated suitable policies for their development and appraisal.
According to Steven Pinker, society would appreciate much more the achievements in science and technology if more scientists shared their enthusiasm with the general public and would take more seriously, the very hard job of making it perceptible.
Thus, it is necessary to convince politicians about the design and application of a Plan for

Science and Society which should take into account, among others, the following recommendations:

- Promotion of education and scientific culture with the government taking the necessary measures for a better education and training of students, and a suitable preparation of the educators.
- To bring science policy closer to the citizens, for which there is a need for the cooperation of the press and social communication media, who should be suitably informed to make accessible to society the scientific advances in a rigorous and clear manner. It is, therefore, advisable to encourage from the public sector, the inclusion of science issues in television, radio, newspapers and magazines.
- Science and technology have to be considered as priorities in the political activity due to their social and economic impact. Thus, it is advisable to establish " help desks" to provide scientific information for the parliament and government following the examples of other European countries and the US, in order to guarantee the transformation of scientific and technological advances into direct social benefits.
- Measures must be taken to progress towards gender equality. Women represent half of the student population in our universities whereas they hold only 13% of senior positions in academia and even a lower percentage in industry.
- Scientific indicators concerning social impact of science should be introduced in all institutes and centres of statistics studies (INE, CIS…).

In short, we must encourage the participation of citizens and the social society in debates concerning science, technology and innovation in order to capture their thoughts and interests. Within this context, this forum represents an important initiative in the long road for a true dialogue between science and society.

FINDING COMMON LANGUAGE

Jill Nelson and Fiona Barbagallo

The BA (British Association for the Advancement of Science), Wellcome Wolfson Building, 165 Queen's Gate, London SW7 5HE, United Kingdom. Tel.: +44 20 7017-4938, fiona.barbagallo@the-ba.net and jill.nelson@the-ba.net

Abstract

Increasingly in the UK issues that involve science are high on the public agenda and there is a willingness to involve the public early in the debate. Early involvement of the public will help scientists and decision makers to understand and respond to public views, and by helping people more generally to appreciate that they can influence the progress of science and technology democratically.

But how early can members of the public become engaged in emerging science and technology?

Can members of the public express 'informed' views and opinions before interacting (interfacing) with applications of science?

The Finding Common Language project aims to identify language, stories and frames of reference that will stimulate mature public discussions about scientific research, and issues arising from scientific research.

Key words: common language, dialogue.

Text

The BA (British Association for the Advancement of Science) has a long track record in science communication and during the past three years has experimented with different formats for a range of target audiences. The purpose of the BA's science in society programme is to connect publics, policy makers and other decision makers, and the scientific and business communities by providing opportunities where issues involving contemporary science can be discussed. However, the BA and its target audiences increasingly recognise the need for public groups to be involved in discussions of science and technology in the early stages of funding and development.

The BA, in partnership with the UK's Office of Science and Technology (OST), is piloting a project –finding common language– to explore at what stages in the process of emerging scientific ideas to their application the public should be involved in discussing the possibilities offered from any particular area of research.

The OST, the government department that oversees much of the (public) science funding in the UK, facilitates a Foresight Programme which aims to provide challenging visions of the future for either a key issue where science holds the promise of solutions, or an area of cutting edge science where the potential applications and technologies have yet to be considered and articulated.[1]

The area of cognitive systems is one of several emerging from the Foresight Programme which aims to crystal ball gaze new areas of science and technology and their implications for funding and for society.

The area of cognitive systems has been defined by the OST as artificial or natural systems that can sense, act, think, feel, communicate, learn and evolve.

The finding common language project is using cognitive systems as the area of science to:

(a) learn how public engagement can be used in the very early development stages of science
(b) explore and identify possible common language that could be used to stimulate mature public discussion
(c) get a snapshot of opinions and thoughts of both the public members and scientists

If the pilot proves to be successful the process will be further developed to apply it to the other areas in the foresight programme.

Method

Three workshops were organised in early May 2004 involving 10 scientists, 4 professional science communicators and 10 members of the general public. The first workshop involved scientists from the life sciences and the physical and engineering sciences, and two science communicators. Two different science communicators were involved in the second workshop with members of the public that had been recruited by a market research company.[2]

Initially, scientists and members of the public met separately to explore and become familiar with the content of the cognitive systems project. Each facilitated workshop lasted two and a half hours. Scenarios where presented in the six areas of applications, identified by the scientists involved in the Foresight Programme, which are: business and commerce; health, well-being and performance; transport; arts, entertainment and companions; education; and military. Participants were asked to consider the risks, uses and moral implications of each of the applications.[3] The third workshop involved all the participants and is where the 'common language' was identified.

Observations

Independently, members of the public and scientists proposed similar discussion points and there were common themes running through the uses, risks and moral implications. Both groups raised issues involving shifts in responsibility, quality of life, loss of social skills, and issues of control including where decisions are made about public funding policies both within science and across society as a whole. This would indicate that if public engagement is handled appropriately, scientists and members of the public can have a mature conversation very early on in the development of science and technology. The similarity of expression exhibited suggests that a degree of empathy was experience by all parties. The scientists were talking about their area of research with non-experts on an equal footing. They were concentrating on areas of discussion (uses, risks and moral implications) where specific technical knowledge was not necessary. Some of the scientists commented that they had not previously thought about their work in this way and had found it enlightening. Something approaching a dialogue perhaps?
What this project has not explored at this stage is whether or not there will be a willingness to listen to public opinions when deciding on allocation of funding resources and policy making.

Notes

[1] For more details about the OST Foresight Programme visit www.foresight.gov.uk
[2] Men and women, aged 20-60 years, who have an interest in science but rarely find the time to read/watch science stories.
[3] The decision to explore the risks, uses and moral implications was based on the research conducted by the Biotechnology and the European Public Concerted Action group in 1997 (*Nature* 1997; 387: 845-847).

IDENTITY AND COMMUNICATION: WHO COLLABORATES IN COLLABORATIVE RESEARCH?

Michelle Riedlinger[1], Susan McKay and Cindy Gallois
[1]The University of Queensland QLD 4072 Australia. Tel.: +61 7 3365 1413, michelle@econnect.com.au

Abstract
Research collaborations involving stakeholder communities outside the research area are believed to produce more innovative and useable outcomes, and increase the support of external stakeholders and community groups for research. Yet social researchers also report that members of diverse research teams have a genuine inability to collaborate due to poor communication. Using concepts gathered from social identity theory (SIT), this paper examines the identity processes that enhance or inhibit communication between researchers and external stakeholder communities in areas of collaborative research. Participants highlighted communication activities associated five goals and all were associated with the management of social identity. The practical applications of these findings will be discussed.

Key words: Collaborative research, communication, Social Identity Theory (SIT), external stakeholders.

Text

Support for industry and end-user-relevant research is on the increase internationally (Adams, Chiang, & Starkey, 2001) and the Australian government offers many incentive programs encouraging research-industry partnerships and rewarding organisations that

promote the uptake of technology. These collaborations are believed to produce more innovative and useable outcomes as the research has been "guided" by external stakeholders during its development. These collaboraitons are also thought to increase the support of external stakeholders and community groups for research.
A number of studies have found, however, that diverse research groups often fail to collaborate due to poor intergroup communication (e.g., Oliver & Blakeborough, 1998; Tushman, 1982). Social identity theory (SIT) (Tajfel, 1982), has already demonstrated its usefulness in examining group processes in organisational contexts (Ashforth & Mael, 1989; Kramer, 1991; Mael & Ashforth, 1992; Northcraft, Polzer, Neale, & Kramer, 1995), including the role of stakeholders (Hogg & Terry, 2000) and is the theoretical approach adopted for investigating communication between research groups and external stakeholders in this study.

Aim

Researchers and communication practitioners often want to know how effective communication activities are at influencing external stakeholders. This is a complex question, as communication is often mediated by the level of identification between the organisation and external stakeholder groups. Thus, it may be more fruitful to ask, How do communication activities aimed at external stakeholders reflect issues of identity and identification?

Method

This study aimed to explore perceptions of stakeholders in Australian Cooperative Research Centres (CRC0. Participants were 17 communication professionals (12 male and 5 female). They represented all sectors of CRC activity (three agriculture and rural-based manufacturing, nine environment, two medical science and technology, two mining and energy and one information and communication technology). In-depth individual interviews were chosen as the method of data collection and constituted semi-structured conversations with prompt questions to guide participants. Participants were asked to describe their CRC's communication activities with external stakeholders and to explain what they were trying to achieve with their external stakeholders through communication. The interviews were recorded and the transcripts were analysed iteratively (Strauss & Corbin, 1990) by looking at themes relating to issues of communication between the CRC and stakeholders.

Findings

The communication activities with external stakeholders discussed by communication professionals centred around five goals. These goals were (1) developing source credibility for the CRC; (2) facilitating constructive contact between the CRC, CRC researchers and external stakeholders; (3) using boundary spanners in intergroup communication; (4) accommodating to the needs and values of stakeholder groups, with a focus on group differences between the CRC and external stakeholder groups; and (5) raising awareness among stakeholders about CRC needs and values, including actively engaging in agenda setting.
Communication activities focused on influencing the homogeneity of stakeholder groups, as well as encouraging these groups to think and act in terms of their group identity and the associated values, norms and behaviour. Other activities acknowledged the importance

of understanding the group identity issues of the diverse group participants in order for communication activities to be effective. Some communication activities, however, showed a lack of understanding of the needs and values of all groups, and were often driven by the needs of one dominant group of internal or external stakeholders. There remained an idea among some CRC members that external stakeholder groups need to be "educated" rather than demonstrating a commitment to the collaborative process.
In summary, this study points to the pitfalls of a top-down approach to collaboration with stakeholders in collaborative research organisations, but it also highlights the opportunities to facilitate communication among stakeholder groups. Both the pitfalls and the opportunities are related to the management of social identity in these collaborative research organisations. Social identity theory, thus, provides a useful way to understand communication in such organisations, which are so important to solving important problems at the present time.

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REPRESENTATIONS OF SCIENCE IN THE KNOWLEDGE SOCIETY

Brian Trench

Dublin City University, Dublin 9, Ireland. brian.trench@dcu.ie

Abstract

The emergence of "the knowledge society" as a guiding concept for public policy has reshaped the context and content of public communication of science and technology. The widespread adoption of "the knowledge society" as a social goal may at the same time enhance the social and political standing of science and give preference to particular, perhaps restrictive, conceptions of its value and roles.

Key words: Knowledge society; public policy; functions of science.

Text

Economists and sociologists have offered plausible accounts of the ever-greater emphasis on mental work, of the increasingly specialized skills required to maintain economic processes, and of the increasing social contextualization of the production of knowledge (Nowotny *et al.*, 2001). Whether this merits the redefinition of advanced economies is unclear.

Two elements of the current "knowledge society" discussion should advise us to be cautious in using this phrase:

1. It is less than a decade since the argument about the primary role of knowledge in individual enterprises was translated into one about the character of the economy; this elision from enterprise to economy has potentially dangerous consequences.
2. It is also only a decade since the concept of "the information society" was commanding the attention now accorded to "the knowledge society".

The rapid turnover and unsteady usage of key phrases reveal both a desire in policy circles to find the "mobilizing metaphors" that can help orchestrate change, but also uncertainty about what is really going on. We should be careful about using "the knowledge society" as if it referred to a given, proven entity. We may be talking about a proposition, a metaphor, an aspiration.

Ireland represents a striking case of a country that promotes research and development with the aim of building a competitive science base. Many countries see Ireland as a model of a rapidly developing knowledge-based economy.

In four years since its establishment, Science Foundation Ireland (SFI) has allocated over €600 million to research and attracted both Irish émigrés and non-nationals to establish significant research teams in Ireland. Universities have received a further €600 million over the same period to support research centres.

There is a consistent pattern to policy documents, ministers' speeches and other formal statement of the arguments supporting this new departure: scientific research, commercial competitiveness and innovation capacity are mutually dependent; in combination, they deliver economic development. Education and training and advanced telecommunications underpin these relationships.

SFI director-general William Harris, for example, has argued that universities need to evolve "a competitive system of intellectual development [which] is essential to boosting the credibility of Irish research in the world community". He derives his definition of a knowledge society from the observation of companies' competitive success.

The dominant discourse is clearly recognisable and is echoed in the editorial columns of the generally independent-minded newspaper, The Irish Times: "The government … wants to foster a knowledge-based economy, one that makes the new discoveries and develops the innovative products as a way to protect our economic future."

In this dominant discourse the public is an object, rather than a subject, of social processes: policy initiatives seek to persuade parents and students of the benefits of studying science.

There is evidence of an awareness in policy circles of a possible different approach: the Minister for Enterprise Trade and Employment last year spoke about a "civic science", that is, "a science engaged with and invited into the national dialogue", "a science responsive to the public and worthy of the public trust". But this challenge remains unanswered.

Elsewhere in Europe, the dominant policy discourse of the knowledge society takes similar forms. Patricia Hewitt, the UK Trade and Industry Secretary, declared: "We still need to get science out of the labs, into our companies and on to the balance sheet". Among the new EU member states Estonia aims to develop "a new knowledge-based economy, based on investment in research and development to generate science-rich technology or products"; it persuaded the European Union to allow it use new EU development funds to support research.

Finland declared as long ago as 1996: "Finland is *a knowledge-based society*". A recent report on that country stated baldly: "In the knowledge society welfare and competitiveness are obtained through innovation. Education and R&D act as catalysts for innovations".

It has been observed that in "the knowledge society", "technology and instrumental technical knowledge becomes not merely the means but … the key measure and goal of societal development" (Preston, 2003). Educationalist Alison Wolf has questioned the assumed relations between educational investment and economic growth that underlies "knowledge society" strategies (Wolf, 2002).

From the point of view of science communication, we also have reason to be concerned about what the push for a "knowledge society" is doing to science and to prospects for its mainstreaming in culture. At one level, "the knowledge society" appears as an answer to the prayers of the science communication community; science may be higher now on political agendas than it has ever been.

But the push for "the knowledge society" presents knowledge and science in reductionist and instrumentalist frames: science is supported for its capacity to deliver improved products, processes and skills; the privileged attention given to techno-scientific knowledge marginalises other forms of creative, critical and analytical knowledge. "The knowledge society" may be promoting a bureaucratic and technocratic "encapsulation" of science.

If science communication has to do with talking about science in a democratic framework of broad social access, balanced dialogue, respect for diversity, and cultural completeness, "the knowledge society" is as much a threat as an opportunity.

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SCIENTISTS AND POLITICIANS: THE NEED TO COMMUNICATE AN UPDATE SINCE PCST GENEVA 2001

Wendy Parsons

Communication Specialist. 10 Bromell Circuit, Wanniassa 2903. Canberra, Australia. Tel.: 02 6231 6342. parsnips@cyberone.com.au

Abstract

At PCST Geneva 2001 I described a successful program of communication with members of parliament then being run by CSIRO National Awareness. Since then, as an independent communication specialist, I have refined the techniques used in the original program and have been running programs on behalf of two other organisations. This paper outlines the work and results over the last two years.

Key words: Politicians communication techniques.

Text

Development of techniques

In the last two years I have been using the communication techniques developed by CSIRO National Awareness in programs for two other organisations – the Co-operative Research Centres and the Grains Research and Development Corporation.

I have established specific databases for the research areas covered by each organisation in which the industries and interests of politicians' electorates are matched up with research being done. For example, I have defined all politicians with electorates where wheat is grown and target wheat research stories to them.

The stories come from media releases prepared by science journalists working for the two organisations. The most effective delivery mechanism for busy politicians seems to be very short (3-4 paragraph) emails with informative headlines and phone, email and web contact details for those seeking the full details.

Here's a very recent example from a Co-operative Research Centre: [1]

Plastics promise a sweeter future for sugar

Scientists predict there will be a brighter future for Australia's hard-hit sugar industry as it becomes a producer of bio-plastics.

Bio-plastics are just one of a number of diversification opportunities for the sugar industry, according to researchers from of the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology (CRC SIIB).

"Every household will be using bio-degradable plastic bags, bottles and containers, every car will have bio-degradable plastic dashboards and fittings, fine clothing will be crafted from these biopolymers to replace petrochemical plastic and nylon with bio-nylons and bio-fabrics all made from renewable resources," says the CRC's Dr Steve Brumbley.

Dr Brumbley says that research being carried out by the CRC is building on an already proven process for making plastics from sucrose, needing only a minor shift in economics for the process to become a market leader. In this lies Australia's opportunity, he says.

This story was strategically placed within a national issue already under much public and political debate – the threatened future of Australia's sugar industry. Politicians whose electorates are affected by the state of the sugar industry are very keen to have presentations from this scientist, and within the next month or so, he will make a

presentation to a Government Industry Policy Committee. As well, there has been considerable media coverage – one politician brought a journalist to the briefing. This is an ideal situation because it not only produces media coverage, it also has the scientist and the politician communicating in front of journalists.
There are several other examples of this kind of outcome, that is, immediate response from politicians in particular electorate, invitations to give personal briefings, and media coverage. This tells me we are hitting targets.
With about one story per week coming out from each of the organisations mentioned above, I am aiming for as many as possible to become the subject of follow-up briefings and to be used by politicians in their committee and legislatory debates as well as for extended media coverage.

Evaluation
This is done mainly by email survey with ongoing phone checks. An example of an email survey is:

Dear (polician's name)
Over the last few months I have been sending to you via email stories about work of Australia's Cooperative Research Centres. The latest item, *Detecting securities fraud* was sent to you on 6 February. Other stories ranged from better avocadoes and beef tenderness tests to help for ageing power stations and pollution checks for the aquaculture industry.
I'd like to find out :

1. Do you wish to be kept on the email list?
Has the material been useful? In what way?
2. Is it in a friendly format for you? Should we make changes?
How?
3. Would you appreciate personal briefings on work relevant to your electorate or State?
Any subject in particular?
Currently I do not have the resources to do a detailed survey of politicians' attitudes to research, of the kind that was reported at Geneva for CSIRO. But it is clear from wide media coverage and comment from politicians that the way Australian research is being funded is a controversial issue in 2004, election year.
Just a few days ago (13 May) the upper house of the parliament debated for two hours the mechanisms for deciding which Cooperative Research Centres would continue to receive funding. There is particular debate about those doing "public good" research and whether government policies on such things as fossil fuels versus alternative energies are affecting the search for sustainable energy. Such a debate is very unusual and it was interesting to hear a number of the senators using some of the very words used in CRC media releases.
I would be happy to provide further details of my programs to PCST colleagues.

Notes
[1] Full version of story from parsnips@cyberone.com.au. Contact: Dr Steven Brumbley, CRC SIIB, tel.: 07 3331 3370 (http://www.crcsugar.uq.edu.au).

"STRANGE BEDFELLOWS AND USUAL SUSPECTS": MAPPING THE EMERGENT COMPLEXITY OF 'SOCIAL MOVEMENT SOCIETY' ENGAGEMENT WITH HUMAN GENETIC TECHNOLOGIES

Dr Alexandra Plows

ESRC Centre for the Social and Economic Aspects of Genomics (plowsa@cardiff.ac.uk, http://www.cesagen.lancs.ac.uk/). Project: 'Emerging Politics of Human Genetic Technologies', Principal Investigators Dr Ian Welsh (welshi@cardiff.ac.uk) and Dr Rob Evans (evansrj1@cardiff.ac.uk)

Abstract

Qualitative field data from year one of this three year project is used to map UK public modes of engagement, core discursive frames, in the context of human genetic technologies (genomics).
The ways "civil society" engages with genomics can be understood as the behaviour of a "social movement society" (Meyer and Tarrow, 1998). Actor groups cannot be seen as completely "pro" or "anti" biotechnology; their responses are more sophisticated and context- dependant. Mobilisation is fragmented, shifting and complex; cross cutting frames emphasise the diffuseness of boundaries between actor groups ("ethno epistemic assemblage"- Irwin and Michael, 2003) with implications for theories of social movements and "collective identity" (Melucci, 1996).

Key words: Genetics, public, globalisation.

Text

Social Movement (SM) theory as a tool for understanding emergent public engagement

1) Social Movement Society

"Social movement modes of action may be becoming part of the conventional repertoire of participation…used to represent a wider range of claims than ever before" (Meyer and Tarrow, 1998). A predisposed population, informed by diffused cultural practises, will mobilise given the right sets of circumstances (issues, POS, existence of social networks etc).

2) Latency

Melucci (1996) defines latency as a period where 'submerged' networks of actors are less visible, but engaged in a crucial exercise of constructing meanings. These 'submerged networks' are predominantly constructed as predisposed actors well placed to see thematic links between the issues they previously mobilised over, and (in this instance) genomics:

"What we need to get to is not a new politics of… human genetics…it's the politics of new technologies…how new technologies impact on society…they're playing on the sidelines, as they have in the nuclear energy debate, in the toxic chemicals debate…" ("Mike": activist in interview 2004). See Welsh (2000), Nelkin (1995), Plows (2004), Doherty Plows and Wall (2003).

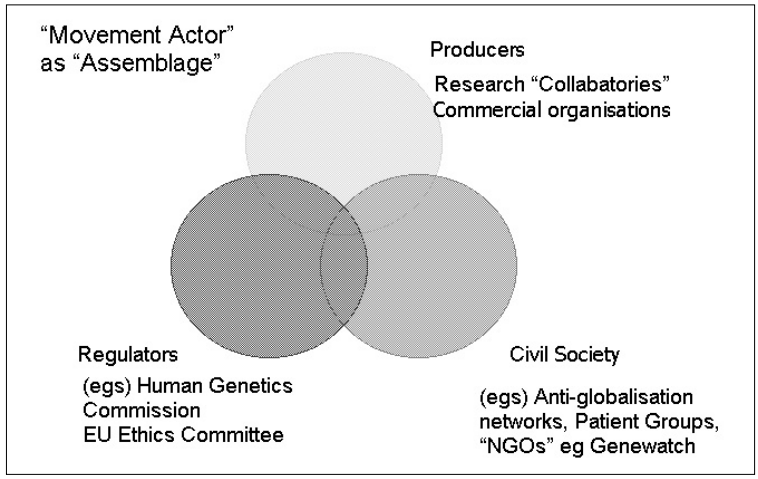
This discursive linkage is also occurring in "conservative" groups and networks such as pro-lifers, and "pro" genetics patient and advocacy groups. Latency is also relevant for the "social movement society"– who are starting to engage over issues like biobanks, screening, sex selection of embryos, etc.

"I think there will be in practice a lot of resistance taking place in quiet ways... you know whether it be no I don't want that test, no I tried that drug and it didn't work I don't want any more of it, that will happen day to day." ("Katie", activist in interview 2004).

3) Early Risers *(Tarrow, 1998)*
"Early risers" are core actors who spark off new waves of mobilisation. Given the diffuseness of the terrain, actor groups of all types mobilising over genomics issues will be finding it hard to identify clear lines of engagement and to attract key allies and support- again, apart from some very clearly identified "usual suspects". "Early risers" can fail to wake other people up. Yet there is an increasing amount of mobilisation, though it is important to recognise that this is predominantly happening in latent networks; though there are signs that critical masses are starting to form.

4) Frames/ Framing
Framing (Snow and Benson, 1992; Steinberg, 1998) is the production of meaning by actor groups, as an ongoing part of the mobilisation process and the construction of "collective identity". It is in the spaces where meanings are struggled over that movement starts to build, targets, allies and 'enemies' are identified, leading ultimately to the taking of action. Whilst 'pro' and 'anti' are generally unhelpful categories, there are of course also clear, important, lines of contention drawn in what are otherwise very shifting sands.

5) "Assemblage" and Collective Identity



"ethno- epistemic assemblage" (Irwin and Michael 2003). Cross- cutting networks, the dissolution of categories and actor identities.

Thus: Dependent on the context (frame or issue raised, existence or lack of Political Opportunities and so on), interaction (oppositional activity, alliance clusters) occurs:
(a) between actor groups within each 'sphere', and (b) between spheres.
There is a blurring of boundaries in terms of actor identities (Jasanoff, 1990) – "strange bedfellows". A range of commentators identify the "scientific citizen" (eg Irwin and Michael, 2003); it is also possible to identify the "citizen scientist".
Is Melucci's (1996) definition of collective identity, and Diani's (1992) definition of a social movement, still robust enough to account for genomic assemblage? Yes and no, and it is telling that it is in the arena of the "anti globalisation movement" that thinking about the collective identity of such a complex group of social actors has produced a similar

ambivalence (McDonald, 2002). It is of course important to distinguish between sets of social interactions, which can even include mobilisation, and a social movement, although in this period of latency/ emergence it is hard to tell which is potentially which.

Conclusion

The network(ed) genome

The fluidity and interactive-ness of the genome (and the proteome) is mirroring the fluidity and interactions of the human actors concerned with it, which could be conceived as a series of network relationships. Overall, we should hardly be surprised that human engagement is as complex as the genomic interactions themselves. For social movement theories regarding emergent mobilisation and the nature of movement collective identity, the impact, and implications, of globalisation and the status of genomics as a complex set of issues and applications, are crucial and will be kept under review by the project.

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SCIENCE COMMUNICATION AT THE LOCAL LEVEL: AN EVALUATION OF LOCAL AUTHORITY COMMUNICATION STRATEGIES

Emma Weitkamp,[1] Frank Burnet,[2] Jim Longhurst,[3] Clare Beattie[4] and David Gibbs[5]

[1] Graphic Science Unit, Faculty of Applied Sciences, University of the West of England, Bristol, BS16 1QY. Tel.: 0117 32 82081, fax: 0117 32 83919, emma.weitkamp@uwe.ac.uk

[2] Graphic Science Unit, Faculty of Applied Sciences, University of the West of England, Bristol, BS16 1QY. Tel.: 0117 32 83756, fax: 0117 32 83919, frank.burnet@uwe.ac.uk

[3] Air Quality Management Resource Centre, Faculty of Applied Sciences, University of the West of England, Bristol, BS16 1QY. Tel.: 0117 32 83825, fax: 0117 32 83360, clare.beattie@uwe.ac.uk

[4] Air Quality Management Resource Centre, Faculty of Applied Sciences, University of the West of England, Bristol, BS16 1QY. Tel.: 0117 32 83692, fax: 0117 32 8290, james.longhurst @uwe.ac.uk

[5] Department of Geography, University of Hull, Tel.: 01482 465330, fax: 01482 466340, d.c.gibbs@hull.ac.uk

Abstract

The authors have devised a theoretical model of the influence of complex science within the Local Air Quality Management consultation process in the UK. The model (Diagram 1) identifies key stages where the nature of the scientific information to be presented has an impact on the mode of presentation, the way in which stakeholders are included in the process, stakeholder interpretation of scientific information and incorporation of lay knowledges of the issues. The model can be used to enhance and identify the value-added parts of the consultation process, in relation to science communication.

