Parallel Session 9: Theoretical Framework evolution around PCST

SCIENCE POPULARIZATION AS A STUDY SUBJECT

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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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Parallel Session 9: Framework evolution around Pcst

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

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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 hisorical-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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DIMENSIONS OF SCIENCE COMMUNICATION

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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.