Key words: Local environmental issues, consultation process, stakeholder involvement.

Text

In line with this trend toward engaging the public in science-based policy initiatives, UK local authorities have recently embarked on one of the largest science communication initiatives undertaken in the UK. As part of the air quality management process local authorities are now required to consult with relevant stakeholders (Schedule 11, Environment Act, 1995) during the air quality management process. While the Environment Act itself specifies statutory stakeholders who must be consulted, UK local authorities are being encouraged to include a wide range of groups in the consultation and policy development process, such as residents, the Highways Agency and the Environment Agency (Defra and National Assembly for Wales, 2003, NSCA, 1999). The Local Air Quality Management consultation process has been used to develop a model of the role of the communication of complex science in the formulation of local environmental policy.

Dialectic approaches allow for a range of different consultation mechanisms to be conceived, including both consultative and participative oriented approaches. Consultation based approaches are routed in two-way communication about policy making, but stop short of involving stakeholders in policy formulation. Thus, policy formulation is still the sole domain of the local authority. Participative approaches, in contrast, are defined by the active involvement of all participants in the decision making process and arise from Habermas' theory of communicative action (Habermas, 1987; Palerm, 2000). Participative approaches incorporate local knowledge and may make the process more relevant to local stakeholders. In terms of involving 'lay' stakeholders, UK Government guidance recommends setting up participative workshops or forums to make

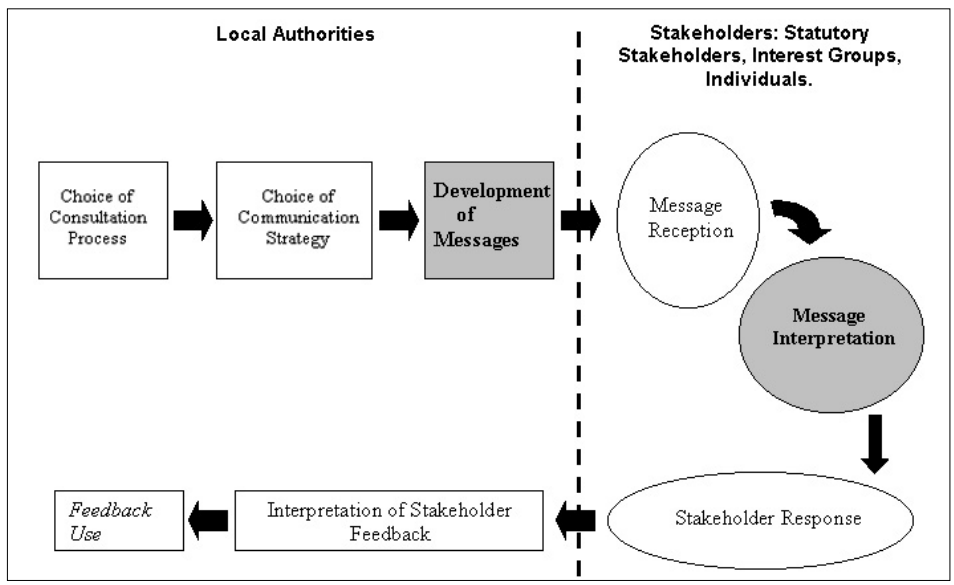
stakeholders feel part of the consultation process (para 4.27, PG(03) (Defra and the National Assembly for Wales, 2003).

The Consultation Model

The model (Diagram 1) outlines the consultation and communication processes undertaken for air quality management. It can be used to explore the role of science communication in consultation about environmentally-oriented policy initiatives and identify those aspects of the process which offer added value to either the local authorities or the consultees. The model takes into account four key aspects of the consultation process where the nature of the complex scientific information to be presented has an impact on the process:

- Mode of presentation.
- Stakeholder inclusion.
- Stakeholder interpretation of scientific information.
- Incorporation of lay knowledges.

The way the technical information is included in the consultation process may disadvantage non-expert stakeholders (Irwin, 1995). Thus, the model focuses on the development of science communication messages and their interpretation by stakeholders. In the case of the Air Quality Management Process, this involves communication of the complex science involved in measuring air quality and incorporation of data from air quality models. Thus, judgments must be made by local authorities about stakeholders' levels of expertise and ability to interpret scientifically complex information.



Pathway of process for consultation on scientifically complex issues such as air quality management. Dark arrows indicate pathway of process, striped gray indicates stages where local authority views of stakeholders determine how local knowledge is incorporated, solid gray highlighted stages are where science has the greatest influence on interpretations.

It is likely that local authority views of different groups will inform the extent to which informative, consultative and participative approaches are used during the consultation process. Thus, the model can be used to understand how lay knowledge is included in the consultation process and to test the extent to which such 'lay' knowledge is valued and included during policy formulation. This allows clusters of approaches to be identified that capture both the approach taken to science communication and the nature of the stakeholders involved.

Stakeholder involvement in the process can be further evaluated by investigating how the input was incorporated into policy. Choice of consultation method provides an initial distinction between informative/consultative and participative approaches. This can be further investigated by determining the extent to which stakeholder input via informative and consultative approaches was incorporated into policy.

Conclusion

The model presented of the way that complex science is incorporated in the policy making process provides a basis from which to evaluate the consultation process. This can be used to develop and evaluate clusters of approaches with a view to identifying those aspects of the process which offer added value (both to the local authorities and to consultees). Although developed specifically for the UK Air Quality Management process, the model is applicable to a range of locally based environmental policy issues.

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IDENTITY AND COMMUNICATION: WHO COLLABORATES IN COLLABORATIVE RESEARCH?

Michelle Riedlinger

The University of Queensland, Australia

Abstract

Internationally, science and technology funding for collaborative research involving external stakeholder communities is on the increase. Funding bodies consider these collaborations will be able to produce more innovative and useable outcomes, and may increase the support of stakeholders and community groups for research. Yet social researchers report that members of diverse research teams have a genuine inability to collaborate due to poor communication.

Using concepts gathered from social identity theory (SIT), this paper examines the processes that enhance or inhibit communication between researchers and stakeholder communities in areas of collaborative research. Communication professionals from 17 Australian Cooperative Research Centres discussed

communication between researchers and stakeholder communities (landholders, industry groups and urban community groups etc.) in collaborative projects within their organisations. Results show that issues of group identity –including loyalty, bias and adhering to group norms– impact significantly on communication, and hence, collaboration. Specifically, participants highlighted factors including establishing source credibility, the impact of the values and norms of the different groups, group boundaries, the role of boundary spanners, and identification with the research organisation. Participants also provided many suggestions for improving communication in these arrangements, and many suggestions acknowledged the importance of understanding the group identity issues of the diverse group participants. However, some suggestions and current practices exhibited a lack of understanding of intergroup relations and the collaborative process, and were often driven by the needs of one dominant group. Underlying these suggestions was a pervasive attitude that, rather than a commitment to the collaborative process, less prestigious groups needed to be "educated".

Parallel session 27

Cultural differences in public understanding of science

SOCIAL PERCEPTION OF THE SCIENCE AND THE TECHNOLOGY IN THE CITY OF MELILLA

José M. Cabo,[1] Carmen Enrique[2] and José R. Cortiñas[3]

[1] Facultad de Educación y Humanidades. Campus de Melilla. Universidad de Granada.
Tel.: 95 269 87 36, fax: 95 269 11 70, jmcabo@ugr.es

[2] Facultad de Educación y Humanidades. Campus de Melilla. Universidad de Granada.
Tel.: 95 269 87 37, fax: 95 269 11 70, cenrique@ugr.es

[3] Facultad de Educación y Humanidades. Campus de Melilla. Universidad de Granada.
Te.l: 95 269 87 37, fax: 95 269 11 70, peperra91@hotmail.com

Abstract

The public perception of Science and Technology has been an object of evaluation in numerous countries. Generally it is a question of interviews or polls orientated as criteria elaborated by the USA National Science Foundation. In the present work results on public perception of Science and Technology in the city of Melilla are exposed, focusing the need to incorporate the cultural origin as variable, since in the works consulted variables of genre, socioeconomic level or grade of formation are included, without laking account of the tendency of the industrialized countries towards multicultural societies.

Key words: Public understanding, cultural diversity, citizen participation.

Text

Context and precedents

In a recent study (Cabo y Enrique, 2004) on the concept of Multicultural Science we synthesize numerous works published in the context of the Science Education where the existence of two views evident for the Science from the cultural diversity: the universaslist orientation and the multicultural orientation. The first can be supported for

several reasons, for example, to undestand that Science and Technology are immune to cultural influences or, on the contrary, to believe that Science and Technology have advanced thanks to the contributions of multiple cultures. On the other hand, the multiculturalist orientation supports that Science, as sociocultural practices, have its origin in the western European culture and, therefore, its assimilation can collide with not western cultures. This debate, open and polemic, is not included in the works consulted on social perception, although in this context the existence of cultural influential factors is supported, for example, to criticize the *model of cognitive deficit* whose results are interpreted on social perception of Science and Technology.
This work is framed in the research promoted from the Facultad de Educación y Humanidades de Melilla and orientated towards the public divulgation of knowledge. The first phase of the project involves the evaluation of the offer and the demand of knowledge on the part of the local population, Science and Technology from us.

Objective
The basic target of this work is to identify possible differences in the social perception on Science and Technology among samples of population of Muslim and Christian origin in order to find empirical evidences that support the need to include the "cultural origin" in the analyses of social perception of Science and Technology according to the general tendency towards the multicultural societies in the industrialized countries, particulary in Melilla.

Methods
Seventy six interviews was performed face to face following the same protocol of questions as in the poll published by the FECYT in 2003, on social perception of Science and Technology in Spain, which was not fullfilled in the cases of Melilla and Ceuta.
The results of part of the chosen questionnaire are exposed here: grade of interest and of information about Science and Technology topics, sources of information used, professionals' credibility, attitudes towards the Science and Technology and evaluations on the benefits and the need of public finance. We will establish a previous diagnosis in order to elaborate a program of public divulgation of the Science and the Technology in Melilla.

Results and conclusions
The general results obtained in Melilla do not show big differences compared with the results of the State and other national studies. Therefore we can state that the interest, attitudes and expectations towards the Science and the Technology are positive, but the grade of knowledge or information is low.
In the sample from Melilla, the negative consequences of the scientific and technological development related to environment are feeling in a lower grade, and lower confidence in social organizations such as ONG's, consumer's association and in a lower proportion in ecologist associations.
In the literature consulted on public perception of the Science and the Technology, the differences observed in relation to the genre, the grade of formation and socioeconomic level, are analyzed, however the cultural origin of the sample is not analyzed. In Melilla, where the majority of the population is Muslim or Christian, the religion is a good indicator of the cultural origin of the population, being able to state that the origin of the

Chiristian community it is the Spanish western culture and of the the Muslim community is Tamazight or Rifeña culture, it is North African origin.
We found differences between the Muslim and Christian population, characterized for a major interest and information about for topics of medicine and health, major percentage (more than 25%) of "does not know, does not answer", and different credibility in professionals in the case of Muslims. The attitudes and expectations towards the Science and Technology are positive in both religious communities. For all these reasons we believe that it is necessary to include the "cultural origin" in the analyses of social perception of Science and Technology.

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PUBLIC PERCEPTION OF SCIENCE IN EASTERN AND CENTRAL EUROPE

Michel Claessens[1]

[1]Head, Information and Communication, Directorate-General for Research, European Commission, 200 rue de la Loi, B-1049 Brussels, Belgium. Tel.: +32 2 295 9971, fax: +32 2 295 8220, michel.claessens@cec.eu.int

Abstract
The presentation will outline the key findings from the first major European Commission survey (so-called Eurobarometers) on public perception of science ever conducted in the 10 new European Union's Member States (Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia), plus Bulgaria, Romania and Turkey. Sample questions were fielded in November 2002 to a total of 12,247 nationals in the 13 countries.

Key words: Public opinion, science and technology, Eastern and Central Europe.

Text

Information, interest, knowledge

- People in the 13 countries do not only feel they are not well informed about science, but indeed, there is a surprising lack of fundamental scientific knowledge in both parts of Europe. Europeans often consider themselves poorly informed about science and technology (so state two-thirds of them), although 45.3% declare that they are interested in this subject.
- In the Eastern and Central Europe, television plays an even more important role than it does in the current Member States in informing the public about developments in

science and technology. Citizens in the 13 countries prefer the other "passive" information dissemination method – e.g. they prefer radio over newspapers when they are looking for news and information related to science and technology.

- Biology, physics, mathematics, and astronomy are accepted by most people as sciences, while about three in 10 people in Eastern and Central Europe do not consider social sciences and psychology "fairly scientific". Ironically, even astrology is rated higher on the CC-13 level than history, economics, or sociology.

Values, science, and technology

- Most people agree that science is good and useful (Fig. 1). Many even think it's omnipotent. It is also true that the more people know scientific fundamentals, the more likely they are to generally believe that science will help to improve our world.

- Combating diseases, improving daily life, and interest at work are still broadly attributed to –and expected from– scientific progress. On the other hand, there is great reservation regarding science and technology as a panacea for all problems. Still, the overall image of science (that it has more positive than negative effects) finds favour in the 13 countries.

The morality of science

- Most people throughout Europe (a bit more in the 15 Member States than in the 13 countries) believe that science is value neutral in the sense that there are no evil inventions – only the application of a certain scientific finding can be good or bad.
- Still, scientists are held responsible for the misuse of their discoveries by almost half of the respondents in the new Member States. Consequently, the overwhelming majority in both parts of Europe agrees that scientists should be regulated by ethical standards that can be enforced by the authorities.
- While people in the 15 Member States are completely divided over the question of whether or not to allow scientists to conduct experiments "on animals like dogs and monkeys" (45% agree with this proposition and 41% disapprove of the idea); the

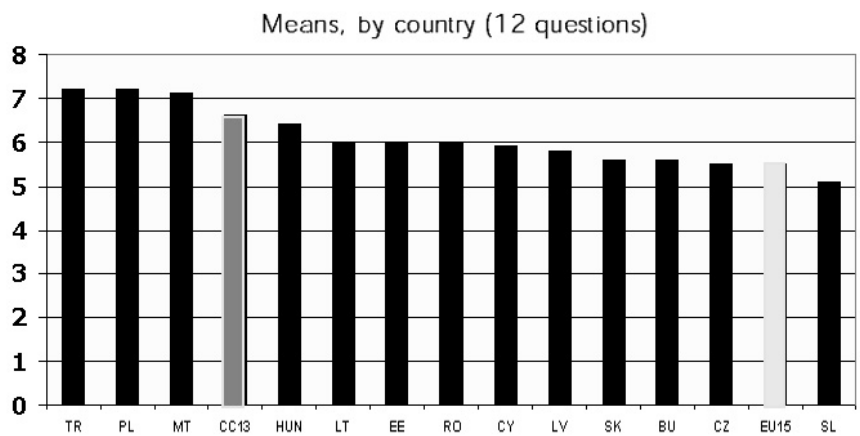

Figure 1 Level of optimism about science

overwhelming majority in Eastern and Central Europe supports (63% *vs.* 22%) these experiments if they target human health problems.

Food based on GMOs

- Attitudes are similar in the two parts of Europe; people first of all want to retain the right to choose between natural produce and foodstuff based on GMOs, which in other words means that the European public expects clear indication of GMO-basis on the packaging of food in supermarkets or in the menus of restaurants.
- This is an indication of the general attitude of the public that can be best described as "cautious". Eighty percent of all teenagers and adults in the 13 countries await more information before consuming genetically modified food, and about the same proportion feel that such food should only be introduced if it is scientifically proven not to be a health hazard.

The scientific profession

- Both in the 15 Member States and the 13 countries, people have the highest regard for those professions that have technological or scientific relevance. Medical doctors have the highest prestige rating in both regions. Scientists come in at second place, followed by engineers.

The scientific vocational situation

- People in Eastern and Central Europe are not sure if there is a scientific vocational crisis in their countries or not.
- But if there is one, certainly one of the most important reasons for a declining interest in scientific careers is attributed to the labour market in the new Member States. Most people think that mediocre career prospects and low salaries turn people away from pursuing scientific studies and careers.
- About two-thirds of Europeans support the idea of active public policies to encourage scientific careers: 60% on the EU-15 level and 67% in the 13 countries would like "the authorities to resolve this situation".

European scientific research

- Eastern and Central Europe' citizens are quite satisfied with the level of activity the European Union displays in the area of scientific research; their expectations and perception are relatively close to each other in this respect.
- Certainly, people in the 13 countries believe that research conducted at the European Union level will be more and more important (62% of the citizens in the new Member States agree) at the expense of national research.
- Clearly, people in both parts of Europe feel an important remedy for the scientific inferiority of Europe is the closer cooperation between European scientists (more in the 13 countries) and European countries (more in the EU).
- On average, six in 10 citizens in Eastern and Central Europe (59%) believe that the enlargement will bring mutual benefits for all: at the end of the process, both the current Member States and the accessing countries will possess an enhanced scientific potential.

FRAMING AS A THEORY FOR THE COMMUNICATION OF SCIENCE AND TECHNOLOGY

Urs Dahinden
University of Zurich, Switzerland. u.dahinden@ ipmz.unizh.ch

Key words: Theoretical framework, media, public opinion, framing, content analysis, survey, international comparison, biotechnology.

Text

Science and technology are issues that receive increasing attention in mass media (Dahinden, 2002). However, the analysis of this media coverage is often done with little or no theoretical background at all. Framing provides a promising theoretical framework that can fill this gap.

In the past several years, the framing approach has received increasing interest in communication studies (Reese, 2001) and also other social science disciplines like sociology, psychology or in political science. Despite the relative success of the concept, there is no agreed-on definition of what framing as a process or frames as results of such processes might be. Nevertheless, the following definition by Entman (1993) can be considered as a least common denominator of the various efforts to define the term: "To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such away as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation" (Entman, 1993: 52). This definition highlights that frames are not issues, but background patterns of interpretation that structure the perception and evaluation of a specific issue. Based on that definition, public debates can be described as framing contests between competing actors that try to frame an issue according to their own point of view (Pan, 2001).

The framing approach has a number of strengths: First, it is independent of the very issue under consideration and therefore a suitable theoretical tool for cross-issue comparisons. The frame concept has been applied to a number of very different issues in science communication, that includes science in general (Dunwoody, 1992; Peters, 1994) biotechnology (Bauer *et al.*, 2001; Priest, 1995) or nuclear energy (Gamson, 1989). Drawing from these studies, five general frames can be identified that are independent of the specific issue to which they are applied:

1) Progress by scientific information.
2) Econcomic aspects.
3) Conflicts (related to distribution of resources).
4) Ethical and legal dimensions.
5) Individual impacts, personalization of a topic.

As a second strength, the framing theory can be applied to all phases of mass media communication processes, including public relations, journalism and media effects on audiences.

However, there are also some weaknesses in framing research, like the lack of terminological precision and the diversity of empirical frame descriptions. Therefore, this paper gives an overview on framing theory and its various empirical frame typologies (Dahinden, 2002).

The biotechnology debate in Europe has been selected as empirical case study. The empirical discussion draws on data from a media content analysis and from population surveys (Gaskell, 2004). In both data sets frames are identified by means of inductive statistical techniques (factor and cluster analysis). The comparison of media frames and audience frames shows a number of shared, but also some different frames. Media effects are found with regard to some frames, but other audience frames are not linked to media use, but to other factors (e.g. gender, age and education). The paper discusses these findings and draws some conclusion for further theoretical and empirical research.

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PUBLIC PERCEPTIONS OF SCIENCE, AS REFLECTED IN THE CONDUCT OF LEGAL INSTITUTIONS

Jeffrey H. Matsuura

University of Dayton School of Law. 300 College Park. Dayton, Ohio 45469. USA.
Tel.: 1 937 229 2256, fax: 1 937 229 2469, Jeffrey.Matsuura@notes.udayton.edu

Abstract

Legal institutions support and impede science and technology, thus they mirror the general public at large. In the future, legal institutions will face more issues involving science and technology. To handle those issues effectively, scientific and technological literacy in the legal community is required.

Proponents of science and technology should strive to foster development of technical literacy in the legal community. Legal institutions possessing greater scientific literacy will create a legal environment more conducive to effective science and technology. Those institutions are also likely to influence the public to develop more realistic perceptions of the value of science and technology.

Key words: law, science literacy.

Text

Courts, legislatures, regulatory agencies, and other legal institutions now commonly rely on science and technology as they perform their public interest functions. For example, courts and law enforcement authorities now widely use forensic science and technology to resolve criminal cases. DNA testing is one example of a set of scientific and technological principles and techniques that is commonly applied by legal institutions in their ordinary course of business. Legal authorities also now routinely make use of computer simulation and modeling technologies to analyze cases and to present cases in court.

Science and technology now play critical roles in the development and enforcement of regulations that comprise administrative law. Standards for environmental quality, pharmaceutical product safety and efficacy, and food quality are widely recognized examples of science and technology applied by government to establish and enforce regulatory law. Regulations identifying threats to public health and safety, and those that establish standards of enforcement to control the threats, rely on science and technology as the key components supporting and sustaining the framework of regulations.

Although legal institutions now actively use and rely on science and technology to serve the public interest, those institutions also reflect uncertainty and fear as to certain aspects of science and technology. For example, in some jurisdictions, legal limitations have been imposed on genetically modified organisms, including food products. Some governments have established legal constraints on research associated with human cloning. Authorities have also begun to consider potential limitations on other developing technologies and fields of research, such as nanotechnology.

It appears that legal institutions have an ambivalent view of science and technology which mirrors the ambivalence felt by the general public. Just as the public is eager to make use of the benefits and advantages afforded by advances in science and technology, so too are legal institutions active consumers of those advances. Simultaneously, however, both the general public and the legal community harbor concerns that occasionally surface as fear of science and technology, and their consequences. That there is consistency between the perceptions of science and technology held by the legal community and those held by the general public should not surprise us, as our legal institutions are populated by ordinary citizens. However, the implications of legal community ambivalence as to the potential impact of science and technology are significant.

Legal institutions affect the conduct of science and the development of technology through direct regulation. For example, in the United States, research involving human cloning has been significantly constrained by law. Actions of the legal community can directly impede scientific inquiry or technological development in specific fields. Law also controls topics such as intellectual property rights, research and development funding opportunities, and conflicts-of-interest, which have significant impact on technical initiatives. Thus, legal institutions frequently exert direct influence over activities in science and technology.

Legal institutions also exert indirect influence over public acceptance of science and technology. Legal institutions are commonly perceived to be conservative entities, thus for example when they choose to acknowledge or accept a scientific concept (e.g., DNA identification) or technology (e.g., electronic filing systems for court documents and other legal records), that acceptance generally enhances the credibility of the concept or technology in the eyes of the general public. Similarly, when legal institutions question or reject a scientific principle or technology, that action can significantly erode public confidence in the principle or technology.

Given this relationship between legal community acceptance of science and technology and general public support, proponents of science and technology should have an interest in cultivating legal community understanding and support for science and technology.

A key step in cultivating support for science and technology in the legal community is promotion of scientific and technological literacy in the legal community. At present, the level of technical literacy in the legal community appears to be quite low. This condition is not surprising, as backgrounds of legal professionals, with a few exceptions such as intellectual property law specialists, do not commonly include significant technical training or experience. In the future, however, technical literacy will likely be increasingly important for the legal community, as a growing number of the issues that community will face will have significant scientific and technological components.

The science and technology communities would thus be well served by working with the legal community to enhance the scientific and technological literacy of legal institutions. That effort would likely create a legal environment more supportive of scientific and technological initiatives. It is also likely to enlist the assistance of the legal community in promoting a more accurate and reasonable perception of science and technology in the eyes of the general public.

PUBLIC UNDERSTANDING, SCIENTIFIC CULTURE PERCEPTION AND CIVIC ENGAGEMENT INDICATORS

Miguel Ángel Quintanilla,[1] Diego Lawler,[2] Mª Dolores González Rodríguez,[3] Óscar Montañés Perales,[4] Juan Antonio Montero Becerra[5] and Diego Jesús Pedrera Gómez[6]

[1] Catedrático de Lógica y Filosofía de la Ciencia, Director del Proyecto Novatores. Universidad de Salamanca, Edificio F.E.S., 507, Campus Miguel de Unamuno, C.P. 37007, Salamanca. Tel./fax: 923 294834, maquinta@usal.es

[2] Doctor en Filosofía. Centro de Estudios sobre Ciencia, Desarrollo y Educación Superior (REDES). Mansilla 2698, 2 Piso, C1425BPD, Buenos Aires, Argentina. Tel./fax: (54 11) 4963-7878 / 8811, dlawler@usal.es

[3] Becaria de investigación, Departamento Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca, Edificio F.E.S., 527, C.P. 37007, Salamanca. Tel.: 923 294640, ext. 3417, mdgr@usal.es

[4] Becario de investigación, Departamento de Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca, Edificio F.E.S., 527, C.P. 37007, Salamanca. Tel.: 923 294640, ext. 3417, om@usal.es

[5] Becario de investigación, Departamento de Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca, Edificio F.E.S., 527, C.P. 37007, Salamanca. Tel.: 923 294640, ext. 3417, antoniomonterob@hotmail.com

[6] Becario de investigación, Departamento de Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca, Edificio F.E.S., 527, C.P. 37007, Salamanca. Tel.: 923 294640, ext. 3417, diegopedrera@eresmas.com

Abstract
The aim of this communication is to present the results of a survey about Public Understanding, Scientific Culture Perception and Civic Engagement in Science and Technology. The main group opinion trends of the survey are depicted. Besides, central conclusions regarding public knowledge and attitudes about S&T in two Castilla y León cities (Salamanca and Valladolid) are showed.

Key words: Public Understanding of Science, Science Literacy.

Text

Context

During February 2003 a survey conducted by The Ibero-American Network for Science and Technology Indicators (RICYT/CYTED) and the Organization of Ibero-American States (OEI), was made in two cities of Castilla y León, Salamanca and Valladolid. The inquiry was part of an international project that included surveys from South American States. The inquiry, a block of 52 items, focused on the usual five groups of questions in Science Literacy: General Attitudes to S&T, the Spanish case of S&T, Civic Engagement in S&T activities, Scientific Information Resources and Scientific Literacy.

Objective

The objective has been to measure the public understanding and attitudes towards S&T and scientific literacy in Spain. We have analyzed and processed surveys polled to university students and graduated people. We have collected and identified general public's attitudes toward S&T. The results were sent to RICYT/REDES (Centre for Studies about Science, Development and Higher Education)

Methods

The survey method was trough interviews conducted by surveyors (face-to-face interviews).
Survey Features:

1) Designed samples: 150
2) Target population: Men and women graduated (26.6%) or University students (73.3%)
3) Sampling method: Random sampling. To identify correlations between elements such as gender and educational background (see Table 1).

Table 1

Graduated / student	Gender (F/M)	Science	Humanities	%
Students	F	20.67%	34.67%	55.33%
	M	9.33%	8.67%	18.00%
% Students		30.00%	43.33%	**73.33%**
Graduated	F	9.33%	4.00%	13.33%
	M	6.00%	7.33%	13.33%
% Graduated		15.33%	11.33%	**26.67%**
%		**45.33%**	**54.67%**	100.00%

Conclusions

The survey about Public Understanding of Science and Technology reveals that polled people have a positive perception and attitude towards S&T, and acknowledges the benefits from S&T as more important than risk and pervasive damages. However, they feel cautious about developments of S&T progress. This cautious realistic attitude to S&T cannot be described as merely an ingenuous one, because it cannot be taken as meaning that S&T have an unlimited power of solving social problems.

On the other hand, the survey mirrors a scarcity of information about scientific topics, as well as a low consulting rate of specialized publications and programs (TV, Radio, etc.). Nonetheless, there is a high percentage of correct answers with regard to scientific literacy. It is remarkable the difference between Science and Humanities students in relation to consumption of S&T information. Polled people do not consider themselves well informed in S&T subjects, especially humanities students.

Regarding citizens participation in S&T derived problems, the survey indicates a low level of active involvement. However, the majority of polled people consider that both citizen participation and concern about S&T impacts and their pervasive effects on social structures and daily life of individuals are relevant matter. Furthermore, the main subjects of concern are quality of life, health and some specific questions as AIDS, cancer, environmental change and pollution.

The shortage of technical knowledge is regarded by polled people as their main handicap to participate and get involved in social decision taking processes. Most people consider Science is valuable for Society.

People adopt a pragmatic attitude when they face scientific questions: health and medicine are considered the most relevant researching activities. These subjects get a high level of concern by polled people.

The survey describes a wrong perception of the origins of S&T sources of financial support in Spain. According to such perception, S&T would receive the majority of its financial support from the private sphere. This fact reveals that most people do not really know the rates of public and private financing S&T. The perception of Public Institutions and S&T funding is basically seen as related to Private Institutions, and less to Government Institutions.

Taking into account the Spanish situation, the survey indicates a negative perception of Spanish Government's promotion of S&T. Paradoxically, despite the actual public investments, most of polled people points to the low support of researching by the Government as the main reason to explain the problems of R+D activities in Spain. In fact, actual data show that Public Institutions' rate of researching and S&T funding is more important than the Private Institutions.

MEASURING PUBLIC PERCEPTION OF SCIENCE IN IBERO AMERICA: THE RICYT/OEI'S STUDY AND ARGENTINA'S NATIONAL SURVEY

Leonardo Vaccarezza,[1] Carmelo Polino[2] and María Eugenia Fazio[3]

[1] Grupo REDES, Mansilla 2698, 2° piso, C1425BPD, Buenos Aires, Argentina. Tel./fax: 54 11 963 8811/7878, vaccarez@mail.retina.ar

[2] Centro de Estudios sobre Ciencia, Desarrollo y Educación Superior (REDES), Mansilla 2698, 2° piso, C1425BPD, Buenos Aires, Argentina. Tel./fax: 54 11 963 8811/7878, cpolino@ricyt.edu.ar

[3] Centro de Estudios sobre Ciencia, Desarrollo y Educación Superior (REDES), Mansilla 2698, 2° piso, C1425BPD, Buenos Aires, Argentina. Tel./fax: 54 11 963 8811/7878, mefazio@ricyt.edu.ar

Abstract

Surveys on public perception and scientific culture are regularly performed in many countries. This information is becoming more useful for the strategic decision-making process and promoting social participation and democratizing science and technology. Latin American countries are also doing a germinal effort to construct this type of indicators. This paper exhibits results of the first national survey in Argentina (SECYT, 2003), taking into account the experience accumulated by the methodological survey performed by RICYT and OEI in Argentina, Brazil, Uruguay and Spain. These indicators are important but it is still necessary to work on their conceptual dimensions and normalization.

Key words: Indicators, public perception of science, national surveys.

Text

Context

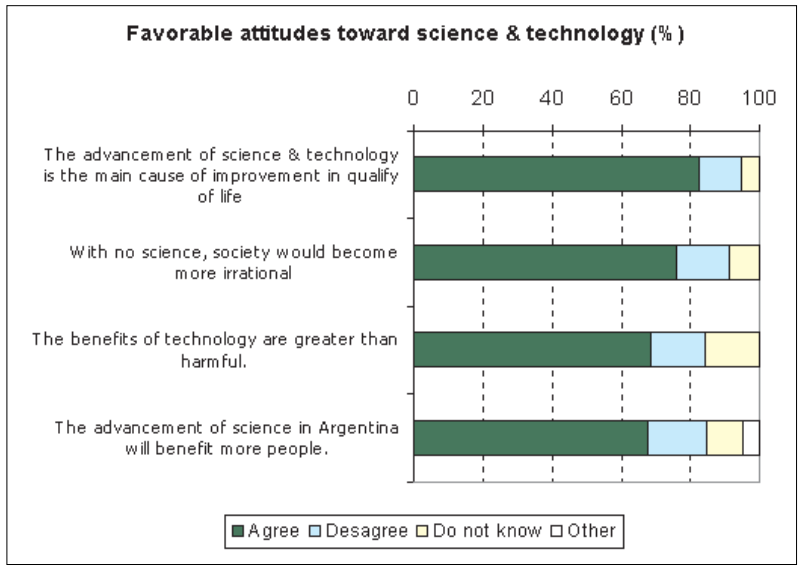
Since 2001, RICYT and OEI have been developing together several studies on public perception, scientific culture and citizen participation in science & technology in order to produce specific regional indicators and to promote this kind of studies in Latin and Ibero American countries. The challenge is significant, since even when the importance of these indicators is acknowledged, there are no total agreements about their definition, construction and normalization yet, specially considering in some cases the debate on the international guidelines or the difficulties for their adaptation.

In November 2002, a comparative pilot survey was implemented by RICYT and OEI in cities of Argentina, Brazil, Uruguay and Spain to analyze perception of science & technology in terms of social imaginary, communication and citizen participation. The study joined different methodological approaches in order to explore valid mechanisms to interpret public answers in this field of social research. The investigation allowed to confirm limitations in massive surveys to cover the linkages between science, technology and society; specially considering scientific culture in society includes not only public understanding and supporting science but a complex social, cultural and political framework. Moreover it showed the importance of developing qualitative studies and specific regional indicators which should allow international comparisons.

The RICYT and OEI's experience was used in the first national survey in Argentina, implemented by the Observatorio de Ciencia y Tecnología of the Secretaría Nacional de Ciencia, Tecnología e Innovación Productiva (SECYT), with researchers from Centro REDES. It includes 1,750 cases in 17 cities covering every region in the country.[1] We present here some results from data collection.

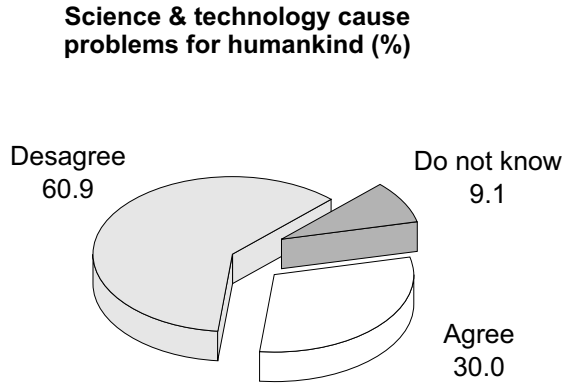
Results

Most of the population in Argentina has favorable attitudes toward science and technology because they improve quality of life and the culture of the society (Graph 1).

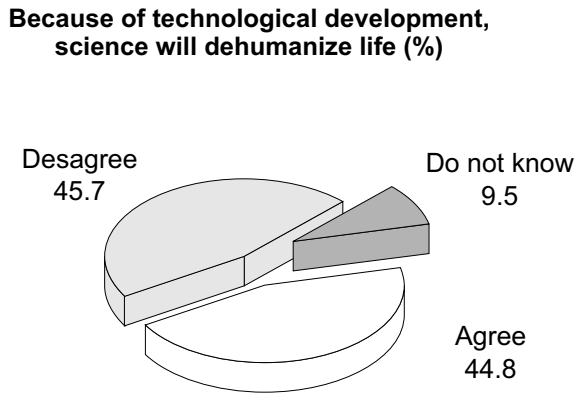


Graph 1

Nonetheless, an important proportion of the public shows precautionary attitudes regarding the consequences of scientific knowledge utilization (Graphs 2 and 3).

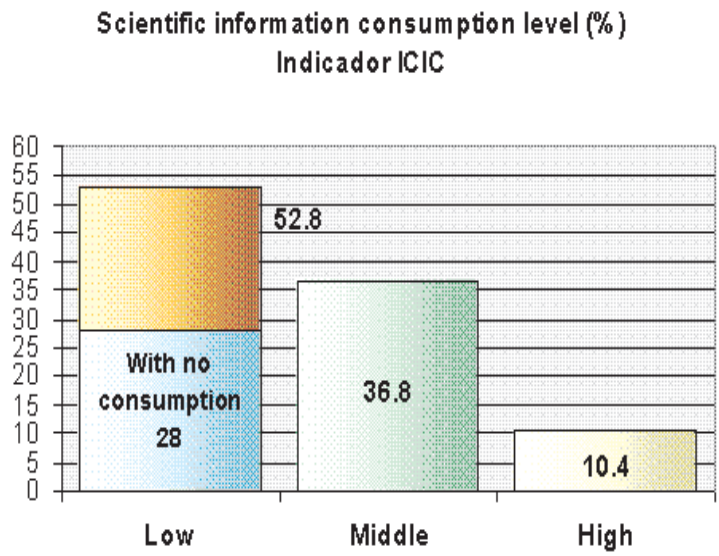


Graph 2



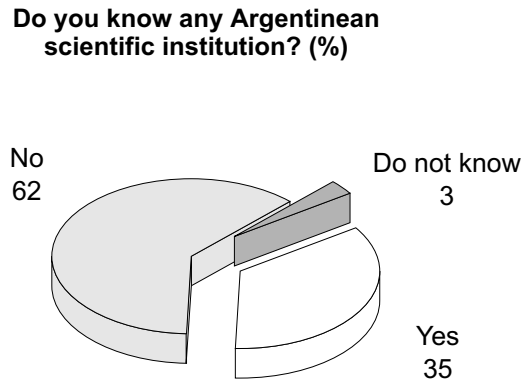
Graph 3

Science and technology, however, do not appear among the informative preferences of the Argentinean people. More than half of the population is poorly informed about science & technology issues. In fact, 22% has never had contact with specific information on science and technology[2] (Graph 4).



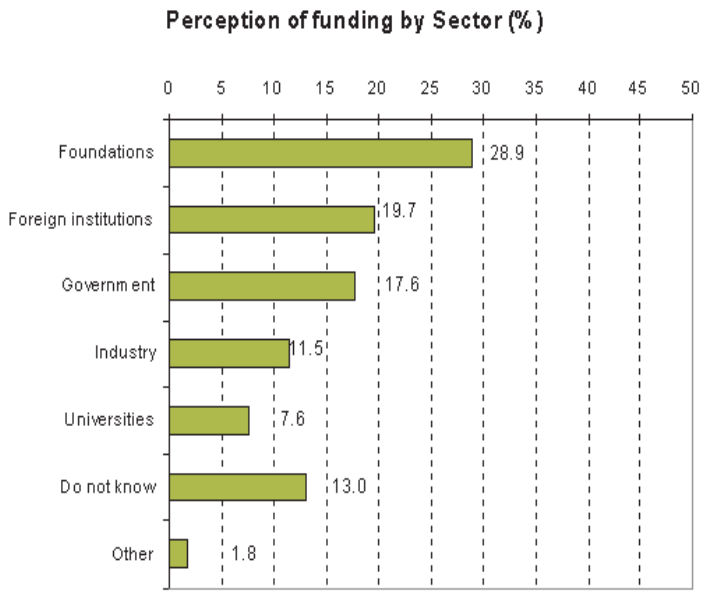
Graph 4

Most Argentineans (62%) do not recognize any scientific institutions in the country (Graph 5).

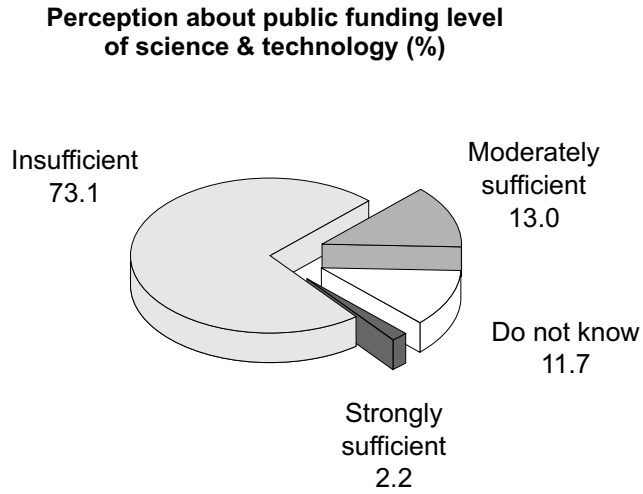


Graph 5

Science & technology in Argentina are supported principally by the public sector. Nonetheless, most of the society believes foundations and foreign institutions are at the top of the list as the main supporters (Graph 6). Also for 73% of the population, the Government does not finance scientific research sufficiently (Graph 7).

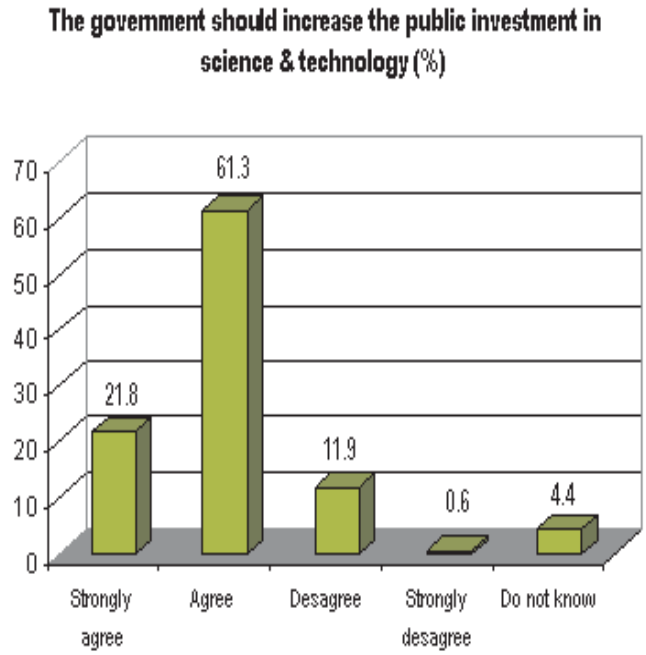


Graph 6



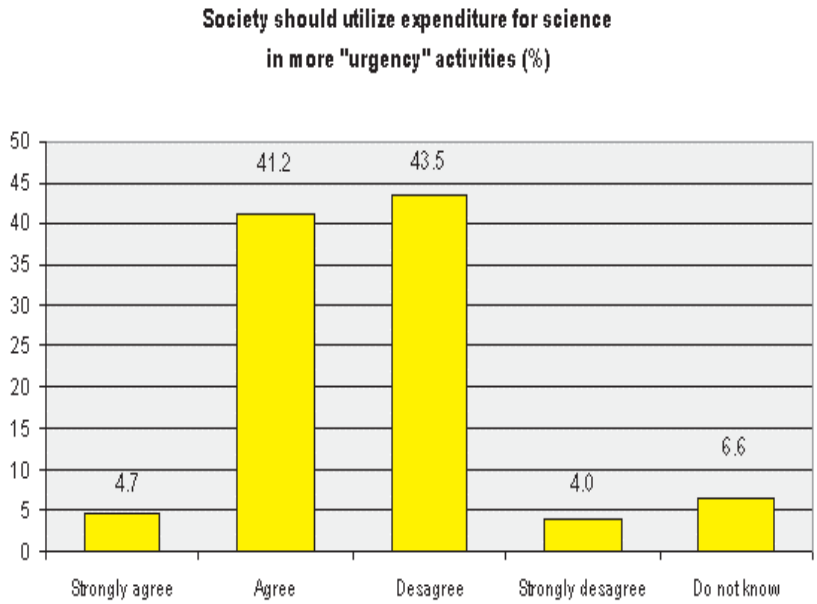
Graph 7

On the other hand, eight out of every ten Argentineans opines that the Government should increase public investment in science & technology (Graph 8).



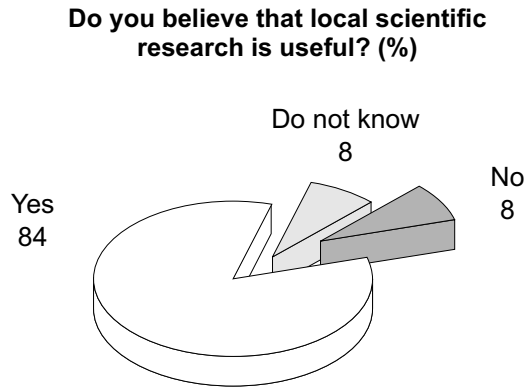
Graph 8

Nevertheless that priority becomes relative if we introduce the concept "urgency" for considering public policies: an important proportion of the public (46%) agrees on utilizing expenditure for science in more urgent activities (Graph 9).



Graph 9

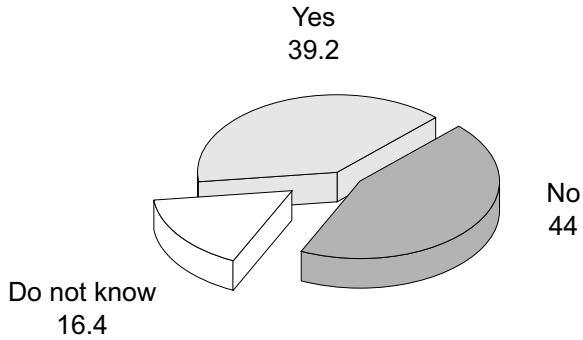
The vast majority of the society (84%) considers national scientific & technological research as useful (Graph 10).



Graph 10

However, that perception does not show an effective knowledge of the usefulness of research because of limited public contact with the system of science & technology (little knowledge of institutions, low consumption of scientific information, etc.). Moreover, the idea of "usefulness" gets blurred faced with a specific issue: an important proportion of the population (44%) thinks that science & technology does not help to increase employment in the country (Graph 11).

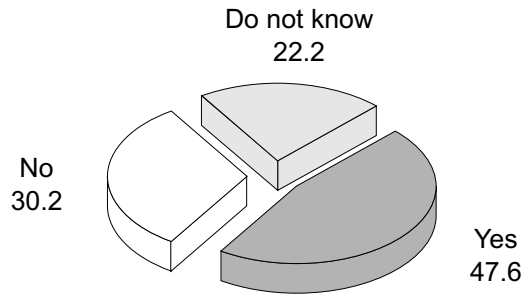
Are science & technology helping to increase employment in the country? (%)



Graph 11

A figure close to half of the population thinks that enterprises use the results of local research. But this is a topic where there is a high ignorance about concreting utilization (Graph 12).

Do the enterprises utilize results of local scientific & technological research? (%)



Graph 12

That valorization, furthermore, coexists with the equally majority opinion of society about the low participation of enterprises both to support and develop research in the country.

Conclusions

The Argentinean society considers science both as a central cultural value and prestigious institution which, in general terms, increases quality of life. However, there is a considerable distance between the system of science & technology and the Argentinean society. Basically, the public has passive attitudes toward scientific & technological information as a periodic pattern of personal consumption of information. In addition, most of society does not recognize either local institutions of S&T or the public sector role as the principal supporter of the local activity research. Moreover, the idea of "usefulness" of the local generated knowledge is more potential than effective. It is necessary, in that sense, to promote strategies for science communication in society for installing in the public opinion a greater appropriation of science & technology. It is an especially important topic: along with favorable attitudes there are reservations that public policies must not neglect. It is central to give to the public elements both to evaluate local S&T capacities and introduce S&T in a real national social, political and cultural context.

Notes

[1] Margin of error: ±2.5%, level of confidence: 95%.

[2] The ICIC Indicator is an aggregate to view public disposition toward scientific & technological consumption of information. This indicator was constructed using the answer to two variables: consumption of newspapers and television.

COMMUNICATING CLIMATE CHANGE: CHALLENGES POSED BY THE DIVERGENCE IN LAY AND EXPERT UNDERSTANDING

Lorraine Whitmarsh

Science Studies Centre, Department of Psychology, University of Bath, Bath BA2 7AY, United Kingdom.
Tel.: +44 1225 383061, fax: +44 1225 386752, psplew@bath.ac.uk

Abstract

Building on previous PCST research which highlights the role of contextual factors in determining lay conceptions, this study examines the UK public's understanding of climate change. Findings from interviews and a major survey expose the heterogeneity in lay understanding about the issue due to individual and social influences. The results also show a clear divergence between lay and expert opinion where knowledge of other environmental, and broader cultural discourses are central in determining lay perceptions of, and response to, climate change. This research shows the need for communication which adopts relational strategies to highlight the relevance of climate change in terms with which people identify.

Key words: Climate change, public understanding of science.

Text

Context

The UK government has been keen to demonstrate its commitment to tackling climate change. However, attempts to inform the UK public about climate change and to

encourage energy conservation have had little impact on individuals' understanding or behaviour (Park et al., 2002). Studies suggest there are notable differences between public understanding of climate change and expert accounts. Lay perceptions of climate change are often related to moral concerns, for example about global inequality (Darier & Schule, 1999), or conceptually integrated with other environmental issues (Hargreaves *et al.*, 2003). Research in PCST indicates that personal, social and institutional context determine how information is interpreted and used (Wynne, 1991). Acceptance of environmental information is influenced by perceptions of relevance, credibility, trust, individual efficacy and responsibility (Eden, 1993; Burgess *et al.*, 1998). Global risks, such as climate change, are inevitably more difficult to communicate, because their relevance to everyday concerns, actions and experience is not necessarily evident, and responding to them may involve sacrificing highly symbolic aspects of modern lifestyles (Kempton, 1991).

If communicating climate change is to be effective, there needs to be a greater understanding of the context in which publics perceive the issue.

Objective

This research examines the contextual determinants and dimensions of public understanding of climate change, including any disparity with scientific conceptions.

Methodology

The research comprises qualitative interviews (n = 24) and a postal survey of residents in Hampshire, UK (n = 589; representing 33.3% response rate). The postal questionnaire addressed themes that emerged during the interviews and included qualitative and quantitative questions. Stratified random sampling was applied to ensure a representative and demographically diverse sample. Analysis included thematic analysis (for qualitative data) and T-tests/Chi-square tests, regression and factor analyses (for quantitative data).

Results

Both the interview and survey data highlight the considerable variation in understanding climate change – both in terms of people's level of knowledge and their conceptions, language and attitudes. This heterogeneity reflects a dynamic process of constructing understanding (evidenced in interviews) and the diverse characteristics of respondents. Analysis reveals participants' background (e.g. gender, age), educational level and experience significantly influence understanding and attitudes. These individual and social influences on lay conceptions of climate change contribute to a divergence with expert accounts.

As anticipated, respondents often conceptually integrated climate change with other environmental issues, particularly ozone depletion. Participants' (particularly women's) understanding was often related to directly-experienced phenomena, particularly air pollution and weather. In some cases, climate change was understood in moral terms - that is, the issue was seen as indicative of modern society's dysfunctional relationship with the environment. There was also a sense that controls should be implemented to ensure an equitable approach to tackling the issue.

The overlapping issues of uncertainty and distrust of information were central in determining interviewees' perceptions of, and response to, climate change. Analysis of the interview and survey data[1] revealed the dimensions of uncertainty and distrust included:

- Feeling under-informed or unsure of one's own knowledge (particularly amongst older respondents).
- Ambivalence (particularly amongst men and more qualified respondents) about the reality of anthropogenic climate change due to perceived uncertainty or dispute among the scientific community and exaggerated or dubious claims made by the media or scientists.

In contrast to second-hand information, respondents trusted the evidence of their senses: those whose health had been affected by air pollution or who believed the weather is changing tended to be more certain of the reality of climate change.

Conclusions

Consistent with previous research in PCST and constructivist theories of learning (e.g., Scott, 1987), this study suggests an individualised, context-dependent process of constructing understanding. Lay-expert divergence in understanding climate change can be understood in terms of different ways of constructing meaning (Bruner, 1986): in contrast to abstract, scientific knowledge, lay understanding is relational. Accordingly, effective communication must adopt relational strategies to highlight the relevance of climate change to people's lives in terms with which they identify.

In addition, this research provides evidence of how the public evaluates information about climate change. Disparity between the UK government's exhortations for individuals to reduce their energy consumption and widely-reported political and scientific debate over climate change is likely to undermine public trust in climate change information.

Notes

[1] Factor analysis of the quantitative data revealed uncertainty to be the strongest and most reliable (alpha = 0.66) dimension of respondents' attitudes.

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SCIENTIFIC CITIZENSHIP CULTURE. A LATINOAMERICAN VIEW

Sergio Ricardo Quiroga Macleimont
GT Asociacion para la Comunicacion Publica de la Ciencia y la Tecnologia, Bolivia (San Luis), Argentina

Abstract
The modern democracies are transformed and the citizenship concept are changed at the time of uncertainly, new technologies, new forms of economic relations and new relation of media and the quotidian life. This is the time of mass media, citizenship and communicative management in the public scene. The information societies are protagonist of communicative networks, in the identities formation, changing our quotidian life, our ideas of world, transforming the development of learning and scientific activity and influent our collectives imaginaries.
The idea of science communication has been developed since the concept of community science including models as Public Understanding of Science and Public Participation of Science and the model of Scientific and Technology Alphabetization of Fourez (1997).
In the Latin American societies with social and economic difficulties we consider the idea of propose a new model of social communication of science, more contemplative with the special characteristics of this context and the relations-tension between science and local communities. We call this on-building model as: Scientific Citizenship Culture. This model of social communication of the science think in the social communication of the science as process, product and culture with the idea to promote the development of the local societies, organise the local actors, development the connections to democratise the scientific knowledge, the exchange fluxes, the division of works to facilitate the work, the institutional autonomy as guarantee of democracy and good intervention and the promotion of energies exogen and endogeny to promote the cognitive synergies.

Parallel session 28

Discourse analysis contributions to PCST study

ASTRONOMY TEACHING AT THE HIGH SCHOOL LEVEL FROM A HUMANISTIC APPROACH

Gilvana Benevides[1] and Luiz Carlos Jafelice[1,2]

[1] Graduate Program on Natural Sciences and Mathematics Teaching, Rio Grande do Norte Federal University (UFRN). Rua São José de Mipibu, 1468 Lagoa Nova 59063-070 Natal-RN Brazil. Tel./fax: 55 84 231 82 62, gibenevides@yahoo.com.br

[2] Physics Department, UFRN. jafelice@dfte.ufrn.br

Abstract

The astronomy teaching is usually excessively technical and dissociated from the human aspect that feeds the great interest and curiosity that those themes arise. In this work we present a proposal aiming to contribute to revert such a picture. For that purpose we choose as opening issues the different views of the Universe: naïve, autochthon, and scientific. We develop practices, instructional materials and texts to make the adoption of a humanistic approach feasible to the astronomy teaching at the high school level. We applied our proposal in an in-service teacher's training course and the receptivity and results were very stimulating.

Key words: High School Education; Humanistic Approach.

Text

Introduction

There is an enormous shortage of astronomy didactic materials for high school teachers that particularly explore humanistic aspects of that subject. The origin of the Universe is a good example of that central conclusion. Although such an origin has had diverse cultural explanations, teachers usually do not have information about, besides lacking material to work on different world views and appropriate training to lead a proper classroom approach to those cosmogonic explanations.

Objectives

Our project in education must be seen as a practical trial to help the effective formation of citizens more integrated with themselves, the environment and the society they live in. Our aims go beyond a verbal and experimental astronomy content for high school teenagers. The project intends to integrate activities that are play oriented and at the same time develop cooperation qualities and skills, respect for the others, respect for their opinions, besides including corporal activities (vivid and theatrical activities), going beyond plain physical concepts.

Methods

In this manner, the challenge of this project was to introduce other aspects of the human being into the learning of physics, in particular astronomy, which usually are not considered because of the adoption of excessively technical and mathematical approaches in exact sciences teaching.

Following what Howard Gardner has proposed (cf. Armstrong, 2001), we see that the human being has different intelligences. Those are cognitive capacities that allow the individual to learn and interact with the world. Therefore, there are other ways of learning besides the rational form, and those ways should have appropriate practices involving them within a discipline or among the disciplines traditionally present at the high-school level of formation.

We develop practices, instructional materials and texts to make the adoption of a humanistic approach feasible to the astronomy teaching at the high-school level, an approach in which the humanistic and scientific cultures could be integrated in a contextualized and efficient way for that level of teaching.

Results

We further criticize the fragmental, positivistic, individualistic and competitive model of education that is so common in most high schools. Such an educational model is more worried with the selection of students to enter university than with their formation as a person. In our view, fragmentation only brings more fragmentation and this puts the individuals apart from the society they live in.

We propose the opposite, the integration and cooperation between the individual and herself/himself, the others and the society. In order for this to happen our “trick” is to put together classes involving the recovering of cultural contents. For that purpose it was chosen some indian cultures to enrich the teaching of astronomy, to compare with the Greek astronomy.

The objectives are to stimulate the comprehension of how different people elucidate the same phenomenon and also to make explicit the human being capacity of elaborating models: religious, philosophical or scientific. Each one attending one aspect of the human being, without the possibility of choosing the best, because the model has something transitory in its structure that the school unfortunately does not work with. Schools adopt the (current) scientific model as if it was the absolute truth when, in reality, we already learned from history of science examples that models are usually replaced by others.

Among other things that our project works with, we point out the following activities:

1) The sky representation made with paint sprinkled on a paper, showing that the formation of the constellations is, in reality, the look we give to those random spots, to

form figures that make sense for our culture; 2) The theatrical activity with texts of different cultures and times [Brazilian Tupi-Guarani indians; Indian "Nasadasiyasukta" of the Rig Veda; Biblical Genesis; and a scientific one (Big Bang)]; this activity involves the body as an expression vehicle of learning, and highlights that the knowledge construction is made through models; and 3) The Brazilian Tupi-Guarani dance of the IEAOUY shows how another culture enters into connection with sky elements not standing off from them but considering themselves as children of the Sun and the Moon, and how this conception creates a less aggressive view for nature.

We point out the following results from that educational experience: The production of activities guidelines; The development of specific pedagogical practices (e.g., myth staging; indigenous Guarani primordial dancing; constellations "creation" and multicultural interpretations; etc.); and Concrete suggestions for the effective accomplishment of a contextualized and interdisciplinary teaching practice, where cosmogonic questions serve as an inspiration to motivate and initiate such a practice.

We applied our proposal in an in-service training course for public school teachers of several subjects. Their receptivity to that approach and the educational results obtained were very encouraging. They clearly indicate how the adopted approach may train teachers for world readings that naturally include cultural, social and historical aspects within the usual curricula subject themes to be taught. [See Benevides and Jafelice (2004) for further comments.]

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SCIENCE IN THE PRESS: PROBLEMS AND POSSIBILITIES OF RECONTEXTUALIZATION

Helena Calsamiglia
Universitat Pompeu Fabra, Barcelona

Abstract
Recent studies on the public communication of science in the press have stressed not only the increase of science news but also the singularities of this kind of communication. The approach advocated in this presentation suggests that the analysis of the precise linguistic formulations in texts can provide insight into, and thus improve the practices of popularization. The analysis of our data shows that there are different types of recontextualization: on the one hand it means that journalists introduce an orientation in their discourse through the citation of different voices; on the other hand it means to relate scientific results to a social situation where the focus is on personal, economic, social and political consequences. Such science news is in general well understood by the readers. And finally, contextualization involves providing information about technical aspects, generally difficult to understand for ordinary people. These are the contents that have to be explained through various strategies, in order to bridge the epistemic gap between what the scientific community knows and what non experts know.

Key words: Discourse, popularization, newspapers, language, recontextualization citacion, explanation.

Text

Discourse analysis focuses on the study of the *use* of language in *context* (Calsamiglia and Tusón, 1999). This approach is clearly distinct from the grammatical study of the structures and forms of language, which abstracts from context and speakers. In discursive linguistics the facts of language are observed and described within texts (understood as units of communicative interaction). The position, aims and involvement of writers with their own text and with their readers is inferred from what may be considered the conscious or unconscious choice of linguistic units at various levels; from the choice of semantic structures or syntactic constructions, the organization of the text and rhetorical resources, to their adaptation to communicative genres and channels, within the framework of the interaction between writer and reader.

Popularization discourse, a substantial component of science communication, constitutes itself on the basis of an asymmetric relationship: the communicating subject, who has access to the knowledge in the field of science, aims to interact with a non-expert audience which does not have such knowledge. With its popularizing practices the world of science (knowledge expressed and communicated within the scientific community) opens itself to the world of everyday experience and of social life. From a communicative point of view this is a particularly interesting case of knowledge transfer and adaptation. During the last years, more and more studies in this perspective have aimed to describe the specificity of popularization discourse (Jacobi, 1999: Moirand, 1997; Ciapuscio, 2000; Myers, 2003). In this framework we make use of the concept of *recontextualization* in order to account of the linguistic-rhetorical treatment of scientific objects and authors in each communicative situation. In each case we encounter a distinct legitimacy as to the function and value of the linguistic units selected for communication. In this presentation we base ourselves on the results of a study of two widely reported cases in the written press (Calsamiglia and Cassany, 2001); Calsamiglia and Lopez Ferrero, 2003; Calsamiglia and Van Dijk, 2004): that of the "mad cow" disease (1996) and the announcement of the sequencing of the human genome (2000).

In the case of Bovine Spongiform Encephalopathy, we studied the way relevant discourses appeared in the press, e.g., the way journalists cite scientists and other social actors. Results show that scientists form a minority, far behind other social actors such as politicians and representatives of health and civil organizations. Moreover we studied in detail the structures of the passages preceding cited words, through which the author uses the voice of a social actor. It was observed that the writers present voices of different kinds and that their role is important because of (a) their choice of social actor, (b) their assignment of a communication verb, (c) their different identification of each social actor. Thus, the role of journalists shows through their introduction of citations with the veiled aim to steer the interpretation of their readers.

In the case of the sequencing of the genome, we focused our attention on another crucial aspect of science communication: explanatory resources. We observed that in the presentation of the sequencing of the human genome two contextualization modalities are activated; the most widely used relates scientific results with its consequences for people's health, with economic and political perspectives, with ethical issues, with the ups and downs of the history of science and its actors, etc. Least used is the form of contextualization that we paid attention to: how is technical information explained to the readers in such a way that they understand the world of contemporary genetics.

The progress of these studies allows us to formulate some questions and thoughts about the role of popularization and in particular about its protagonists. If it can be shown that

the role of the communicators is to put the advances of science into a socially relevant context, then their writing is not innocent and neutral, but rather contributes actively to the public presentation of new social representations (opinion, conceptualization). The selection of their quotations corresponds to a value scale; these citations can no longer be considered only as a way to avoid responsibilities or to enhance credibility, but also as a presentation of voices that argumentatively orient their own discourse.

As to the contextualization of scientific events, the new knowledge is didactically presented (through explanatory resources such as synonyms and metaphors) in a way that corresponds to cognitive functions that play a role in the introduction of new knowledge in relation to assumed previous knowledge. But the fact that this type of contextualization forms only a minor part of contextualization when compared to sociopolitical contextualization suggests that knowledge remains very approximate. Are these inexact concepts necessary for the social circulation of new knowledge or do we have to intensify the explanatory endeavors?

Finally, my position with respect to the role of science communicators is that they must be *creative* and *involved* with the particular social context as well as *adapt* themselves subtly to each communicative situation. Their aim should be to achieve an approximate or basic technical knowledge which allows people to operate in social life in a piecemeal process of conceptual construction that cannot be realized at once.

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THE RHETORIC OF BREAKTHROUGHS IN THE COMMUNICATION OF BIOTECHNOSCIENCE

Fernando Cascais

Department of Communication Sciences, School of Social and Human Sciences. New University of Lisbon, Ave. de Berna, 26-C, 1069-061 Lisbon, Portugal. Tel.: +217933519, fax: +217977759, afcascais@netcabo.pt

Abstract

The rhetoric of breakthroughs consists of representing science by its products, subsuming scientific processes to the teleological and cumulative pursuit of results, with an exclusive emphasis on outcomes

that can be evaluated *ex post facto* as breakthroughs in applied science. This is tantamount to ignoring the cognitive pursuit of science as a process, disregarding the role of productive error in scientific decision-making processes, and identifying scientific ends to actual results, by excluding unanticipated and hazardous results, and, ultimately, risks. It must be acknowledged that biomedical technoscience is capable of providing means to an end, rather than producing results.

Key words: Rhetoric, breakthroughs, result evaluation.

Text

The crisis of the linear model (AAVV, 1985) of the communication of science, permitted the emergence of an interaction model still open to discussion. An issue both frequently and superficially pointed concerns the representation of science and its following public perception according to its results rather than the process that lead to them. In effect, the euphoric and spectacular avowal of communication of science privileges (Nelkin, 1995; Semir, 1999) is not far from becoming a common-place, along with the display of its results to the detriment of the exposition of scientific process.

In the epicenter of the conceptual controversy in which the linear model has been questioned one can detect a assortment of demarcations between: what is science and what is not; literacy (of scientists) and illiteracy (of laymen) (Bauer, 1992); the domain of science and non-scientific public domain. The interaction model (Felt, 2000b) between scientists, communicators and the publics emphasizes that interaction ought to be understood not as cooperation but rather as negotiation and, strictly, in the extent that those demarcations, far from remaining stable or stabilized by means of consensus, are rather permanently rebuilt, in a process of dissension and conflicts, befalling on those who hold the authority to discuss the very criteria of demarcation.

To this process of negotiation the henceforth classic concept of “boundary work” has been applied. It consists of a process concerning: when, how, and to what ends the boundaries of science are drawn and defended in natural settings often distant from laboratories and professional journals (Gieryn, 1994). Boundary work is brought on by disputes over credibility, about who has the legitimate power to represent a sector of the universe, on what grounds, by what methods or virtues, and in which circumstances (Gieryn, 1999). Boundary work intensifies when people fight for, legitimize or defy the cognitive authority of science (Felt, 2000a). In that sense, a rhetoric (Gross, 1996) of breakthroughs can easily be placed in the core of boundary work occurring in the communication of science.

Essentially, the rhetoric of the breakthroughs consists of:

- Representing scientific activity by its products.
- Subsuming scientific processes to ultimate and cumulative attainment of results.
- Exclusively isolating as results those *a posteriori* assessed as successful accomplishments.

The above implicitly stands for:

- Ignoring scientific activity as a process whilst proceeding through protocolar observance of *a priori* criteria of methodological rigor of investigation, advances in a non-linear, erratic and tentative way - that is akin to saying that it whitewashes both the intrinsic reversibility of all scientific knowledge and the rational reconstruction inherent to the pursuit of cognitive interests.

- Canceling the role of productive error in decision-making and scientific choices, in such a way that success in the attainment of results can be ascribed to the rigor of methodological conception – which implies the necessary elimination of whatever surpasses the domains of rigidity delimited by method, and regarded as its spurious outgrowth rather than a mark of its limits of validity.
- Producing an effect of positive censorship of science: either as producer of risks –to the extent that it encourages the illusion of the control of technoscientific risk– or as the provider of means, to the extent that it assimilates ends to results, defining in retrospect the former via the latest and exclusively identifying as results of scientific process those evaluated as positive, excluding haphazard, unexpected and adverse results.

Scientific process is defined by the means it employs and not by the results that is pursues or effectively reaches. This implies not at all the underestimation or disregarding of results, but it merely rearranges them within the discursive economy of the communication of science (Jeanneret, 1994). Thus, it becomes imperative to assert that biomedical technosciences are able to provide means rather than produce results, contrary to the rhetoric that hastens the illusion of the control of risk (Beck, 2000).

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SCIENCE POPULARISATION PRACTICES FROM A LINGUISTIC POINT OF VIEW

Daniel Cassany and Carmen López Ferrero

Universitat Pompeu Fabra (UPF), Barcelona

Abstract

Contrasting specialized discourse and popularising discourse from a linguistic point of view, we show that the most relevant feature of popularising discourse is *linguistic variation*. We illustrate these characteristics with the analysis of Internet forums and chats produced by Spanish language people affected by the HIV, by diet diseases or by the use of drugs. The questions that guide our research are:

1) which semantic characteristics of scientific concepts can be understood by the public?; and 2) which referring expressions (names) are the most adequate? The results show that: a) discourse linguistic approach provides useful tools to categorize and evaluate science popularisation practices, and b) the study of these practices from a linguistic point of view is a necessary requirement to think about the way science is communicated to society and understood by people.

Key words: Discourse, linguistic variation, science popularisation, Internet communication.

Text

Theoretical framework and objectives

The discourse linguistic approach provides useful tools to categorize and evaluate science popularisation practices. Contrasting specialized discourse and popularising discourse from a linguistic point of view, we show that the most relevant feature of popularising discourse is *linguistic variation*. The questions that are guiding our reflection are:

1) Which semantic characteristics of *scientific concepts* can be understood by the public at large?; which *conceptual relations* are the most relevant and appropriate, and why? (Cassany, López and Martí, 2000).
2) Which *referring expressions* (names) are the most adequate in popularising science? (Cassany and López, 2002).

We illustrate these two points with the analysis of Internet forums and chats produced by Spanish language people affected by the HIV, the use of drugs or by diet diseases.

Popularising science and Internet

Our aim is to characterise the use of science language by virtual Spanish comunities related to the specialized medical fields mentioned. Three aspects define discourses within those communities: a) they show some typical features of each electronic techno-genre (chat, forum, web, etc.); b) they include a diversity of Spanish geographical, generational and social dialects; and c) they use an oustanding amount of terminology and specialized forms, coming from the corresponding scientific disciplines, used at popularized contexts by non-expert people (chats) or addressed to non-expert people (forums), which acquire connotations and special meanings.

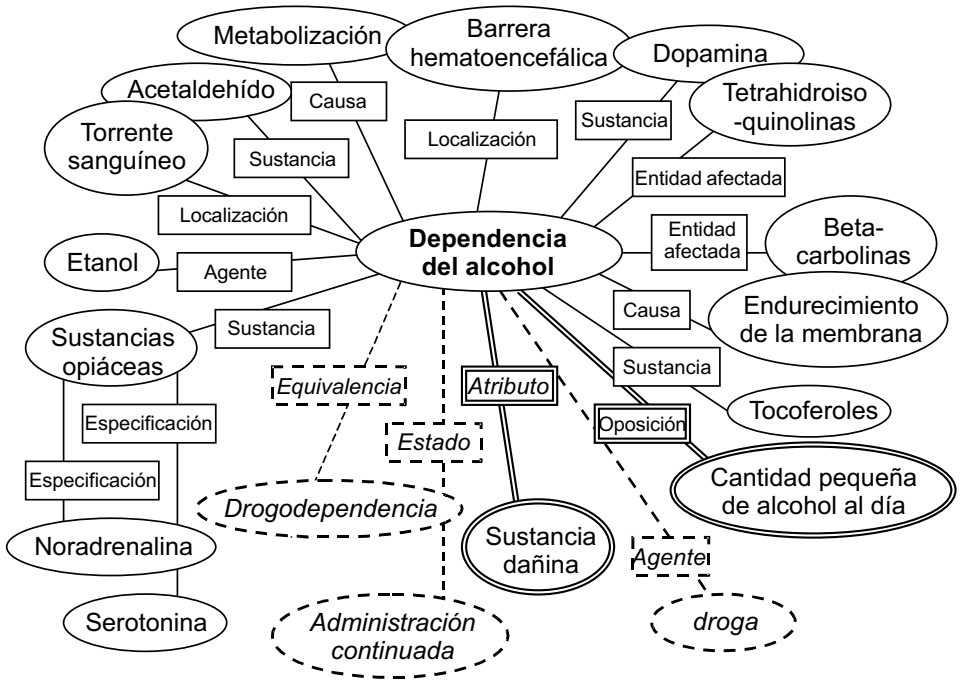
Science semantic and lexical variation at Internet

We analyse discourses at Internet from two perspectives:

1) The study of *conceptual networks* of terms employed in the messages. We compare the conceptual networks of the used terms with those of the same terms used within more specialized scientific discourses. This comparison allows us to establish the meaning variation that is going on at a term depending on the context (more o less general or specific) where it is used.
2) The description of the popularising strategies (discursive, lexical and rhetorical) unfolded to *name* and *present* scientific concepts within messages. These analyses show the greater or lesser formality of discourse and the degree of shared knowledge among virtual communication participants.

Those two analyses are made on the discourses produced within the following web sites: egalia.com, interactua.net, foro-vih.org/preg, biopsicologia.net, foroanorexia.com, www.lasdrogas.info, foroanorexia.com, from 1999 to 2003, with 1082 messages and 140,770 words.

Semantic variation at conceptual networks
In the following diagram we show the changes that suffers the conceptual network of the term *alcohol dependence.* The central concept is the nucleus that establishes different links with other secondary concepts. With a straight line we stand out the links that are kept in the two domains (specialized and popularised), and we specify the type of established relation (according to De Beaugrande and Dressler, 1981). With a discontinuous line we point to the conceptual links that disappears at the popularised text. Finally, with a double line we mark the new conceptual relations that are established at the popularised discourse in front of the specialized source (Cassany and López, in press).



Naming variation
As for lexical issues, we have identified different types of popularisation practices at Internet, depending on the status of scientific knowledge (new or shared):

a) The contrast between two terms and the use of metalinguistic forms, which introduce new concepts within the communicative context:

A diferencia de otros fármacos de las mismas características, la mirtazapina tiene un efecto serotoninérgico más específico, con lo cual se evitan algunos efectos secundarios. [...] *Sin embargo*, la mirzapaina tiene efecto antihistamínico, [...]

b) Presupposition and naming proforms of very little semantic value, that involve shared information by participants:

Estoy muy bien, físicamente perfecto, en realidad nunca me he encontrado mal, me enteré de mi *"cosilla especial"* de forma totalmente casual.

c) Creative uses to present scientific concepts, such as comparisons and metaphors, which combine the *new* information *with the shared* one, and the use of general and spontaneous terms of science origin:

No os voy a enumerar todos los padecimientos, ni quiero hablar de tratamientos, nauseas, y todas estas cargas que compartimos, sino de la carga que para mi fue más pesada durante algún tiempo: el silencio, el secreto.

Implications of the study

The study of science popularisation practices from a linguistic point of view is a necessary requirement to think about how scientific language is used by non expert people in their interaction. In this sense, it allows to evaluate the shared scientifc knowledge and the way concepts from science are understood.

About the first question arised, our studies conclude that relations of *localization* and *cause* are the more frequent meaning variations introduced at scientific concepts to be understood by lay people. They are also new relations that place the concept, that is to say, contextualize it and stand out what causes it. They are conceptual relations which give answer to questions like who?, why? and where? The answers to these questions allow lay people to understand and give social relevance to scientific knowledge.

As for the second question is related, discursive (definitions, contrasts between two terms, for example), lexical (uses of specific terminology together with proforms) and rhetorical (metaphors, for instance) strategies are required by lay people to talk about science. In relation with these strategies, the main difference with specialized discourse lies in the use of some type of discursive (like constrast) and lexical (like proforms) practices in popularizing science, that are strange in specialized context.

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KNOWLEDGE, DISCOURSE AND SCIENTIFIC COMMUNICATION

Teun A. van Dijk

Universitat Pompeu Fabra; Barcelona. Rambla 30, 08002 Barcelona. Tel: +34 93 542 2494, vandijk@discourse-in-society-org, www.discourse-in-society.org

Abstract

In this communication we present some fragments of a new, multidisciplinary theory of knowledge as certified shared beliefs of epistemic communities and a typology of knowledge and epistemic communities, including scientific communities and the public as a whole, as a basis for a multidisciplinary study of popularization discourse. Besides transformations between different types of

knowledge, popularization also involves recontextualization of knowledge from scientific to everyday knowledge. In a study conducted with Helena Calsamiglia, we analyzed press reports in Spanish newspaper *El País* about the presentation of the completion of the sequencing of the human genome and found that popularization not only features the usual discursive means of new knowledge introduction (such as definitions and metaphors), but also a limited set of fixed categories such as Location, Composition, Type, Size and Number, which link old with new knowledge. It is assumed that these categories are expressions of underlying schemas of knowledge representation.

Key words: Discourse analysis, popularization, knowledge.

Text

Aim

The theoretical aim of this paper is to propose some fragments of a new theory of knowledge and its relations with discourse structures as a basis for new developments in the study of science communication. Its empirical aim is to apply this theory in a study of the popularization discourse in the Spanish press about the international presentation of the first draft of the human genome.

Theoretical framework

The theoretical framework of this research project is multidisciplinary, and involves discourse analysis, cognitive psychology and epistemology and their integration with the study of science communication. Cognitive psychology in the last decades has shown that discourse production and comprehension requires vast amounts of knowledge (Van Dijk and Kintsch, 1983). But it does not provide a general theory nor a typology of knowledge needed to explain which kind of knowledge is needed by and for which language users, as is the case for the knowledge and discourse of scientists, specialized journalists and the public at large in science communication in the press. Similarly discourse studies of popularization have analyzed some textual structures used in these forms of scientific knowledge transformation and recontextualization, such as denominations, explanations, definitions, denominations and metaphors (Beacco, 1999; Calsamiglia, 2004). However, these studies have not been carried out on the basis of a cognitive psychology of text processing and within a broader theory of knowledge and its uses.

Against this multidisciplinary background, this paper proposes a new framework for the theory of the knowledge-discourse interface and its integration within a theory of science communication. Thus, unlike definitions in classical epistemology, knowledge is not defined in terms of "justified true beliefs" (Bernecker and Dretzke, 2000), but more pragmatically, discursively and socioculturally, namely as the shared beliefs of (epistemic) communities that are certified by the (epistemic) criteria of that community (for details, see Van Dijk, 2003). That is, knowledge is relative to communities, and maybe deemed 'mere belief' by other communities, or later by the same community. Besides such a socioculturally relative definition, it is also proposed that we need a typology of knowledge, distinguishing, e.g., between general vs. specific or abstract vs. concrete, various represented in episodic and semantic (social) memory. Since knowledge as defined here is social, it is also proposed to define different 'scopes' of knowledge, such as interpersonal, group, national and cultural. Crucial for the interface between knowledge and discourse is the general pragmatic strategy that the knowledge of a K-community is presupposed in the discourses within that community. For communication across community boundaries, special forms of communication and strategies of knowledge transformation are necessary, as is the case in popularization, i.e.,

between scholars, journalists and the public at large. These strategies are defined in the K-device of the episodic context models that regulate all discourse and communication and that subjectively construct the relevant aspects of the communicative situation.

The Study

In order to examine some of the empirical implications of the theory, a study was carried out with Helena Calsamiglia (Calsamiglia and Van Dijk, 2004), analyzing Spanish press accounts of the announcement of the sequencing of the human genome in June 2000. Forty-two articles were systematically discourse analyzed for their relations between scientific (community) knowledge and everyday commonsense knowledge, and how their structures were involved in such transformation and recontextualization.

Results

Apart from the usual findings in discourse analytical studies of popularization discourse, such as the use of definitions, descriptions, explanations, paraphrases or metaphors, most interesting for our theoretical framework was the systematic *categorical* way in which 'new' knowledge was discursively introduced by the journalists. Since new knowledge can only be established by links with 'old' knowledge, what happens is that these links are defined in terms of a rather limited *categorical schema*, involving such relationships as Composition, Type, Size, Number, Form, Color, Variation, Generalization, Comparison and Denomination, as in "*The gigantic DNA is composed of millions of small compounds called bases"*, which features the categories Composition, Number, Size and Denomination. Since these categories appear to be very generally used in definitions and explanations, and hence for the introduction of 'new' knowledge in general, we surmise that they might be part of the very schematic structures of knowledge representation.

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SCIENCE IN COURT. EXPERTS AND ADVISERS AS POST-ACADEMIC SCIENCE COMMUNICATORS

Licia Gambarelli[1,2]

[1] ICS, Innovations in Science Communication, International School for Advanced Studies (ISAS), via Beirut 4, 34014 Trieste (Italy). Tel.: +39 040 378711, fax:+39 040 3787528, gambalicia@libero.it

[2] Laboratorio Multimedia e divulgazione, Instituto Nazionale per la Fisica della Materia (INFM). Dipartimento di Fisica Università di Parma. Via delle Scienze 7/A, 43100 Parma (Italy). Tel.: +39 052 1906142, fax: +39 052 1905223, gambarelli@infm.it

Abstract
Scientific communication in court is particularly relevant for the understanding of the post-academic era of science. For this study twelve narrative interviews with experts, lawyers, judges and journalists were collected. The analysis revealed that they all communicate science in different ways and with different interlocutors, with varying expectations and results. Another peculiarity of scientific communication in the legal context is that there is a conflict of expectations between experts and jurists. While the expert's priority is the correct understanding and use of scientific truth, the legal party's priority is the acceptance or refusal of a scientific truth, to reconstruct the legal truth.

Key words: Science communication in court, forensic science, narrative interviews.

Text

In the modern era, when techno-scientific ideas and products are increasingly present in everyone's lives, conflicts stemming from the intersection of science, technology and law are one of the main fields of redefinition for modern societies (Tallachini, 2001).
Scientific truth and legal truth are being increasingly brought together to find effective solutions in legal proceedings (Josanoff, 1995; 2002).This research starts form the idea that in a multiple-centred system of science communication (Greco, 2002) scientific communication in court is particularly important for the understanding of the process of post-academic science communication (Ziman, 1998; Greco, 2002).
The problem of science communication in court is analogous to that of public science communication in general. Communicating science in court is often necessary for the carrying out of several legal proceedings, and sometimes for their solution. This kind of communication, however, faces specific problems due to the cultural, linguistic, methodological and epistemic difference between the legal and scientific parties of a proceeding. The court is thus a post-academic context of science communication, with special characteristics that can influence society, making a specific study of this context necessary.
This research aims at:

- Verifying whether and how the dynamics of science communication in court can be traced back to the problem of public science communication.
- Underlining specific characteristics of science communication in court.
- Proposing a sample of a "general table on science communication", to analyse every possible communication between the different parties of a legal proceeding.

A first attempt at finding an answer to these questions was field investigation.
Ethnographic research on communication (Matera, 2000) was used to explore the places where science and law cooperate; experts, judges, lawyers and journalists were interviewed to discover the opinion of the main operators in this context, where the relationship between science and society is continuously changing.

Methods

Twelve narrative interviews (Atkinson, 1998) were collected for research and divided into two groups: experts and non-experts (such as lawyers, judges, journalists, etc.).
The narrative method (Atkinson, 1998) is based on non-structured "open" interviews. The result of this kind of interview is not a set of specific answers to a series of questions, but a "story" guiding the interviewer to enter the "other" world, the one in which science and the law meet, focusing on the experts, judges and lawyers and their modes of communication (Matera, 2002).

The communicative events (Duranti, 1999) between the researcher and the interviewees was important to approach experiences and cultural contexts, the understanding of which would have otherwise been difficult. Narratives present mainly personal experiences that no data, questionnaire, or news could express (Bruner, 1990).

Analysis of the interviews and conclusions

The following points emerged from an analysis of the interviews:

1) An analogy between the public communication of science in court and the proposal of the *Venice model* (Greco, 2002) based on the assumption that in the post-academic era public communication of science follows more than one direction to reach different audiences in different ways, not necessarily bound to the scientific community. Experts communicate science in different ways and with different interlocutors. But they are not the only ones speaking of science in court: judges, lawyers, speak of science among themselves with different expectations and results, not depending on the expert's mediation.
2) An analogy of the above model allowed for the creation of a general table identifying every possible "bridge" of scientific communication in court and perceptions of scientific communication by forensic protagonists.
3) An identification of some peculiarities of scientific communication in the legal context emerged. First of all, the conflict of experts' and jurists' expectations in the legal proceeding. While the expert's priority is the correct understanding and use of scientific truth, the other legal parties have another starting point: the acceptance of a scientific truth, or its refusal, in order to reconstruct the "highest" truth in the legal context, that is the legal truth.

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THE SKY IN THE INDIGENOUS ORAL TRADITION IN THE RIO GRANDE DO NORTE STATE, BRAZIL

Luiz C. Jafelice,[1,2] Julie A. Cavignac,[3] Aucides B. Sales,[4] Neilton S.F. Lucena,[1] Walter Romero R.S. Jr,.[1] Antenor C. Araújo,[1]Eduardo A. O. Rocha,[1] Gilvana Benevides,[2] Almir F. Silva[1] and Laysa G.A. Jucá[3]

[1] Depto. Física, Rio Grande do Norte Federal University (UFRN), P.O. box: 1641, 59078-970 Natal, RN, Brazil. Tel.: 55 84 215 37 93- branch 214, fax: 55 84 215 37 91, jafelice@dfte.ufrn.br

[2] Programa Pós-Graduação Ensino Ciências Naturais e Matemática, UFRN.

[3] Depto. Antropologia, UFRN.

[4] Fundação José Augusto, Governo do Estado do Rio Grande do Norte.

Abstract

We develop an ethnoastronomical research with indigenous descendants from the Rio Grande do Norte State (RN), in the Northeast of Brazil. We discuss their knowledge about, and relationship with, sky objects and phenomena. We adopt the ethnographic method. Our objectives are: to contribute to rescue the identity of the RN indigenous population and to propose procedures to use a holistic anthropological approach for scientific education in multicultural communities. A preliminary conclusion is that among the remained indian descendants the affinity with celestial phenomena is greater and sensibly more present in their quotidian talks compared to the rest of the population.

Key words: Autochthon knowledge, holistic education.

Text

Introduction

We present here the first work on ethnoastronomy dealing specifically with indigenous descendants in RN [see Jafelice *et al.* (2004) for detailed comments].

Mostly because of historical discrimination and persecution, RN indian descendants have not been used to accept their ethnical ancestry. The last national population census, however, shows that the number of people in RN who declared themselves "indians" evolved from 394 (in 1991) to 3,168 (in 2000) (for a total RN population of around 2.5 million inhabitants). That quick "growth" in fact reflects a change of mentality concerning people recognition of their ascendancy.

The work of surveying the indigenous descendants in the RN, aiming for FUNAI (a governmental entity dedicated to deal with indigenous affairs in Brazil) to attend their claiming for their recognition and rights, was initiated by one of us (ABS) more than twenty years ago. Such an initiative has led to the identification of at least four or five groups of indigenous descendants in the RN. That work received important contribution in the last years from the researches of one of us (JAC). Recently that discussion has been greatly improved thanks to the 2002 Fraternity Campaign promoted by the Natal Archdiocese.

The works of one of us (LCJ) are devoted to develop a holistic anthropological approach to education. Because of lack of space, see Jafelice (2002) for further discussions.

Objectives

- To survey speeches and practices of RN indian descendants related to celestial phenomena.
- To develop pedagogical procedures for application in a holistic anthropological approach for teacher training and scientific education in multicultural communities.

Methods

For the anthropological research we adopt the ethnographic method (i.e., interviews, empirical observation, etc.).
For the research on education we propose a holistic anthropological approach, in which subjects like anthropology, psychology and folklore inspire objectives, contents and teaching methodologies throughout any teachers course.

Results

Because intense indian persecutions in RN for centuries we hardly found indians who do recognize themselves as so. Contrary to first expectations, however, several basic aspects of pre-Colombian cultural habits seem to have resisted pressure and time.
We noticed that vivid local knowledge are still present today. They can be identified from procedures to find water resources and make weather prediction to autochthon expertises, like: obtaining adequate antidotes to endemic poisonous animals; taking advantage of local fauna and flora in order to prepare medicines, etc. (Cavignac 2004).
Most of those procedures are naturally connected to sky matters by those adopting them, like: the time to cross chickens and cocks according to the moon's phase; the measure of the night time by a given star, or the year's epoch by a given constellation, which usually are none of the traditional western constellations; etc.
Those and many other examples reveals knowledge used until today, which could not have been brought from Europe or Africa because of the unambiguous local character of their contents. This research indicates that in many important aspects for daily life in that region, the acculturation process seems to have had a much stronger influence from indigenous cultures onto the European culture than was usually assumed.
From the total of 201 people we interviewed from many places in the RN, 190 declared to be non-indians, and 11 clearly accept their indigenous ascendancy. From those, 71% of non-indians, and 82% of indians know about astronomy related issues and apply that knowledge in their daily life.
We conclude that within indian descendants the affinity with celestial phenomena is greater and sensibly more present in their quotidian talks compared to the rest of the population. Moreover, and perhaps with more profound implications, we notice that also for non-indians there is a relatively great affinity and inclusion of celestial phenomena in their daily lives.

Conclusions

As expected, such a greater indigenous influence involves knowledge which are more evident in areas where environmental and local autochthon wisdom could make the difference for survival, and require many centuries of human occupation in that region to be acquired.
Further researches will evaluate to what extent such a difference on knowledge and behaviour between indians and non-indians is evident for other cultural aspects and is exclusive of RN.

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RADIOSCOPY OF THE PSYCHIATRIC SPEECH

Anne-Laurence Margérard

Ecole Doctorale Management Information Finances. Université Jean Moulin Lyon III, 1, rue de l'Université, 69007 Lyon (France). Laboratoire ERSICOM, Université Jean Moulin Lyon III, 6, cours Albert Thomas, 69008 Lyon (France). margerard@voila.fr

Abstract
Wimmer, in 1982, endeavoured to distinguish common language and language of speciality but the medical speech can common, be specialized if not both at the same time. The fact that a psychiatrist, in the exercise of his practice, address himself to various types of interlocutors, the fellow-members, the patients, the associations of patients*, it is led to adopt several types of speech. In a context external with the medical field, the informative speech, is centered on popularization thus simplified.
Thus, how to define "the medical speech clearly"? How to highlight the intention to communicate of a psychiatrist through written text of popularization? This work proposes to define the typology of the medical sociolect in the psychiatrists within the framework of popularization. By analyses of writings with intention to popularize, we show that the medical sociolect is not built according to a scientific terminology which dictates the bases of the medical terminology. It evolves, it is unstable and cannot escape from the influence from its successive users.

* Regrouping of patients and family of patients around the same cause, like the fight against the same disease, generally formalized under the aegis of an association.

Key words: Sociolect medical, psychiatrist, scientific terminology, popularisation.

Text

Introduction

The popularization of psychiatry as object of research

The popularization of psychiatry, which falls under medical popularization itself overlapping in the scientific popularization, so quite widespread today, is paradoxically not studied. Often regarded as simplified lacunar, approximate information, popularization in psychiatry settles as well as the scientific paper in the polemic which opposes the erudite knowledge to the profane knowledge. It becomes, in this context, a particularly sensitive study object.
The nearly simultaneous publication of two books in 2003 and of acts of a centenary congress make it possible to develop a comparative analysis of this same type of communication through two speeches, into psychiatric speciality and for public.

Need or required?

We distinguish already three types from the psychiatric speech : that of the psychiatrist, that of the patient, and that of the media and mediators. We will be interested here in the speech of the psychiatrist only. We base ourselves on the classification of Regent (1992) evoked by Christian Balliu (2001) and distinguish three types of psychiatric speech:

- The esoteric intern speech, i.e. inherent with the microdomain, allowing the exchange and the discussion of information his even of the specialisation.
- The esoteric external speech, which leaves the microdomain (general practitioners or doctors of other specialities). This speech will not be treated here.
- The exoteric speech, primarily aiming at informing in a simple, clear way and concretes a public external with the psychiatric activity (patients, association of patients), but necessarily in contact with the latter by consultations, treatments or of a legitimate will of information.

Esoteric intern speech

The approach of the psychiatrist is informed methodically with tools and references explicit, adapted and verifiable. It is before a whole theoretical approach, methodological, or practical which to check a theory, develops a method, analyzes the operation of a phenomenon while making it comprehensible using intellectual diagrams of reference. The psychiatrist announces his theoretical and conceptual referents. The reproducibility of the comprehension of the "operation" of the phenomenon is an indisputable requirement of the scientificity. A "scientific" approach thus refers primarily to a scientific theory and concepts. The theory was elaborate starting from experimentation, of assumptions formulated and validation/invalidation of these assumptions on the phenomena.

The esoteric intern speech is built on statements in fact IE "any assertion which can be confirmed or refuted by the examination of evidence provided by the directions or their technological prolongation" (Stern, 1979) – example of a statement in fact: "Since 1953, the teenagers suicide increased by 300%". It is an assertion in connection with what is. That includes information which is true, those which are false and those whose truth or falseness is unspecified.

The esoteric intern speech results from an explanatory, persuasive and strategic language. Indeed, according to Balliu (2001), "a specialized text must, for reasons of syntactic and semantic articulation, to resort to a lexical and stylistic stock whose function is as well descriptive as explanatory and conjunctive".

A medical text comprises many terms of speciality but also good number of words borrowed from the usual vocabulary which taken, independently, does not predispose to think that one is in the presence of a medical text, of speciality which more is.

Esocteric extern speech

First of all, the psychiatric speech of popularization differs from a "narratologic" step or "esthetics" in that that the psychiatrist cannot be satisfied simply to bring back phenomena or to subject its own feelings to us. For a communication bound for large public, the step rests on the principle that the reader inevitably does not have at his disposal knowledge necessary, Mucchielli (2000) talks about "intellectual equipment sufficient for a comprehension which exceeds the comprehension of the vulgum pecus". The exoteric speech, simple, informative, abounds in normative statements i.e. an assertion in which one evaluates or one prescribes –example of normative statement: "the divorce is a painful experiment". It is an assertion in connection with what should be. Such an assertion cannot be shown nor refuted by the examination of significant evidence because it connects an object and a value, ie a personal judgement. The following statements are normative statements. They are subjected to a regulation or value judgment.

Opposition common language / language of speciality
Several authors dissociate common language and language of speciality. According to Wimmer (1982), here how are distinguished scientific language and from speciality and common language:

Scientific language and of speciality	Common language
Precision	Indetermination
Univocity	Ambiguity
Economy	Redundancy
Situational invariance	Situational multiplicity
Report with the matter / the object	Multiplicity set of themes/evaluation
Theoretical level	Everyday life

With this inventory the opposition of Kocourek (1982) is added:

Objectivity	Subjectivity

"It [the language of speciality] aims at the ideal of intellectualization, i.e. the semantic precision, conceptual systematization, emotive neutrality, the formal and semantic economy; it thus tends [...] to neutralize or contain emotivity, subjectivity" (Kocourek, 1982).

Conclusion

The speech of the psychiatrist intrinsically to his field of specialization makes the use of the common language, the objective being for him to make itself comprehensible by its pars, a contrary when it intends to popularise, it does not hesitate to balance the speech of key concepts by the use of complex terms loans to the scientific semantic field of psychiatry. Thus, the distinction between language of speciality and language common, if expensive to several authors, can then be regarded only as one Utopia "the biunivocity, dreams of any terminologist, remains a pious wish which will never be" (Balliu, 2001).

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COSMOEDUCATION: THE EMERGING ALLIANCE OF ASTRONOMY TEACHING AND TRANSPERSONAL PSYCHOLOGY

Luziânia Medeiros[1] and Luiz Carlos Jafelice[1,2]

[1] Graduate Program on Natural Sciences and Mathematics Teaching,Rio Grande do Norte Federal University (UFRN). Rua Presbítero Porfírio Gomes Silva 1753 Capim Macio 59082-420 Natal-RN Brazil. Tel./fax: 55 84 6423081, luzianiamedeiros@yahoo.com

[2] Physics Department, UFRN, P.O. Box: 1641, 59078-970 Natal, RN, Brazil.
Tel.: 55 84 215 37 93 - branch 214, fax: 55 84 215 37 91, jafelice@dfte.ufrn.br

Abstract

In this work we are exploring the interface between astronomy teaching and transpersonal psychology in the educational context. Our working hypothesis is that astronomy contents, when correlated with transpersonal psychology practices, can be used as a cultural and academic vehicle to develop a cosmic identity. Our research universe was a group of students attending the Astronomy discipline in an undergraduate Geography course. We use the phenomenological method and applied active observation, interviews and psychotherapeutic practices. The results indicate that the subjective experience involving astronomical phenomena allows students to relate their inner and outer world and to expand their environmental perception.

Key words: Education, environment; ethics.

Text

Introduction

Nowadays, although current space research has advanced with no precedents in the history of science, the majority of the people have no contact with the sky. It reflects the fragmentation crisis of modern life in different levels.

In science education the present crack between scientific knowledge and human experience in the western culture exposes such a crisis. Since humans started to understand reality from a Cartesian perspective, the Universe was perceived as a collection of objects separated from one another. The capitalism has reinforced this view and day-by-day we run away from ourselves.

According to Vajpeyi (1995), “the purpose of any education is somehow to return an individual to himself or herself and to enable him or her to see where she/he is placed in the system of relationships which constitutes life”. At this crucial point, however, is where the current educational system has failed.
Cosmoeducation aims to be a practical approach that would awake our ecological and cosmic awareness in order to rescue a holistic relationship between humans and cosmos. This concept is based on transpersonal psychology that studies the human being in its wholeness. This science can be defined as the scientific study of consciousness states especially the cosmic consciousness (Matos, 1991).
As stated in PCN (1999), through astronomy students are incited to understand the Universe and to project themselves to the great dimensions of space and time. Transcending the Earth limits they may achieve an amplified perspective about their existence in the cosmos.
We consider astronomy a privileged entrance way into the human-cosmos dialogue for any culture, in particular the western one. Our working hypothesis is that astronomy contents when correlated with transpersonal psychology practices can be used as a cultural and academic vehicle to develop a cosmic identity in our students.

Practices

During a semester, a group of students, enrolled in the Astronomy class of an undergraduate UFRN Geography course, attended to a series of meetings to experience psychotherapeutic techniques that were correlated with astronomical issues and adapted to that situation.
For instance, one practice was the “body expression of lunar eclipse”. First, the students had a warm up to render sensitive their sensory perception. Then, they followed the command of finding a comfortable place to stay and pay attention to their breathing. Following, students were asked to pay attention to emergent images and sensations that would come to them as a consequence of the words the instructor was going to say. They were asked also to express those emerging inner experiences through both sound and body movement. After that the instructor suddenly mentioned the words “lunar eclipse”. Afterwards they should occupy that space expressively and interacting with others to accomplish a collective composition.
According to their speeches during the afterward discussion we could infer that this practice stimulate the spontaneous emergence of archetypical elements from the collective unconciousness in many of them and led the group to a better connection between inner and outer worlds.
Another example was the “representation of the Universe’s origin through a mandala”. It was proposed to the group to meditate about the images that come to their minds when listening the (then unexpected) words “Universe’s Origin”. As a next command the instructor asked them to represent such images by a free drawing called mandala (a centred symmetrical drawing usually found in oriental meditative practices and used in psychoterapy to express psychic contents). From that it was suggested to each one to look at her/his own drawing deeply and to penetrate into the figure as if it was a three-dimensional space.
We noticed that this exercise favoured the experience of an expanded state of mind to the majority and evocked deep reflections about the relationship between microcosmos and macrocosmos.

Final Comments

At the end of semester we could observe that the techniques used revealed to be an efficient tool to awake a cosmic consciousness in our students. In addition, the results reinforced the idea of astronomy teaching correlated with those practices as a valuable entrance to a cosmos and human existencial relationship. (See Medeiros and Jafelice, 2004, for further comments).

In the future we intend to apply this methodology of cosmoeducation in a course for primary school teachers dealing with 6 to 11 year old children. They are supposed to teach reading, writing, mathematics, language, science, and particularly traditional astronomy, all in an integrated way.

Finally, this is a proposal for the future in order to create alternatives for our students to expand their perception about the environment they live. From that we hope they start to build a new ethic body that could guide sustainable communities.

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Parallel session 29

Is there a real social participation in GMO discussion?

HOW PRESS COVERAGE ON TRANSGENIC FOOD HAS EVOLVED IN COLOMBIA?

Mara Brugés Polo

President, Colombian Association of Science Journalism, ACPC. Cra. 7 No. 69-05, Bogotá (Colombia).
Tel.: (57-1) 3102911, fax: (57-1) 3104988, mara_bruges@yahoo.com

Key words: Genetically Modified Organisms, media, public perception.

Text

Transgenics have been controversial throughout the world, and Colombia is not the exception. This year, for the first time, the Colombian government approved Monsanto's BT cotton and it has been a red-hot issue in the national and regional press. The media, through editorialists, columnists and journalists, has taken on the task of informing, and sometimes misinforming, the public.

The approval of the BT cotton crop has managed to change the journalistic speech and the speech of government sources. The print media, that was indifferent to these matters, now publishes related articles; others who had positions against plant biotechnology now tend to be neutral on the subject. Although opinions and columns harshly questioning the benefits of genetically modified organisms, GMO, are still being published, the media is now more cautious than it was 5 years ago when transgenics were recorded by the Colombian media for the first time in 1999, on occasion of the Biosafety Summit held in Cartagena de Indias.

An analysis of the media coverage since then up to the present day, allows us to confirm that the Colombian press coverage of transgenic food has evolved positively for those who endorse these new technologies.

We found that the articles analyzed were written mostly by science journalists, editorialists and columnists, each one in their own journalistic style, but, what about social responsibility? The journalist must try to find the truth, show the public the different angles of the news; explain the controversy and provide arguments, so the public can take a stand on this issue. Editorialists and columnists must act based on knowledge, recognize the power of the pen and be aware that their comments affect the public opinion. However, in 1999, we found comments like this, from an editorialist opining on biotechnology: "a genetically modified product: a monster that nature by itself would never produce...".
With the objective of analyzing the print media's stand on this issue, we reviewed information published by 26 national and regional circulation newspapers in Colombia. We defined three analysis categories, as follows:

1. PRO articles: those that show a positive angle of the news, from a single source.
2. NEUTRAL articles: those that examine different angles of the news, from several sources.
3. CON articles: those based on a single source against GMO's.

These same categories were applied to columnists and journalists to define their stand on the issue.
How does the transgenic issue should be covered? Although there are many ways to do science journalism, we established that a good article must have: journalistc rigor, suitable sources, different angles of the news, plain language and responsibility.
Considering all the above, we established the evolution of the news coverage on GMO's from the point of view of reporters, sources, the media and the public.
We concluded that in 1999, with the Biosafety Summit, the media was characterized by its immediacy, aggressive headlines, unbalanced visual resources and the importance of the subject, which made front page news.
We found front page information with no further follow-up, as the newspaper did not have the complete news story. This is the case of a ship supposedly loaded with transgenic corn from the United States, arriving in Santa Marta. The news was published as a front page headline with a one-fourth page photo, but no further information.
Headlines such as "*Terminato*r protocol to be signed…", "*Frankenstein* Food…" and "Genetic curse", are samples of the aggressiveness with which the media published the information.
News reporters did not research the issue and arrived in Cartagena without a clear understanding of the Summit dimension and the implications of what was to be defined there. As days passed, the quality of the news articles improved, as news reporters steeped themselves in the subject.
Although reporters made efforts to keep the public informed, journalistic flaws were exposed with the publication of inaccurate data, influence on the part of the sources and lack of follow-up to the news generated.
GMO's were new to the sources, so, some were emotionally passionate about it and others preferred not to talk about it. Greenpeace took advantage of the Public Officials' lack of knowledge and organized a protest in Cartagena to grab the media's attention.
By the end of the Biosafety Summit, the public was left confused. The public's perception on the subject was based more on the headlines than on contextualized information.
In 2001, no notable coverage event occurred. There were no scandals about transgenics, but the subject was discussed in the media, considering social, political and economic

aspects. The issue didn't make front page, but editorials and opinions were published that have influenced the public opinion.
Columnists, in some cases, explained better the scope of plant biotechnology than the journalists who wrote the articles. The difference was the colloquial language used to talk about transgenics. This situation showed the need for training writers in the handling of these matters: So, the Colombian Association of Science Journalism, with the support of Colciencias and AgroBio, carried out regional science journalism workshops aimed at students and journalists.
Sources consulted, including government representatives, private businesses, scientists, etc., are now more knowledgeable, as compared to 1999.
This time, the public took part in the debate through letters that were published by the media. This is a good indicator of the audience's interest in biotechnology issues.
2003 was a key year for biotechnology. The Colombian Ministry of Agriculture approved the sowing of BT cotton in the Cordoba Province and included transgenics in the government plan as an alternative to save the agricultural sector. This brought press coverage from the approval of this initiative to the first cotton harvest.
Journalists, now more familiar with the subject, decided to rely more on government officials to write their articles. The economic aspect is evident. The reports are now more comprehensive and contextualized than they were in 1999. The journalistic speech is more neutral and the sources consulted are more in favor of biotechnology. In other cases, some personalities who oppose GMO's, are the same who always appear in the articles to balance the information, as it is the case with Germán Vélez, of the "Grupo Semilla".
In conclusion, transgenics will continue to be present in the Colombian and international press for a long time. For this reason, it is necessary to conduct coverage studies for specific cases to give the journalistic community the tools to judge their rights and wrongs in relation to the information delivered to the public. It is important to have qualified journalists to cover this subject with responsibility and journalistic rigor.

THE DEMOCRATISATION OF A "SCIENTIFIC' DECISION": THE "GM NATION?" EXPERIMENT IN THE UK

Matthew Harvey

Centre for Knowledge Expertise and Science, School of Social Sciences, Cardiff University, Glamorgan Building, King Edward VII Avenue, Cardiff, CF10 3WT. Tel.: +44 029 20876217, harveym4@cardiff.ac.uk

Abstract

This paper takes a critical approach to public participation in technological decision-making. I argue for the separate and concurrent consideration of technical and politico-ethical domains. The "GM Nation?" public debate conducted across the UK in 2003 failed to increase powerful public participation because the policy under scrutiny –the commercialisation of GM crops– could only be determined by science, technocratically. This effectively marginalized alternative citizen framings or understandings of the issue. Observations from 11 GM debates however showed that the majority were adversarial and participants mostly debated propositional and technical matters; but the technical sophistication of citizens was not sophisticated and experts often outmanoeuvred them. It is better that citizens are involved in political and ethical judgement for which they have genuine expertise, whilst technical aspects of a decision are best left to those with certified or experiential expertise. However, unlike regulations as they stand, this technical evaluation should feed into the broader political decision, not be it.

Key words: Expertise, public participation, GM.

Text

Context and argument

This paper concerns expertise, public participation in real-life decision-making, and the problem of extension (Collins and Evans, 2002). The problem of extension refers to determining that point at which participation in technological decision-making can be increased without "expertise" in itself losing it's meaning. The problem arises because of the desire to increase public participation in decisions that would previously have been considered merely technical and for experts. For example various actors and institutions have been pressing for public participation in the case of biotechnologies, including and particularly genetic modification (GM). The call is for a shift in the established and 'natural' policy and decision-making mode, which in the UK has been based on a technocratic rationality. According to the critique, this technical frame effectively disempowers the public from democratic participation. It is easy to see why: Framing is concerned with defining GM as, in the first instance, a certain type of issue or problem. The right to determine problem definition can result in power, particularly when there are associated policy-making issues, for it entails the terms of reference for that policy. This means determining what questions need to be asked, what form answers would take, and consequently, who holds legitimate contributory knowledge in the decision making process. If the public can be shown to be scientifically and technically unsophisticated or ignorant, then this reflects a deficiency in their democratic capability.

With a concern for democratic principles, that all voices should be heard, and to redress the balance of power more toward "citizens", social scientists have called for a restructuring of policy making to consider symmetrically, or even primarily, alternative citizen understandings or frames based on the assumption that there is incongruence between citizen frames and those deployed by those in positions of power. This would allow for increased participation in policy-making. "GM Nation? The Public Debate" (GMN), held across the UK in the summer of 2003, was marketed with just these principles in mind: it would be a genuine example of public participation in a policy decision, widely interpreted to be about, more specifically, the possible commercialisation of GM crops. However I wish to show that the context and conduct of the debate meant that it was science that was being democratised: only science mattered for policy, and it was mostly science that the public debated. I then develop a position in support of the concurrent consideration of two separable categories of problem definition –technical and politico-ethical– toward building a more critical approach to public participation.

Public participation in a technocracy

The legal structures governing genetically modified organisms (GMO's) in place at the time of GMN had two consequences. First, the space for the UK Government to determine policy on GM crops is formally limited, and in turn, so is the space for public participation. Secondly, the EU legal structure literally defines the problem GM, strictly determining the frame from within which decisions are made. This is how: Under EU Directive 2001/18/EC, GMO's are treated as a "product", defined as a preparation consisting of, or containing, a GMO or a combination of GMO's placed on the market (e.g. as a food or crop). As such, consent for release is determined *only* by a technical risk assessment of the risks to human health and the environment. In this way the political, ethical and the technical are *fused*: the political was the technical and vice versa, effectively excluding alternative framings or understandings of the issue. This legal structure clearly had implications for GMN as a proper participatory exercise.

In the early formulations of GMN, Government committed itself to taking public opinion, expressed through the debate, into consideration in formulating policy on GM crops. A dilemma lay however in offering this commitment whilst at the same time satisfying EU law. Established consent procedures meant that public opinion could not in fact influence a decision either way except, in principle, as it pertained to the technical assessment of specific foods and crops. But could science be so democratised? Recognising the dilemma, the government later attempted to distance the public debate from decisions over crop commercialisation. Despite this shift, the debate still centred on that singular issue. At any rate, Government both before and after the debate constructed the problem GM as only a scientific matter. For example, Prime Minister Tony Blair stated that "this Government's approach is to make decisions on GM crops on the basis of sound science",[1] and in the face of public opposition, in March this year the Government risk assessed and passed a GM maize. Again, framing the problem GM as merely a technical matter with a decision to be based on scientific grounds marginalised the public, both in terms of their capacity to participate and the grounds on which GM could be powerfully challenged.

Public GM debates

However, GM is contested in part because there is disagreement over the correct problem definition, and previous research suggests that the public construct additional politico-ethical framings for the problem GM. I attended 11 GM meetings to find out what was discussed. Generally, technical and politico-ethical matters were *confounded*. Table 1 below summarises the frames deployed across 8 meetings for which I have complete transcript data. The first thing to note is that there was a range of frames deployed. However, the frequency column shows that whilst there was a *wider range* of politico-ethical based frames deployed, the most *frequently used* frames were technically based, particularly concerning GM as *risk*. The majority of meetings I attended were adversarial and the public, as far as they were represented at these meetings, frequently argued over propositional and technical matters. This suggests that science was being democratised in a second sense: participants at these debates spent much of the time contending and defending evaluations of technical questions.

Public participation and expertise

But analysis of the technical reasoning of participants reveals limitations. For example, it was common to particularise the *technique* of genetic modification and then consider the *products* (foods, crops) as an undifferentiated category. Any claims of risk were therefore attributed to the whole class without a technical appreciation of for example, contextual factors, that different crops breed differently, or that some food products contain no transgenic material. Another common claim was that the technique is unnatural and that therefore it will lead to new risks and hazards. More rarely it was argued that the products are natural and therefore safe. Of course, it is not the naturalness of a crop, food or technique that determines if it is a risk. Categorisation of products and particularisation of the technique leads to powerful political arguments but not especially sophisticated technical one's. For instance, the precautionary principle is a powerful political tool. But it was sometimes claimed that it must be imposed until proof is provided that products are safe. We should not be surprised at this deficit, but it meant that the few technical experts often out manoeuvred other participants. It is of course the case that there are people with no

Table 1 Frames deployed at GM meetings

Frame	Frame type	Total frequency of frame deployment across meetings (*n* = 8)
Risk	Technical	39
Capitalism	Politico-ethical	19
Benefits	Technical	17
Technology	Technical & politico-ethical	17
Developing world	Politico-ethical & technical	15
Choice	Technical & politico-ethical	13
Futures	Politico-ethical & technical	8
Debate	Meta discursive	7
Science as politics	Politico-ethical	5
Legal	Politico-ethical & technical	4
Co-existence	Technical & politico-ethical	4
Uncertainty	Technical	3
Management	Technical & politico-ethical	2
Trust	Politico-ethical	2
Regulations	Politico-ethical	2
Pure ethics	Politico-ethical	2
Interests	Politico-ethical	1

The left-hand column of this table shows the range of ways that the problem GM was defined (i.e. framed) across 11 public GM meetings. The right hand column shows the frequency with which these frames were deployed at 8. The central column shows whether that frame concerned almost exclusively ('technical') or mostly ('technical & politico-ethical') propositional and technical questions/domains, or whether that frame concerned exclusively ('politico-ethical') or mostly ('politico-ethical & technical') political and ethical questions/domains.

formal scientific certification with much expertise to offer in the case of GM, and some GMN participants had much knowledge and expertise. Consequently, as Collins and Evans (2002) argue, there are no publics, just groups of people with different levels of expertise relative to a domain or question. In matters such as the commercialisation of GM crops, there clearly are propositional questions that in principle call for empirical investigation and scientific evaluation. Appeal to deep democracy does not talk these questions away. But there are political and ethical questions too. The public would be better served if the grounds on which they are being invited to participate were made clear. It is better that the public is involved in political and ethical judgement for which they have genuine expertise, whilst technical aspects of a decision are best left to those with certified or experiential expertise. However, unlike regulations as they stand, this technical evaluation should feed into the broader political decision, not be it. The extent to which the *final* decision should be handed to the public depends on one's favoured version of democracy, and getting the public to trust technical experts is of course a different matter.

Notes

[1] Prime Ministers Correspondence, 10/11/2003. Available to view at: http://www.parliament.the-stationery-office.co.uk/pa/cm200203/cmhansrd/cm031110/text/31110w04.htm#31110w04.html_sbhd1 (Last accessed: 07/05/04.)

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SCIENTIFIC CITIZENSHIP: DANISH CITIZENS AND BIOTECHNOLOGY

Niels Mejlgaard[1]

[1]The Danish Centre for Studies in Research and Research Policy. University of Aarhus, Finlandsgade 4, DK 8200 Aarhus N. Tel.: +45 89422389, fax: +45 89422399, nm@cfa.au.dk

Abstract

An emerging paradigm of dialogue and participation in Danish S&T policy provides new arenas for public participation in decision making processes concerning biotechnology. Based on survey data this study examines indicators of both spectator and participatory scientific citizenship. While indicators of spectator scientific citizenship show that Danish citizens increasingly acknowledge the importance of biotechnology *for* their lives, the indicators of participatory scientific citizenship reveal a decreasing inclination to make biotechnology an element of importance *in* the daily lives of Danish citizens. In order to meet their democratic potential, the new arenas for public participation must be further cultivated.

Key words: Citizen participation.

Text

Context

Recently, within the Danish political discourse on science-society integration, the "paradigm of science dissemination", which has emphasized the need for one-way transmission of knowledge from the world of science, to the passive lay citizen, has found company in an emerging "paradigm of dialogue and participation", not least concerning the integration of new genetic technologies in economic and social systems. The Danish Board of Technology has been the primary engine in ensuring direct public participation in S&T assessment and actual face-to-face dialogue between scientists, industrialists, policymakers, and citizens. BioTik, the Danish action plan for biotechnology and ethics, has institutionalized public consultation as a guiding principle, and offers a web-based arena for public debate. NGO participation in long-term strategic S&T prioritization and The Danish Council of Ethics' efforts to support public meetings concerning ethical problems in biotechnology has also contributed to creating arenas for public involvement in biotech policy and debate.

These emerging arenas of participation offer a framework for democratic renewal. The science dissemination paradigm corresponds with the notion "spectator democracy", in which "..citizens are superficially *interested* in politics –as citizens they want to know what happens– but not by any means *engaged* in politics... Politics is perceived to play a role *for* their lives but it does not play much of a role *in* their lives" (Andersen and Torpe,

2000, p. 5). This notion of spectator democracy is opposed by the notion of "participatory democracy", which emphasizes citizen's *engagement* in politics – political consumption, participation in grass root activities or demonstrations, involvement in public debate, etc. Participatory democracy stresses the importance of full citizenship in terms of both political and social *rights* and a republican ideal of civicness as a sense of societal obligation or *duty,* in which participation is a *virtue* (Barber, 1984). Participatory citizenship is not simply about enjoying the right to enter the sphere of politics, but rather about actually entering it. The emerging paradigm of dialogue and participation in Danish S&T policy potentially enhance a democratic development towards participatory citizenship.

Objective and methods

Applying quantitative survey-based data on the public understanding of biotechnology in Denmark, indicators of what could be termed "spectator" and "participatory" scientific citizenship are examined.[1] Indicators of spectator scientific citizenship include general interest in S&T, awareness of biotechnology, and factual knowledge of biotechnology. These indicators concern the passive appropriation of genetic technologies as an issue of importance *for* everyday life. Indicators of participatory scientific citizenship include engaging in discussions with family and friends about biotechnology, the inclination to engage in public debates / hearings concerning biotechnology, and the inclination to seek information by reading articles or watching programmes on the advantages and disadvantages of developments in biotechnology. These indicators concern the active appropriation of genetic technologies as an issue of importance in everyday life. Combining various surveys allows for examining the indicators over time.

Results

Over the last years, interest in S&T, awareness of biotechnology, and factual knowledge of biotechnology in Denmark has increased. The share of citizens that report interest in S&T has significantly increased from 57% in 1997 to 75% in 2000. From 1997 to 2000 the awareness of biotechnology, measured as unprovoked mentioning of biotechnology when describing associations to S&T, increased from 11% to 25%. Similarly, the mean score on a 0-9 scale biotech knowledge index rose from 5.78 in 1996 to 5.87 in 1999 and has recently been measured at 5.98 in 2002. These figures suggest that Danes increasingly consider biotechnology relevant for their lives.

Yet, the fact that Danish citizens have a relatively subtle insight in biotechnology, which is also observed in cross-country comparisons, does not necessarily imply that scientific citizenship is in accordance with its democratic potential. Citizens recognize and appreciate the importance of biotechnology *for* their lives, but the indicators for participatory scientific citizenship seem to tell a somewhat different story. The share of respondents, who report having engaged in discussion about biotechnology prior to the interview decreased from 53% in 1996 to 50% in 2002. Citizens were also less inclined to engage in public debates or hearing in 2002 (44%) compared to 1999 (53%). Finally, making a dedicated effort to read an article or watch a programme, in order to better grasp advantages and disadvantages of developments in biotechnology seemed less attractive in 2002 (77%) than in 1999 (83%). The active appropriation of biotechnology, in which biotechnology figures as an element of importance *in* the daily lives of citizens is thus modestly declining.

Conclusions

In Denmark, new arenas for public participation in decision making processes concerning biotechnology offer a democratic development towards participatory scientific citizenship. Yet, survey results indicate that while Danish citizens tend to be increasingly aware of biotechnology from a spectator position, the level of active engagement is modestly decreasing. In order to strengthen the level of inclusion and ensure that scientific citizenship meets the promises it holds, the new arenas of public participation must be further cultivated.

Notes

[1] Eurobarometers 46.1, 52.1, 58.0 and two Danish studies (1997 and 2000) are applied. It should be observed that the reported results cover disparate time spans due to changing items in the surveys.

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INCOMMENSURATE RISKS: DEBATES CONCERNING GENETIC MODIFICATION AND CULTURAL TRANSGRESSION AMONG NEW ZEALAND MAORI

Mere Roberts,[1] Richard Benton,[2] Terre Satterfield[3] and Nena Benton[4]

[1] Faculty of Science, Te Whare Wänanga o Awanuiärangi, Private Bag, Whakatane, New Zealand. Tel.: +64 27 227 9831, fax: +64 7 307 1475, mere.roberts@wananga.ac.nz

[2] Te Mätähauariki Institute, University of Waikato, Private Bag 3105, Hamilton, New Zealand. Tel.: +64 7 838 4879, fax: +64 7 858 5032, r.benton@waikato.ac.nz

[3] Institute for Resources, Environment and Sustainability, University of British Columbia, Vancouver, Canada. Tel: +1-604-822-2333, Fax: +1-604-822-9250, E-mail: satterfd@interchange.ubc.ca

[4] Alta Vista Pacifica Ltd., P.O. Box 33, Ngaruawahia, New Zealand. Tel: +64 7 824 8045, fax: +64 7 824 8025, nena.benton@altavista.maori.nz

Abstract

Growing public anxiety about the development of genetically modified organisms (GMOs), prompted the New Zealand Government's year 2000 Royal Commission enquiry into Genetic Modification. The Commission noted overwhelming public rejection of GM, including multiple concerns specific to Mäori. Maori concerns carry legislative weight because several Acts of Parliament, including that which governs GMOs, require that the views of Maori be considered. This paper draws on primary and secondary sources to identify key values perceived by Maori as important in assessing the effects of GMO's on their culture and traditions, and focuses on the concept of *mauri* (life force or essence).

Key words: Mauri, risk, culture.

Text

Context

In 2000, the NZ Government ordered a Royal Commission of enquiry into GM, in response to growing public anxiety about research intended to lead to the development of genetically modified organisms (GMOs), and especially the production and release of GM

food crops into a currently GMO –free environment. The Commission found that the public in general, including New Zealand's indigenous (Maori) people, overwhelmingly rejected this form of biotechnology. Maori concerns carry legislative weight because several Acts of Parliament, including the Hazardous Substances and New Organisms Act 1996 (HSNO), which governs all GMO activities in New Zealand, require that the views of Maori to be taken into consideration.

Objectives

This paper identifies key values perceived by Maori as important in any consideration of the potential effects of GMO's on their culture and traditions.

Methods

Individual and focus group interviews with Maori were conducted in 2001-2002. Transcripts were analysed, then subjected to further discussion by a team of experts. All Mäori submissions to the Royal Commission were also examined, along with Mäori submissions to the Environmental Risk Management Authority (ERMA) and other contemporary and archival material pertaining to Mäori values.

Results

Three concepts were particularly prominent across the various sets of submissions and discussions: *mauri* (life force or essence), *kaitiakitanga* (guardianship) and *whakapapa* (inherited genealogy). Underpinning these was the view that genetic modification was a process demanding the exercise of great caution. Many Maori voiced concerns about the potential for GMOs to impact adversely on the *mauri* and *whakapapa* of the organisms involved, including humans who might eat products with GM components. This paper will focus on the concept of *mauri* in relation to genetic modification.

Mauri is a central notion in Mäori philosophy, derived from the Proto-Austronesian term *hudip "to live", and acquiring in Mäori the sense of "the essence which gives a thing its specific natural character" (Metge, 1976, p. 57). The word refers both to the life principle or essential quality of a being or entity, and a physical object in which this essence has been located. In this context "being" and "entity" comprise all observable phenomena: individual beings, objects and events (including, for example, a speaker, their speech, and the platform they are standing on) have a *mauri*, and, importantly, ecosystems and social groupings. In classical Mäori thought, the *mauri* was linked to the vitality, or *hau*, of a being, bound closely and inseparably to individual human beings, but having a collective significance parallelling *mauri* in relation to the forest and other phenomena (cf. Gathercole, 1978; Best, 1978).

While references to *hau* were comparatively sparse, the notion of *mauri* was frequently raised across all fora, and also in submissions by Mäori to the Environmental Risk Management Authority. Many felt strongly that the transfer of genetic material between organisms, especially the mixture of human and animal genetic material, would have adverse consequences, disrupting the natural order of things, and affecting negatively the *mauri* of ecosystems, the animal world, and humanity. For example, the Ngati Wairere tribe, who objected to an application to insert a human gene into a cow, asserted that this affront to the mauri of both donor and recipient organisms would result in physical and psychological ill health for all concerned including Ngati Wairere on whose land the research took place.

Even cultural experts who held that addition or removal of genes did not affect the *mauri* of a particular organism had very strong concern for maintaining the integrity of the natural world, and a parallel certainty that serious disruption to this would affect people as well as things and places.

Conclusions

Communication of these values and their meaning between Mäori and scientists responsible for regulatory decisions has been fraught with difficulty. This is in part because: (a) risk management legislation is effects based and hence concern about *mauri* must be matched by forensic proof of adverse consequences; (b) the current decision-making framework cannot weigh cultural transgressions and intangible expressions of risk alongside physical ones; and (c) there is a general lack of knowledge among regulators and lawmakers in an increasingly secular society of Mäori spiritual beliefs. Thus despite attempts by the Courts to acknowledge Mäori spiritual values, it is the scientific information which dominates the ERMA's risk assessment process. No application has yet been declined for cultural reasons. Thus in the case involving Ngati Wairere, the Authority concluded that "taking into account the need to provide active protection for Mäori spiritual beliefs does not extend to accepting those beliefs as the determinant of whether the research… should be approved". Efforts by Mäori to promote a broader decision-making approach to solve this impasse include the development of values-based risk assessment frameworks (e.g. Durie, 2003).

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COMMUNICATING GENETIC ENGINEERING: NEW CONCEPTS FOR SOCIAL PARTICIPATION

Bernhard Wieser

IFZ–Inter-University Research Centre for Technology work and Culture. Schlögelgasse 2, A-8010 Graz.
Tel.: +43 316 81 39 09 / 40, fax: +43 316 81 26 61 11, wieser@ifz.tugraz.at

Abstract

Many publications can be found within the social science domain calling for a change in the communication of scientific expertise in terms of increasing participation and democratization. Still the question that remains is: How do we do it? How must science communication be organized that it does not fall back on the so called deficit model and as far as genetic engineering is concerned does not focus on the knowledge-acceptance-relation. After more than five years of experience the author has gained valuable experiences in organizing such communication processes. Against the backdrop of this some conclusions can be drawn.

Key words: Genetic engineering, participation, education.

Text

Aiming at Participation

When asking for socially sound design of science and technology, one will often get one answer: this can be ensured through participation. A stronger involvement of users, consumers and patients seems to be appropriate to achieve a socially sound practice. Genetic engineering is a prominent example where science communication plays a crucial role. That more should be done to inform the public was a common demand in the course of bio-tech controversies in many countries. Most often the framing of genetic engineering as a problem or matter of science communication focussed mainly on the fact that the public would to a very large extent reject most applications of genetic engineering. A characteristic feature for the concentration on the acceptance problem is its framing. In this view the lack of public acceptance is explained by a lack of information and knowledge in the public sphere. Consequently an increase of information is seen as an adequate means to solve this problem.

The point here is that such a framing which focuses on the knowledge-acceptance-relation goes along with a specific form of science communication. The communication style has become known as the "deficit model" (Wynne, 1991). The deficit model refers to a communication mode that concentrates on formal knowledge and aims at imparting such formal knowledge. Against the backdrop of this approach, experts only need to explain genetic engineering properly and all doubts and resistance of lay people will disappear into thin air. In this framing the seemingly neutral element "knowledge" serves various objectives.

It is obvious that a framing of the relation between science and the public goes along with an instrumentalisation of science communication: Science communication as provision for acceptance. Researchers have found much to criticise in the deficit model. Against the backdrop of the critique on the deficit model many call for alternatives that are occasionally called the democratic model (Durant 1999, p. 315). In essence its aim is to overcome the privileged position of scientists, as well as the one-way-communication from experts to lay people. What is demanded is a equal communication between scientists and non-scientists. In other words an extension of science communication in terms of a true dialogue is needed: the acknowledgement of local and practical knowledge, the right to a say for effected people and the inclusion of contextual aspects such as values, power-relations, profit-interests and issues of justice, economic consequences and risk.

Against the backdrop of the outlined problem, the request for new ways in science communication is not easy to fulfil. How can science communication be organized without falling back on a style that has been criticised as deficit model earlier on? It is argued in this paper that this is possible through job related continuing education (further training). A few accounts can be given why job related continuing education is understood to be a suitable framework to overcome the obsession with the acceptance problem and communication forms of the deficit model type.

The firsts reason that favours job related continuing education is the fact that relationships to action are perfectly given. Vocational activities provide educational processes with relationships to action in a way in which they could hardly be established elsewhere. A precondition, however, is a precise definition of the respective target group. For the case of genetic engineering this means to identify groups of a profession which have to work with applications of genetic engineering directly or indirectly (farmers, health providers, teachers etc.).

Organizing science communication on the organisational basis of job related continuing education one could benefit from the advantage of homogeneous target groups. Such target groups are significantly different from what is often called "the public at large". Developing an idea of who should be addressed is profitable in any case. Experiences have shown that events addressing a specific target group are much better attended in comparison to events which unspecifically invite everybody.
Continuing education is characteristically organized in the framework of small or medium settings. From a didactical perspective such events usually combine lectures and discussions. Even though more generalisations can't be drawn on the didactics of continuing education since a wide methodical variety is employed, the interactive character remains elementary for continuing education.

Conclusion

This paper took its point of departure in the democratic aim for more participation through science communication. The proposed way –focussing on learning processes relevant to action– has been formulated against the backdrop of a critique on the common practice in science communication which in social science literature has been described in terms of the so called deficit model. Summing up it can be said that the integration of the topic genetic engineering within the field of continuing education can be understood as a meaningful approach, not least because in this way perspectives for participatory science communication can be explored, too. However, it should be pointed out that associated measures in continuing education also need proper framework conditions and adequate financial backing if they are to be put into practice in a meaningful and valuable way.

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FRAMING BIOTECHNOLOGIES IN GREECE

Moses A. Boudourides
University of Patras, Greece

Abstract

In this paper we will attempt to scrutinize the framing of biotechnologies in Greece, where the debates over biotechnologies have been following rather than leading their counterparts in other European countries. Initially, public awareness about the applications of biotechnologies has not been comparable to that of other countries of the European Union. In fact, the Greek public has been by and large uninformed of the innovative biotechnological applications until the mid 1990s. Curiously, the initial unawareness about these issues in the early 1990s has not been translated to negative public stance towards biotechnologies. Nevertheless, the increased media coverage of issues such as the cloning of Dolly has ignited public debates. Subsequently, it has been the permission for experimental cultivations of GM crops in Greece that provided to NGOs and consumers' organisations the opportunity to set the

agenda in terms of protest mobilisations leading to a suspension of these cultivations. Subsequently, the Greek government has been trying to incorporate the EU directives rather than making attempts to promote public engagement with biotechnologies.
Our aim will be to give a picture of both the impact of the novel applications of biotechnologies on the Greek society and the public responses to it. For this purpose, we will provide an account of the public debates about biotechnologies in Greece during the 1980s and the 1990s. We will focus on the key decisions in regulating biotechnologies as well as on issues pertaining to public engagement with biotechnology in Greece, such as the agenda setting role of the actors involved in policy-making, the formats of participation and the framing of issues, expertise and the publics. To accomplish this we are going to utilise the results of a survey of a Greek daily newspaper's articles concerning biotechnologies.

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A COMPARATIVE STUDY OF THE SCIENTIFIC CONTRIBUTION OF MALE/FEMALE RESEARCHERS IN THE CSIC OF CATALONIA

Joaquina Álvarez-Marrón,[1] Francesca Campabadal[2] and Flora de Pablo[3]

[1] Instituto de Ciencias de la Tierra Jaume Almera, CSIC, Barcelona

[2] Centre Nacional de Microelectrònica, CSIC, Barcelona

[3] Centro de Investigaciones Biológicas, CSIC, Madrid

Women are under-represented among researchers in Europe and their numbers decrease drastically in higher research positions. In Spain, 53% of university students are women, while only 13% of university Full Professors are female. In the CSIC, the largest governmental research institution in Spain, 32% of permanent researchers are female, 75% of them at the lowest rank. The progress of females into higher positions has been much slower than for males. Our objective was to investigate whether lower scientific productivity was among the reasons for this slow progression. We have considered the data from the 15 CSIC centres located in Catalonia (total researchers, 284). We focused on calculating a 'production rate' during a period of four years, 1999-02, to compare the productivity of male and female at different levels of their career. The sample covers a wide range of fields of knowledge and has a distribution of female and male researchers similar to the whole CSIC. The results highlight that there are no significant differences in the production rates between sexes that could justify the difference in promotion to higher positions. An implementation of measures to correct this situation is mandatory.

DOCTOR-PATIENT RELATIONSHIP IN A MULTICULTURAL SOCIETY

Josep Maria Argemí Ballbé, Mireia Andrés Villarreal and Joan Vidal-Bota
Medical Students Association for Bioethics (Associació de Bioètica d'Estudiants de Medicina, ABEM), Universitat de Barcelona

Context. Cultural diversity has changed our professional attitudes in doctor-patient relationship. Patients are also confronted helpless with the new reality. This is a very recent trait in the European continental society and neither patients nor professionals seem to feel very comfortable with it. We rather behave unconfident and conflicts tend often to turn up as a result of uncertainty and confusion. In this paper we try to appoint the main priorities needed to overcome such detrimental situation. We try to draw the attention to values that enhance humanity in doctor-patient relationship.

Methodology. We undertake a bibliographic revision about different approaches to the problem in several countries so far. Our proposals are matched with the standards historically proposed by Hippocrates, and accepted through the centuries by the common medical sense to verify that they agree with the appropriate ethical excellence.

Results. Although tolerance and respect to minorities seem a convenient approach for integration of cultural diversity in hospital setting, the most effective attitude both for patients and professionals relates with solidarity and open-minded and self-detached professionalism that try to understand other cultures and give them personally the necessary support.

Conclusions. Cultural diversity represents a challenge for health professionals. It can be faced either by getting defensive, or considering it as a chance to enrich oneself and others through solidarity and open-minded attitude. Whereas getting defensive avoids interpersonal relationship and makes tolerance suspicious leading up eventually to conflicts, solidarity and understanding give rise to integration and social welfare and should be promoted in every institution.

ASTRONOMY AS A SCIENTIFIC MIND SEDUCER

Bibiana Bonmatí Recolons
Instituto de Astrofísica de Canarias, bibore@yahoo.com

Recent European surveys about science show a scientific vocation crisis. The need to improve the interest in science at a young age requires a extra information, in addition to formal education, in order to motivate the new generations. Astronomy is probably one of the most coloured subjects in science.
Displayed in this poster, is a qualitative analysis of the "special characteristics" of Astronomy used in the mass media to attract the public towards science. Science journalists must to compete with many other news, most of them with hard social involvement. Moreover they have to do an extra effort to "translate" the scientific terms

into a more intelligible words. Behind a great Universe image could be a complex phenomena explanation, that must be rigorously described and, at the same time, understandable by the public. Luckily, in some cases, the writers can play with the language and use some word tricks to approach science to all kind of readers. The outreach of science done out of school is the way to temp the youngest to study sciences. Not only the mass media, also the science museums, the visits to the scientific equipments, like the astronomic observatories, could awake the interest through science. Thanks to its properties, Astronomy continues to be a mind seducer, attracting people to science.

THE ROLE OF REMOTE SENSING IN THE COMMUNICATION OF GLOBAL AND LOCAL CHANGE

Mirco Boschetti, Alba L'Astorina and Eugenio Zilioli
Institute for the Remote Sensing of Environment (IREA-CNR)
Milano, Italy

Human beings assimilate the world chiefly through their senses of sight and this can explain why the use of images has always been so important in the communication and representation of the scientific world.
The development of modern technologies for visualizing the scientific aspects of life on the Earth has provided new opportunities for communicating the increasing complexity of science to the public. In particular, the use of Earth Observation satellites for civil purposes started in the 70s has opened new perspectives in the perception of natural phenomena and antropic impact, especially of those processes developing on a long term period and on a global scale. Instruments for remote sensing extend the capability of human visual field, giving access to additional information about the physical world sorrounding us that the human eye could not perceive.
The possibility to observe from a remote perspective and almost every day processes like climate change, ozone depletion, desertification, urban development, makes it possible to observers appreciate and experience the complexity of environment, reveal the impact of human activities on the terrestrial ecosystem, and understand concepts like global and local change as never before.
In this poster the impact of Remote Sensing imagery as an effective means of communication of science and its importance for a better environmental awareness is described.

MAKING SCIENCE FRIENDLY

Carmen Chica, Jordi Mas, Enric Garrell, Begoña Durán
Catalan Research Foundation, carmen.chica@fcr.es

There are common people that have science and technology matters among their hobbies and enjoy them. They are used to belonging to amateur associations dealing with the different fields, astronomy, cosmology, biology, environment, etc. Does science conceived as a scientific culture contribute to thereto? Efficient public communication of science faces a problem derived from the heterogeneity of recipients, i.e. age, educational background, time availability, and so on. But almost all people have specific interests and hobbies modelled by their educational of cultural background. So, why do not use this potential for scientific culture as a way to provide elements that contribute to self-satisfaction by developing abilities that will allow him or her to arouse these feelings and to share them? In a wide sample of Catalonian regions, as in other Spanish ones, scientific amateur associations offer activities and call for the active participation of people of all ages. This is a tool to awake, canalise and communicate science and technology. Yearly, as science friends, they are widely represented in Catalonian Science Week coordinated by FCR. Clearly hobbies towards science and technology are a way to make public science communication friendly. Further prospection will trace a map of the scientific and technological communication in Catalonia showing the most frequent branches of the different fields, geographical areas and features of participants.

Context. Science communication to the public has come to age in Spain as shown by a number of indicators: digital/print publications, activities and institutions dealing with the subject and organization of national/international conferences. Several initiatives are contributing to science dissemination in Catalonia, such as the Circle of Friends of Science (CAC). It includes and coordinates a number of amateur scientific associations devoted to different scientific fields. Collected data will allow to map their situation and to assess its success to extend/exchange benefits and experience.

Methodology. A survey on the number of amateur scientific associations has been undertaken. Data about members (number, age, background, participation), scientific field, regularity of the activities organized, attendance and information about their geographical and population characteristics are being collected in this work. Success indicators are established taking into account facilities and number of inhabitants of the specific place (small village or city, rural or urban typos) where each association is located.

Results and conclusions. Astronomy and meteorology are the scientific topics that arouse the most interest. Environment (pollution versus preservation and types of action to preserve it) generates the next most interest. Natural science, botany, ornithology, entomology also arouse a great public interest. Results depend on urban versus rural environment, but media, mainly television attract people towards the topic which it deals with more frequently. To enjoy science by itself could be the motto of amateur science friends and is another way to deal with public science communication. Other benefits of those experiences are to organize extra-academic activities to become children familiar with scientific topics. Further coordinated actions in public science communication will take advantage of this kind of studies at national and international level.

THE ENCOUNTER BETWEEN NATIVE VISIONARY EXPERIENCES AND COLONIAL SCIENCE IN THE EARLY NINETEENTH-CENTURY TAHITI

Mioara Deac
Program in History and Philosophy of Science, University of Notre Dame, USA, mdeac@nd.edu

In 1812, the conversion to Christianity of Pomare, king of Tahiti, initiated an irreversible series of changes in the religious and social life of the island. Pomare's conversion was the culmination of a fifteen-year christianizing process initiated by the London Missionary Society, founded in 1797. Nevertheless, the native rejection of the new religion occurred regularly. The most notable was the cult of *mamaia*, initiated in 1827 by two "apostate Christians" Teao and Hue, and which propagated rapidly in the Society Islands of Tahiti and Maupiti. The importance of inner revelations, prophetic visions, and the belief in the intercourse with the world of spirits had been deeply rooted within the Tahitian tradition. New was the *mamaia* prophets' attempt to express their visions through Christian themes and imagery. The native 'apostates' desired to contest Christian authority in its own terms. This is why it was so crucial for contemporary Christian missionaries to discredit through scientific arguments the relevance and authenticity of the visions claimed by the *mamaia* prophets. My paper analyzes the way in which those British missionaries articulated their rebuttal of *mamaia* prophecies within the framework offered by mainstream Christianity, and reinforced by arguments borrowed from the contemporary sciences of the mind.

IMPACT OF AUTHENTIC ASSESSMENT IN A NEW SCIENCE COMMUNICATION DEGREE

Jan Dook and Nancy Longnecker
The University of Western Australia, Jan.Dook@uwa.edu.au, Nancy.Longnecker@uwa.edu.au

New science communication programs are being established at The University of Western Australia (UWA), including a BSc (Communication Studies) and postgraduate courses. The poster highlights the use of authentic assessment within all aspects of the science communication program.

Relevance is a clear objective of all our assessments and an attempt has been made to make all assessments realistic, useful and reflective of tasks that science communicators do in the workplace. Students have prepared and presented talks about science to both their peers and primary school students, written press releases about current UWA research, designed posters for research groups, produced short digital movies about science, attended and evaluated science seminars and written articles after interviewing researchers.

A key component of all assessments has been reflective: students have been asked to reflect on the worth of all assessments as well as their impact on the student's personal learning. The poster features examples of student work and feedback from reflections

concerning student perceptions of the use of authentic assessment. Feedback has also been gained from university and industry staff who have participated in assessments via questionnaires and interviews.

SPANISH LITERATURE AND SCIENTIFIC POPULARIZATION: HISTORICAL APPROACH (XVI-XVIII)

Mª Dolores González Rodríguez
Universidad de Salamanca, Departamento de Filosofía y Lógica y Filosofía de la Ciencia, Salamanca (Spain)

Before scientific journalism and scientific specialized publications, literature had the role of a primitive popularization of science. The history of the Spanish literature offers interesting examples of an early communication of science through the literary fictions. Literary text are a platform for the scientific communication; three literary genres, Renaissance's dialogues, Baroque burlesque poetry and Enlightenment's essays, typify how was shown the nascent modern Science in literary plays for three centuries. Literature had an educative and pedagogic role, in the sense of "scientific ideas' bearer". More than being essential in the plot, scientific contents are depicted by literary characters, background ideas and the social prejudices about scientific practices, or the problems with philosophy and ideology.
The study of the literature of this period is a beforehand example of what later will be the scientific popularization and, at the same time, it offers resources for spreading scientific knowledge to a general public. Some of this resources are metaphors, explanatory digressions, technical vocabulary, social problems and utopian thought, prejudices, patriotism and the modern ideas, interest for museums and others cultures, the role of savants in Spanish society –especially doctors, astronomers, mathematicians.

HIGH SCHOOL STUDENTS COME FACE TO FACE WITH MODERN BIOTECHNOLOGIES IN THE EUROPEAN PROJECT PULSE (PUBLIC UNDERSTANDING OF LIFE SCIENCE)

Roberta Guardini,[1] Floriana Marin[2] and Lucia Martinelli[2]
[1] Museo Tridentino di Scienze Naturali, Italy
[2] Istituto Agrario di S. Michele all'Adige, Italy

PULSE is a project promoted by three Science Centres (Danish Experimentarium, Portuguese Pavilhao do Conhecimento - Ciencia Viva, and Italian Museo Tridentino di Scienze Naturali) and supported by EU.
A two-day happening on biotechnology was organized in November 2003 during the European Week for Science and Technology for over 300 students within Denmark, Italy and Portugal.

The initiative aimed to identify the most effective activities to apply as informal education tools on life science and allow students to form a personal opinion on the topics discussed.
Participants filled in a questionnaire both at the beginning and end of the happening: the results were analyzed and students showing the most and least mind changes were interviewed to enlighten the reasons of their answers and collect their feedback on the project.
The project provided interesting insight on the crucial aspects of organizing such an event, in the view of stimulating student critical attitude towards such a controversial problem. It also proved to be an effective tool to bring together experts and students and could prove useful for the diffusion of research project results.
More information and the student's PULSE web magazine are available at www.experimentarium.dk/dk/pulse and www.mtsn.tn.it/progettispeciali/pulse.html.

CHILDREN'S RECOGNITION AND DECISION TO INQUIRED PROBLEMS THROUGH COMMUNICATIONS: A CASE STUDY IN SCHOOL SCIENCE

Hiroki, Fujii
Hiroshima Women's University, Japan

This study is the endeavor to develop the children's scientific inquiry skills in order to be able to apply scientific knowledge to the issues and the problems children encounter when they do something in daily life. In the study, I also attached great importance to the learning process that the children try to recognize and decide inquired problems through their communications. The study developed many learning materials focused on the learning process.
The result of the trial at elementary science lessons for about one year and a half and the evaluation through participant observations and interviews for the children and the teachers showed the following:

- Most of the children discovered and expressed many kinds of simple questions through their encounters with interesting natural objects and phenomena in learning materials.
- Some of the children mastered to raise simple questions to inquired problems through their communications. But the argument about inquired problems isn't easy for the children. It is necessary for teachers to support the argument precisely with considering the children's development of communication skills.
- Most of the children constantly understood inquired problems and promoted reflective thinking on inquiring actions. Moreover, they had a sense of responsibility toward their own science learning.

DOES SCIENCE FIT IN TELEVISION?

Beñar Kortabarria and Elhuyar Fundazioa
teknopolis@elhuyar.com

Undoubtedly, if one has enough economic resources, there is not problem. But if those resources, do not exist? We all know that television is an expensive communication medium; nevertheless, the economic factor does not constitute an insurmountable obstacle for the scientific disclosure. Attending to the objectives of reporting, informing and entertaining, we, as the ones who dedicate to the disclosure of science, can have a space in the small screen. The secret is up to knowing how to find an equilibrium among rigorousity and amiability of the contents and, consequently, to adopt an adequate communicative format.
The program called Teknopolis, produced by Elhuyar Fundazioa, complies its sixth season of emission in the Basque public television. It is a weekly program of half an hour dedicated to scientific disclosure. Many of its contents attend to the present time research of the Basque Country, but without forgetting what science gives around the world. The experience of Teknopolis, being already a consolidated program, and the evolution in terms of audience, always raising, takes us to the conclusion that science, really, is of interest for the main public and, consequently, for television.

AN ANALYSIS OF THE THEORETICAL AND EPISTEMOLOGICAL IMPLICATIONS OF THE RELATIONSHIPS BETWEEN GENDER AND SCIENCE

Matilde Massó
Departamento de Sociología. Universidad Autónoma de Barcelona. matilde.masso@uab.es

The aim of this communication is to analyse the theoretical and epistemological implications derived from the question about the androcentric condition of science, based on the idea of objectivity and autonomy of scientific knowledge. This issue will lead us to think about the role that the ideology of gender plays on the construction of science, after considering the elements that characterize its singularity which contribute to determine its identity in relation to other kind of social practices.
Firstly this paper introduces the central ideas of some feminist researchers about the relationships between gender and science. Then these arguments are analysed in relation to some contemporary transformations in physics that lead to reconsider the notions of objectivity and cognoscibility of the physic world, questions that are in the base of the feminist criticism to the androcentric bias of science.
Finally, it is proposed a critical lecture about the role that gender plays on the construction of scientific knowledge. This question can't be reduce to a simple opposition "masculine / feminine science" but its field envisages the study of the complex relationships between mind and nature that are shown in the way that we interrogate our object of study.

SEXUAL IDENTITY WITHOUT CULTURAL DIVERSITY: THE PARADOX OF A PREVENTION CAMPAIGN IN FRANCE

Eleni Meliou
CERIC

We present an ongoing research on the interrelation between culture and sexuality by the means of AIDS public campaigns. The focus is set on the common but paradoxical strategy that members of sexually different groups (heterosexual and homosexuals) are addressed by the means of identical communication campaigns. Even though epidemiological studies show that specific publics are the high risk groups, the target group of campaigns often remains the general public.
We examine the mass media public campaigns that were held in France in the year 2000, and analyze how culturally different groups are addressed, in terms of diverging sexual behavior and practice. By the means of situational analysis (Analyse Semio-Contextuelle) on the campaigns' components, the communication strategies for the different groups are compared and checked on their heterogeneity with regard to their target group.

ETHNOPHARMACOLOGY AND DRUG DISCOVERY

Francisco Pérez García
Unitat de Farmacologia i Farmacognòsia, Facultat de Farmacia, Universitat de Barcelona. perez@ub.edu

Ethnopharmacology is useful for searching new bioactive drugs. Less than 1% of 300,000 higher plants species have been studied and 5% could become extinct by 2050. It is of utmose importance to develop sustainable practices, to implement the Convention of Biodiversity that positions indigenous people as the rightful owners of applications of indigenous plant knowledge and to obtain ethnobiodiversity data about popular use of medicinal plants, since this knowledge is disappearing at a high rate because of accelerated acculturation of the societies and substitution of traditional knowledge, considered inferior, to the so-called modern culture. Therefore, next generations will contribute and share to the knowledge and preservation of a part of the local and global cultural heritage and it will be find out new or rare uses of medicinal plants, which could lead to the used of new plant-derived medicines since many drugs have been discovered from natural sources: quinine, colchicine, digitalis derivatives, morphine, vincristin, etoposide, camptothecin, taxol among many others.
Our laboratory study plants used in the Southamerican traditional medicine for different diseases and we have isolated from *Pluchea sagittalis* by bioguided assay fractionation an active principle with anti-inflammatory activity called taraxasteryl acetate.

POPULARISATION OF THERMODYNAMICS AS A STRATEGY OF LEGITIMISATION

Stefan Pohl Valero
PhD student, History of Science, Universitat Autònoma de Barcelona

What means popularisation of science? What are its main goals? Is the public a passive receptor? The intellectual content and the professional organisation of science can not be separated from its social and cultural environment. Consequently, scientist must justify their activities to the political powers and others institutions upon whose support they depend. Thus, it is clear that scientists do not propagate scientific knowledge for its own sake, but they try to persuade specific public sectors, showing that science both supports and nurtures broadly accepted social, political, and religious goals and values.
The popularisation of Thermodynamics in the second half of the 19th century in Spain exemplifies this process of legitimisation. How the Spanish social and cultural values shaped the meaning of Thermodynamics in this period, is the main subject of the present poster. I will argue that, trough popularisation, some Spanish scientists categorised Thermodynamics as a product of theoretical physics, as a strategy for legitimating this discipline, in a moment in which physics was not well institutionalised. In this process, they portrayed Thermodynamics in such a way, that they thought would avoid materialism critiques, and therefore confrontations with the religious authorities.

BROWN DWARFS DO EXIST!

Carmen del Puerto
Instituto de Astrofísica de Canarias (IAC). cpv@iac.es

The first "brown dwarfs" known were discovered with the IAC-80 telescope, at the Teide Observatory (Tenerife), by researchers at the Instituto de Astrofísica de Canarias (IAC). Until that moment, brown dwarfs were mere theoretical hypotheses, but their discovery has allowed for great advances in the study of stellar evolution. This poster presents the results of an investigation about the origin of the term "brown dwarf," in relationship with the nature of these cosmic objects and their effect on the media. *Brown dwarfs* are the missing link in the chain of stellar evolution: not stars or planets, and who knows about dark matter. It is more than a new name, be it correct or not. Similarly to what happened with *black holes,* their scientific relevance resides in their own theoretical notion, and the subsequent proof of their existence. However, the current interest, scientific and of the media, for *brown dwarfs* is not due as much to the inclusion of a new species in the "cosmic zoo" as to the fact that the discoveries of the first *brown dwarf -Teide 1-* and the first *extrasolar planet -51 PegB-* happened almost simultaneously. Since 1995, the announcements of new planets and *brown dwarfs* follow one another in the media and, in some cases, with significant doubts about whether it is one object or the other.

BORGES Y LA CIENCIA: LA ENTONACIÓN DE UNA METÁFORA

María del Carmen Rodríguez Martín
Becaria de Investigación de la Junta de Castilla y León. Departamento de Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca. mamenrom@hotmail.com

The purpose of this paper is to provide an overview of the science present in the literature written by Jorge Luis Borges. This author has a conception of the science similar to the one he has of the philosophy. In his view, both instruments are incapable to account for the world conceived as a labyrinth. Furthermore, our knowledge of it is not objective but rather a production of fantasies. However, the scientific theories have a significant presence in his shorts narratives and essays. Moreover, the borgesian literature deals with the problem of the infinite an the limit, represented for the rationalist philosophy by the paradox. This concept destabilizes the scientific an speculative thought. In conclusion, his texts are not just paradigmatic examples of the way Borges uses the science as a constituent of his literary production, but it serves him to divulge, communicate and reflect about this issue.

FROM PAPER TO MULTIMEDIA: NEW TOOLS FOR MODERN SCIENTIFIC COMMUNICATION

Elena Sanz Pérez de Guzmán and Patricia Vicente López
Ciencia Digital,S.L., Málaga (Spain). esanz@cienciadigital.es

By examining the history of public communication of science, we can see how new technologies and new media can interact with changes in new communication forms. We can remember examples as known as the first science articles in the *Gazzete de France,* the book *Dialogo sopra i due massimi sistemi del mondo, tolemaico e copernicano* writen by Galileo Galilei in 1632, and the English films of the series *Unseen World*, in the beginnig of last century.
Now, the digital age arrives with a set of big challenges for traditional mainstream media. In the new scenario, multimedia is the new language, the user becomes the axis of communication process, interactivity is the key and knowledge is the new name of information.
If we represent information and interactivity as a pair of variables, and compare traditional media (books, press, radio, cinema, television) with the 'new' multimedia, this one can reach the highest values.
In this poster innovative uses of visuals and multimedia will be presented, with a practical example -a multimedia infography development step by step-, to show how scientific communication can take advantage of multimedia technologies and help us to identify emerging trends in the promotion of scientific culture.

THE COMMUNICATION OF SCIENCE IN MÉXICO DURING XVIIITH CENTURY IN THE *GACETAS DE LITERATURA* BY JOSÉ ANTONIO ALZATE

Silvia Torres Alamilla
Departamento de Matemáticas. Facultad de Ciencias, UNAM, México

To introduce science as a part of general culture has been the work of many pioneers who since the XVIIth century, considered to carry science to people. They thought that this was an important part of scientific work. Several glorious attempts have been registered during the history of Science in México, and for some specialists, the scientific popularization is located since the XVIIth century, when modern science and the knowledge of the systems of the world became an important part of people's education.
It will be through the XVIIIth century in Mexico that a character will highlight with great intensity: the *Presbítero* José Antonio Alzate, the most enlightened Mexican of the XVIIIth century in Mexico, scientist that looked in science the manifestation and the creation of an own culture.
Alzate immersed in the enlightenment ideas that permeate the Mexican Society of his time; he wanted to take science to the people. For that purpose he published along 30 years, a series of periodic publications from which the most important was The *Gacetas de Literatura de México* from 1788 to 1795. It was in this publication where he captured topics as varied as medicine, botany, chemistry, agronomy, philosophy, zoology, architecture, anthropology, natural history, geography, botany, mining, etc. Also this publication opened a space to the presentation of ideas and other scientific results of people of his time and many times published debates and polemics on certain topics as the nomenclature of Linneo, the origin of the northerly lights,
the eclipses, etc.

THE TECHNO-SCIENTIFIC IMAGES IN THE GREEK INTER-WAR YOUTH PRESS: THE CASE OF THE AIRPLANE

Vaios Tsilikas and Michalis Assimakopoulos
National Technical University Athens, Greece

In this article we examine six youth journals of inter-war Greece, in order to get a picture of the context and the goals of science and technology popularisation at the period.
We claim that the picture gained from the above studies, apart of the ideological differences, is a picture of science and technology as a western ideal, where its utilitarian use prevails from its notion as a means to a new world picture. The scientist is pictured mainly as a sympathetic but idiosyncratic figure, sometimes wise. The techno phobic ideal is also strongly represented.
The journals are definitely in resonance with the ideological fermentations of examined period. The attempts, after the failure of irredentism, to create a new national idea based on a notion of modernity are the major framework of this work.

ATTITUDES ON SOCIAL AND RACIAL CONTROL IN CALIFORNIA

Alicia Villela
National University of Mexico City, UNAM

The history of the eugenic movement in the United States at the beginning of the twenty century, is a remarkable case study to show how involuntary sterilization of defective persons, particularly in California was used for some eugenicists who were convinced that the future of the United States depended on protecting the "race".
A remarkable number of sterilizations laws were strongly support in the United States and between 1907 and 1960 more than sixty thousand retarded and mentally ill persons were sterilized without their consent, all victims of programs designed to cut off the flow of allegedly defective genes into the nation's pool.
California sterilization program provide a peculiar model for many states in the United States and also for other countries to invoke because more than 6000 operations were performed in its institutions during at least three decades.
This situation changed when a postwar influx of immigrants from all around the world arrived in the United States and then many Americans seemed to feel threatened by the unprecedentedly high number of immigrants. Some eugenicists like Harry Laughlin who was the superintendent of the Eugenic Record Office, Charles Davenport, director of the ERO, Paul Popenoe who was in charge of the California sterilization program and others were active in bringing their genetical arguments to support immigration legislation and linking the hardening of immigrant legislation to the development of the eugenic program in USA.
The California law was introduced in February, 1909 as a bill by Senator W.F. Price of Santa Rosa. It passed the Senate on March 16 th with 21 ayes and 1 no. On march 22th passed the House with 41 ayes and not a single vote record against it. It was finally approved on April 26th by Government James N. Gillet and became a law on June 25. 1909. California Law like Indiana that was the first state to pass a sterilization measure based upon eugenic principles, it gave institutional physicians broad powers to reviews inmate records and to sterilize those whom they decide would benefit from the procedure. The California law, the Eugenic Record office gave a list of members to be considered as socially unfit and be possible eliminated from the human stock: the feebleminded, the pauper class, the criminaloids, epileptics, the insane, the constitutionally wak, those predisposed to specific diseases, the congenitally deformed, those having defective sense organs, such as the deaf generally.
During these years, racial considerations became foremost. Considerable attention was paid to the fact that most of these people were immigrants. With these sentiments, it was easily enacted the Immigration Restriction Act of 1924. The important feature of the new Law was not only the restriction of immigration to two per cent, but the selection among immigrants which was achieved by reducing the relative proportion of new immigration.

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"KÓGNOPOLIS": CROSS-BORDERING NETWORK OF KNOWLEDGE CITIES

Tomás M. Bañegil Palacios and Ramón Sanguino Galván
KOGNOPOLIS Project, Badajoz (Spain). tbanegil@unex.es, sanguino@unex.es

The knowledge management has become a very important competitive element to the economic agents: firms, administrations, regions and cities. Those regions integrated in the OECD are turning their development strategies into learning processes, investigation and innovation, through an effort equally carried out by the administrations, the private sector and the society.

In the present context, with the competitiveness and the globalization, the profit from the cooperation among cities and the learning processes are evident. In fact, they are expected to be even more significant in the future, when these practices become a common activity among the largest cities around the world.

Our project KOGNOPOLIS[1] "Cross-Bordering Network of Knowledge Cities" has been partially funded by the INTERREG IIIA Programme. Two years of studies have been planed as a pilot scheme. Our proposal has got several innovation elements:

- It is a network, there are very different ways to improve the economic and social local development. The city entities will be collaborating together in order to work out the best solutions to the city needs.
- The size, it consists of small-sized cities. Other projects like EUROCITIES or TELECITIES are dedicated to medium an large cities.
- The cross-bordeting character of the network, those cities of the network belonging to neighbouring regions between Spain and Portugal.

[1] See www.redkognopolis.com for further information.

ESCENTIAL: THE FIRST EUROPEAN SCIENCE FESTIVAL IN THE EUROPEAN CITY OF CULTURE 2004

*M. Bianucci, P. Bussei, S. Merlino and R. Fieschi**
National Institute for the Physics of Matter (INFM) (Parma, Italy)
* Physics Department, University of Parma & INFM (Italy)

In the year of Genova 2004, the European Capital of the Culture, science enters the stage with the approval of the European Union. Within the Science Festival (October 28th to November 8th 2004), indeed, started the project ESCIENTIAL (European Science Festival), supported by the EU within the European Science and Technology Week 2004 (FP6).
With ESCENTIAL project, we intend to bring to an European level the events and to enhance the results of the first edition (23/10–03/11 2003): 28 different places for 23 scientific exhibitions, 83 conferences, 10 performances, 24 films, 34 laboratories..., more than 130,000 visitors.
People will have the opportunity to visit some of the most renowned centres-museums of Europe: Tecniquest, Museo de la Ciencia de Barcelona, Tecniczi Muzej Slovenije, University of Edinburgh, Institut Non Lineaire de Nice.
From October 25th to 28th science centres and museums representatives will train a restricted group of young promoters, teaching them all the secrets of the European exhibits, so to best interact with the public.

MORE THAN PREACHING TO THE CONVERTED: INTRANET APPROACHES TO SCIENCE COMMUNICATION

Rick E. Borchelt and Melissa L. Withers
Whitehead Institute for Biomedical Research, Cambridge, MA (USA)

Cultivating employee awareness of broader policy and social issues that affect organizational activities can one of the best, but is frequently the most underused, public engagement tool available to public information officers. By substantively engaging employees in these issues and keeping them abreast of important happenings, employees are empowered to take a more active interest in the social context of their work. What's the organizational payoff? More articulate and informed, these employees become better qualified to serve as institutional ambassadors and spread the news of organizational success. Whitehead Institute for Biomedical Research recently developed a web-based intranet for employees that serves not only as a central hub for information about what's happening at the Institute, but more importantly, in the broader world of science. Using this approach, Whitehead has seen an increase in demand for information about the state of scientific affairs, as well as a shift in information flow wherein employees can weigh in on matters, both local and national, that significantly impact organizational activities. This poster will describe the intranets backbone a news and information service updated daily in real time and illustrate how Whitehead is using this service to build better ambassadors from the inside out.

WWW.CAOSYCIENCIA.COM

Annia Domènech
Instituto de Astrofísica de Canarias (Spain). info@caosyciencia.com

Once upon a time there was an Astronomy who was bored of the seriousness that always accompanied her. One day she escaped her boredom and met up with some other sciences. Together they decided to invite the video clips, the animations, the images, the short stories... in short whoever who could help them be better understood.
caosyciencia is an on-line magazine containing astronomical information explained in a simple way and, hopefully, with an innovative didactic approach. Since Astronomy is a field which is related to almost all other branches of science, this magazine also provides a channel to explore them and show their interconnectedness.
caosyciencia contents are renewed periodically and alerts are sent via mail to anyone interested. This magazine is an initiative of the Instituto de Astrofísica de Canarias (IAC).

LACiencia: A WAY TO SEARCH FOR LATIN AMERICAN SCIENCE AND TECHNOLOGY NEWS

Marianne Karin Biben Frederick and Abel Laerte Packer
BIREME/OPS/OMS – Latin American and Caribbean Center on Health Sciences, São Paulo (Brazil).
marianne@bireme.br

LACiencia (www.laciencia.org) is a portal based on a search engine of Science and Health news published in newspapers, bulletins and university sites, mainly from Latin America and the Caribbean countries. This initiative is included in the Virtual Library of Health (VHL) developed by BIREME, a specialized center of the Pan American Health Organization.
This portal aims to be a fast tool that permits visibility and accessibility of scientific content news, contributing to overcome the phenomena known as “lost science” – coming from the developing countries. LACiencia collects daily the news from selected sites, following the next criteria: originality, periodicity, authorship and responsibility for the contents.
Users can search by key words in all sites or select their favorite ones from each country. The answers appear in order of relevance that is calculated by a search tool algorithm and can be changed to date order. In addition, from an answer users can go directly to similar news. Each answer links to the site that originally produced the news.
Launched in the end of 2003, LACiencia’s interface is in Spanish, but the searches can be made in Portuguese, English and Spanish, accordingly to the original news site language. Beyond searches, the portal can also send clippings “on demand”. The VHLs (www.bvsalud.org) are going to use this information source, as well as the PAHO representatives’ sites.
Since April, all the complete news texts are been stored in a Database that will allow to analyze and describe tendencies of these news about science and health, and produce indicators in Science Communication.

THE HELIX GAME: A TREASURE HUNT GAME

Cristina Junyent,[1] Laia Fernández Barat,[2] Núria Rosés,[3] Lluís Tort[4] and Frederic Udina[5]

[1] Agencia Planetaria, REDES – Biology and Society Section (Catalan Society for Biology-IEC). junyent@menta.net

[2] Biology and Society Section (Catalan Society for Biology-IEC)

[3] Tasca, social and cultural development projects

[4] Cell Biology, Physiology and Immunology. Faculty of Sciences, Universitat Autonoma de Barcelona

[5] Department of Economics and Business, Universitat Pompeu Fabra

From the Catalan Society for Biology we organized the treasure hunt game *Build the double helix of DNA* addressed to secondary students.
During the game, almost 1,000 secondary students visited 18 research centers or science museums, split in groups. In each of them, the students had to pass a test related to DNA: a crossword, a hidden poem in a "letter soup", etc. When they reached it, they were given a rubber piece of a DNA model. With them, they built a 40 m DNA structure in a public place.
We prepared an evaluation test to be answered by the students both before the treasure hunting game and after it. There were also questions for the teachers to know whether they gave the students information related with the DNA.
As general conclusions, we can say that the most colorful tests of the game were those that had more impact (questions related with DNA dimensions and splicing). The most confusing questions were those related with the effect of environment on gene expression. Apart from students, teachers were interested in our game for new teaching material; and, because of building the structure in a public place, we obtained a great public participation in a science communication event.

SCIENCE IN ADVERTISEMENT: USE AND CONSUMPTION

Pietro Greco, Federica Manzoli and Nico Pitrelli

ICS–Laboratorio interdisciplinare, Sissa, Trieste (Italy)

In the large amount of science that appears in advertising –a social practice so distant from the scientific production field– science is used to persuade its receivers and scientific knowledge becomes part of the consumer process.
Moreover, from a Science Communication studies point of view, advertising is an interesting example of how a relevant part of its transmission does not comply with the usual linear modality from science and scientists towards the public. Instead, science passes through a more or less distorted translation, flows through multiple, hybrid, cross-setting channels.
Within this context, the aim of our study was to understand how and to what extent advertising uses science. Therefore, we carried out a quantitative study on a significant sample of newspapers, newspaper supplements, weekly magazines and monthly scientific magazines, which we monitored for a period of one year (May 2002/April 2003).
The main findings concern the high presence of science in advertising (17% of the total of

advertisements), the very positive image that it takes up (only 1% of a negative message on science) and a surprising use of less marketable sciences such as Chemistry, Physics, Mathematics alongside the most predictable fields of pharmacology and medicine.

POPULARIZATION OF SCIENCE AS PLAN-DRAWING OF SCIENTIFIC REALITY

Óscar Montañés Perales

Becario de investigación, Departamento de Filosofía y Lógica y Filosofía de la Ciencia. Universidad de Salamanca. om@usal.es

Popularizers' work is usually compared to translators' work, as it is a substitution of technical words for others that belong to ordinary usage. In this way, popularization can only aim at offering a blurred and distorted image of the real meaning of science. Therefore, it is necessary to widen the sphere of action of popularization, by providing a vision of science transcending the space of contents. The goal of this poster is to present the popularizer's work as a process of plan-drawing, in which scientific contents are adapted to new purposes, by now not going round criteria of objectivity.
In this way, the deficiencies of popularization, regarded as a translation, will be mitigated by the plan-drawing process of science, allowing citizens to move smoothly in scientific world, previously adapted by popularization. This is about offering a global image of the world of science. Thus, the conception of scientific literacy related to such an image corresponds to the transmission of a scientific culture to the public, avoiding the limitations of deficit model. Being a form of culture, it is supposed to display the reality of science from its many perspectives.

SCIENCE AND ART: THE ARTISTS' VIEW ON MARINE AND POLAR RESEARCH

Margarete Pauls

Alfred-Wegener-Institut für Polar- und Meeresforschung Presse- und Öffentlichkeitsarbeit (AWI), Bremerhaven (Germany). mpauls@awi-bremerhaven.de

In the dialogue between science and art two worlds meet each other: The interaction of these two different kinds of culture opens up new perspectives for both. To document this and point it out to the public is an exiting way in science communication.
In order to cultivate the dialogue with artists, the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven (Germany) enables every four to five years artists to take part in an expedition. As an example I will describe the *Bibliothek im Eis* in the Antarctic. There on the ice, in close proximity to the German research station Neumayer the *Library in Ice* was erected in the winter of 2003/04, an art project, a sculpture by Lutz Fritsch. In the winter of 2004/05, Lutz Fritsch will complete the library in the Antarctic and install the 1,000 books. With this act, the *Library in Ice* will be opened.

FOOD AND GMOS. TRACEABILITY AND LABELLING IN THE PUBLIC DEBATE

Giuseppe Pellegrini,[1] Floriana Marin[2] and Lucia Martinelli[2]

[1] Università degli Studi di Padova. giuseppe.pellegrini@unipd.it

[2] ISMAA. flomarin@itc.it, lucia.martinelli@ismaa.it

Citizens ask to the institutions for security and transparent regulation on biotech food. Trento Autonomous Province (PAT), Italy, controls and certifies food and feed commercialised on its territory, and Istituto Agrario San Michele all'Adige is setting up the expertise for this. The new European Union regulation on GMOs (2003/1829/CEE; 2003/1830/CEE) promises consideration of public concern since traceabilty and labelling would enable consumers for choosing desired market products. With the aim of checking on the local agrobiotech stakeholders the impact of such regulation, we are carrying out a research based on focus groups and meetings. Both an analysis on the ruling innovation impact, and a guideline for a better certification on the PAT's territory are expected outcomes of this activity. The focus groups showed a consistent opposition to GM products, a sort of "green resistance" resulting in fear for human health and environment preservation. Besides, doubts based on economic elements and purpose of preserving specific local products were expressed. The new regulation is positively considered, in particular where enabling consumers for a free choice of the market products. During further meetings, citizens will match up perceptions and point of views exposed in the Focus Groups. (Research supported by PAT, OSSERVA3 Project.)

¿DOES THE SCIENTISTS CONTRIBUTE TO THE SCIENCE DIVULGATION?

Jaime Pérez del Val,[1] Pilar Tigeras,[1] Jesús Rey-Rocha[2] and Mª José Martín-Sempere[2]

[1]Consejo Superior de Investigaciones Científicas. Coordinación Institucional en la Comunidad de Madrid. Madrid (España). j.perez@orgc.csic.es

[2] Centro de Información y Documentación Científica (CSIC). Madrid (España). j.rey@cindoc.csic.es

The contribution of the scientists to the science divulgation programs is not as usual as it would be desirable. To their research work, scientists must to add the administration activities of their projects (getting funds, reports...) and, in many cases, they feel the popularisation of the science not being part of their duties. However, many scientists decide to contribute to the growth of a scientific culture when articulate initiatives on scientific divulgation exists.

We make this state on the basis of four year review (2000-2003) participation of the Consejo Superior de Investigaciones Científicas (CSIC) in the two more important initiatives of science divulgation in Madrid: the Science and Technology Week and the science fair "Madrid por la Ciencia". These activities were promotioned/coordinated since 2001 by a Programme of Scientific Culture of the Madrid Community joint with the CSIC. In the 2003 Science and Technology Week 21 research institutes/centres and more than 150 scientists of CSIC from Madrid were involved.

ENHANCING INTERFACES BETWEEN SCIENCE AND SOCIETY: AN AUSTRALIAN INSTITUTIONAL RESPONSE

Cathy Pitkin[1] and Anna Littleboy[2]

[1]CSIRO Social and Economic Integration (Australia)
[2]CSIRO Exploration and Mining (Australia)

Communities and stakeholders no longer support the pursuit of excellence in science if the outcomes are not justified in terms of economic and social benefits. But how can research organisations more effectively bridge the divide between science and society, and integrate social and economic perspectives into the development of scientific solutions?

CSIRO,* Australia's National Science and Technology Research Organisation, has responded to this challenge through a new initiative called Social and Economic Integration (SEI). SEI supports new approaches to research that enable science to not only explore and understand the social contexts and drivers of problems but also identify where R&D is most needed and likely to be effective.

This poster outlines the communication and training strategies being implemented through SEI to:

- Support cultural change foster greater awareness of the social context of science.
- Facilitate better engagement between researchers and those effected by their research.
- Enhance public awareness and participation in science and technology development, particularly emergent 'disruptive' technologies eg. Nanotechnology.
- Support the development of research approaches that recognise and value the contribution of 'lay knowledge and experience'.

It also profiles an example of current research that is exploring public understanding of different forms of energy to inform the development of a major new research strategy about energy futures in Australia.

* CSIRO has over 6500 staff conducting research and development across a wide range of areas including health, agriculture, minerals and energy, manufacturing, information and communication technology, construction and the environment.

SOCIAL COMMUNICATION OF THE SCIENTIFIC KNOWLEDGE IN THE SCHOOL OF SCIENCES OF NATIONAL UNIVERSITY OF MEXICO

Moisés Robles Aguirre

Facultad de Ciencias, UNAM, México. mra@hp.fciencias.unam.mx

The social communication of the scientific knowledge in the Faculty of Sciences, begun formally with the celebration of the 40th anniversary of its foundation in 1979. The School of Sciences as main creator of professional scientists of our country, in Actuarial Sciences, Biology, Computer Sciences, Mathematics and Physics, is divided in three

departments: Biology, Mathematics, and Physics with a total of 385 full and associate professors and technicians. It generates a big and important scientific production contained in research, teaching and communication books, scientific journals, conferences, workshops, videos, etc.
The activities of academic and cultural communication, inside as outside of the School of Sciences, relates and projects with different scientific and cultural media as a necessity of exchange that allows simultaneously to agglutinate the academic work with the social life of our country.
Actually the social communication media has a big influence mainly in the Mexican Society, distorting sometimes the reality, and in their majority they show a poor quality.
The National University of Mexico produces more than half of the scientific and humanistic knowledge of our country, moreover its considered the cultural center of Mexico. That is why its requires of a huge and professional social communication to incorporate it to our Society. The institutional interested of the UNAM is to construct and reinforce systematically back feed itself to generate new knowledge and culture.
Our Society for a good development needs our science to abandon some historical recession and to help to construct a proper identity coherent with our life style.
The cultural, scientific and educational institutions, they find themselves against a big historic challenge: to establish, foment and create an adequate scientific culture to establish social conditions and fairness.

BEYOND THE EXHIBITION: EDUCATIONAL RESOURCES AND STRATEGIES IN VIRTUAL SCIENCE MUSEUMS

Marcelo Sabbatini

Instituto Universitario de Estudios de la Ciencia y la Tecnología – Universidad de Salamanca. Salamanca (Spain). sabbatini@usal.es

We explore in the present work the potential represented by virtual science museums as a new approach based on key novel information technologies that can be used to extend and complement educational functions of real world museums and interactive science centers. We propose that the main element that distinguishes virtual museums from their real counterparts is the use of purely digital, “virtual” elements, in the form of interactive multimedia resources and experiments that may help the public to better understand scientific concepts and phenomena. These resources, at the same time in which they are used to try to solve some of the problems demanded by a science education reform, also relate to specific problems of scientific museology, for example, the representation of contemporary science, in a realistic and motivational manner. The use of digital objects for learning may be complemented with the establishment of collaborative bonds between the science museum and the formal educational system. Together, this would make possible the accomplishment of collaborative projects between different institutions, as a way to promote the investments and resources dedicated to this extension of science museums and interactive centers’ mission, vis-à-vis the more general society’s needs for the public understanding of science.

AWARENESS AND UNDERSTANDING OF SCIENCE GUIDED BY DIALOGUE: GENETICS AS A CASE

Maarten C.A. van der Sanden[1] and Frans J. Meijman[2]

[1] MSc, PhD-student, VU University Medical Center, Department of Metamedica, Amsterdam / science press and information officer/teacher of science communication, Marketing & Communication Department, Delft University of Technology, Delft, The Netherlands. m.c.a.vandersanden@tudelft.nl

[2] Professor/GP, MD, PhD, Biomedical communication, journalism and it's history, VU University Medical Center, department of Metamedica, Amsterdam/ The Netherlands

The current belief is that, in science communication, interaction with the audience must take place through a dialogue. Dialogue has become a buzzword. The notion seems good, dialogue is indeed a powerful communications tool, and can be used to great effect to inform or convince an audience. However, dialogue is often mentioned as a tool within the framework of awareness. In the "classical" from of science communication, public understanding, dialogue is seen as less important. This latter restriction does not contribute to effective science communication.

The term dialogue can be operationalized in several ways, depending on the communication goal. As determined in our own research project we will discuss the use and goal of the term dialogue in science communication as being awareness and understanding. Genetics forms the case.

In the case of dialogue as a tool for public awareness of genetics, the dialogue will be about notions of genetics. The subject matter is not facts of genetics, but the question is, for example, how one feels about genetics. Does genetics feel controllable? In this case dialogue contributes to the forming of mutual notions of genetics: a conceptual goal.

In a dialogue aimed at public understanding of genetics, the goal is to exchange facts. These facts can be about: content, methods or science as social enterprise. In this case dialogue contributes to mutual understanding of facts: a functional goal.

Clear distinction between both operationalisations of dialogue are important for effective science communication.

CULTURAL FACTORS IN THE RECEPTION OF NEWSPAPER ARTICLES ABOUT FOOD BIOTECHNOLOGY: USA AND GERMANY

Magda Sawicka and Hans Peter Peters

Research Center Juelich, Programme Group Humans, Environment, Technology (MUT), Germany

European consumers are more critical of food biotechnology than US Americans, studies say. Because in a media society opinion formation about issues like food biotechnology mostly takes place during the reception of media coverage, the question of different opinions can be analyzed from two sides: the stimulus side (differences in the media coverage) and the reception side (differences in the sense-making of the media coverage). The poster shows results of an intercultural experimental study designed to explore the second factor. 2 x 40 test persons from the US and Germany read the same four newspaper articles on food biotechnology. In order to explore the differences in the sense-

making we asked the test persons to list their thoughts they had while reading the articles. The cognitive responses were then analyzed for references to general cultural "tools" (Ann Swidler) which are supposed to be used by the members of a culture for the development of perspectives towards new issues.
The results support the hypothesis that the cultural background influences the audiences' processing of media information about science & technology. In particular we identified an influence of "trust in institutions" and "concepts of nature" on the formation of opinions on food biotechnology.

SCIENTIFIC CULTURE FOR TEENAGERS: AN EXPERIENCE THROUGH THE WEB CONTENTS DEVELOPMENT BY YOUNG STUDENTS

Sergi Serrano Cano
Master in Physic Science. Educator/Web Contents Developer. sserranoca@cofis.es

The aim of this work is related to my own experience as a science teacher.
I'm interested about developing activities where teachers may offer new methodologies to achieve that our students reach the science comprehension in a pedagogical and creative way. Sometimes it is difficult to achieve this objective because we should follow the standard topics. But I think that we have a good opportunity to communicate this important feature about our own culture. And science is a part of our own culture.
I developed a project in relation to the new technologies and all the possibilities they offer. We worked from the general ideas to the specific concepts. And I tried to set up a pedagogical methodology to work with scientific ideas.
The students wrote about scientific subjects: from the origins of our planet to the life of insects, the inventions, etc. They walked near the frontier between science learners and science communicators. The result was the first step to develop web page contents.
It is very important to set up the scientific knowledge at the beginning of our apprenticeship, because when we grow up, it gives us a critical point of view about our reality, our societies. And this is a synonymous of freedom.

THE WEB PRESENCE AND NEW PRACTICES OF SCIENTIFIC COMMUNICATION AND PUBLICATION

Rosa Maria Villares de Souza Berto
Brazil. rosamvsb@ipt.br

The paper identifies the impacts caused by Information Technology (IT) to scientific publication production. The research was developed through a case study, in a Science and Technology community. An self-managed electronic questionnaire and a semi-structured interviews had been used for data field collection. The result analysis pointed

out that the community assumed and legitimised the electronic communication mediated by computers. The e-mail was elected the main medium of communication among the players. They perceived IT as a differential of autonomy and optimisation of work processes. IT also promotes time saving and increases institutional and personal visibility. Significant alterations had been identified in internal and external communication flows. Some changes were also related on invisible colleges and peers relationships. The web presence and the information and communication technologies promoted an increase on the researcher's productivity but they realise they have been more real work to do. The scientific community recognises the benefits of remote access to bibliographical databases and to digital full texts. Therefore some caution is required in relation to free texts or non refereed papers published/posted on the Web.
A survey was applied according to statistical data on gender, age and population distribution in the districts of middle and middle high class. 1,063 interviews were performed in the cities of Campinas, Ribeirão Preto and São Paulo (important cities of São Paulo State), Brazil.
Besides some quite usual features of public perception, we also detected some other interesting aspects:

1) The classical hypotheses of a direct correlation between low levels of scientific literacy and "anti-science" attitudes, is partially falsified by our data.
2) The simple dichotomy sometimes used to analyze public attitudes and awareness, between "pro-science" and "anti-science" publics cannot be maintained.
3) On the other hand, some general features of public perception of science appear to be similar among sex, age, and even in different countries, indicating that scientific culture is not only an individual attribute, but also a social one, and that the social image of science is deeply rooted in our culture and linked not only to factual knowledge, but also to ancient stereotypes, myths and symbols about knowledge in general.

We also propose possible improvements based on qualitative social research that may be adequate to investigate the Brazilian reality.

CAMPAIGNING AGAINST DISEASE THROUGH MUSEOLOGICAL OBJECTS IN 1930S BARCELONA

Alfons Zarzoso
Museu d'Història de la Medicina de Catalunya, Barcelona (Spain). azarzoso@museu.comb.es

Early in 20th-century Barcelona, a new discipline, social medicine, aimed at sensibilize the popular classes to medical problems through medical campaigns, was resorted by authorities facing what was called the social question. One of those resources was *spectacle* as a strategic means to popularize the goodness of a healthy style of living. This poster will focus on the activities developed in the premises of the Roca Museum, understood as one of the popularizing practices implemented in order to sensitise the popular classes to physical problems.

The Roca Museum was mainly devoted to magic, but they also exhibited natural curiosities. In the thirties, that museum started a medical campaign addressed to the popular classes. It was a fight against *social vices*, such as alcoholism, drug addiction and venereal diseases. Among the spectacular, museological resources deployed there was a collection of human, normal and pathological, waxes that aimed at producing a vivid impression by fascinating, or frightening, the audience; stereoscopic and tri-dimensional pictures, and *scientific* films were also exhibited in order to impress a healthy behaviour upon the audience; and the selling of popular books devoted to prevention. Such an spectacle not only held the medical authorities support, but the Roca family also claimed its scientific and moral foundations.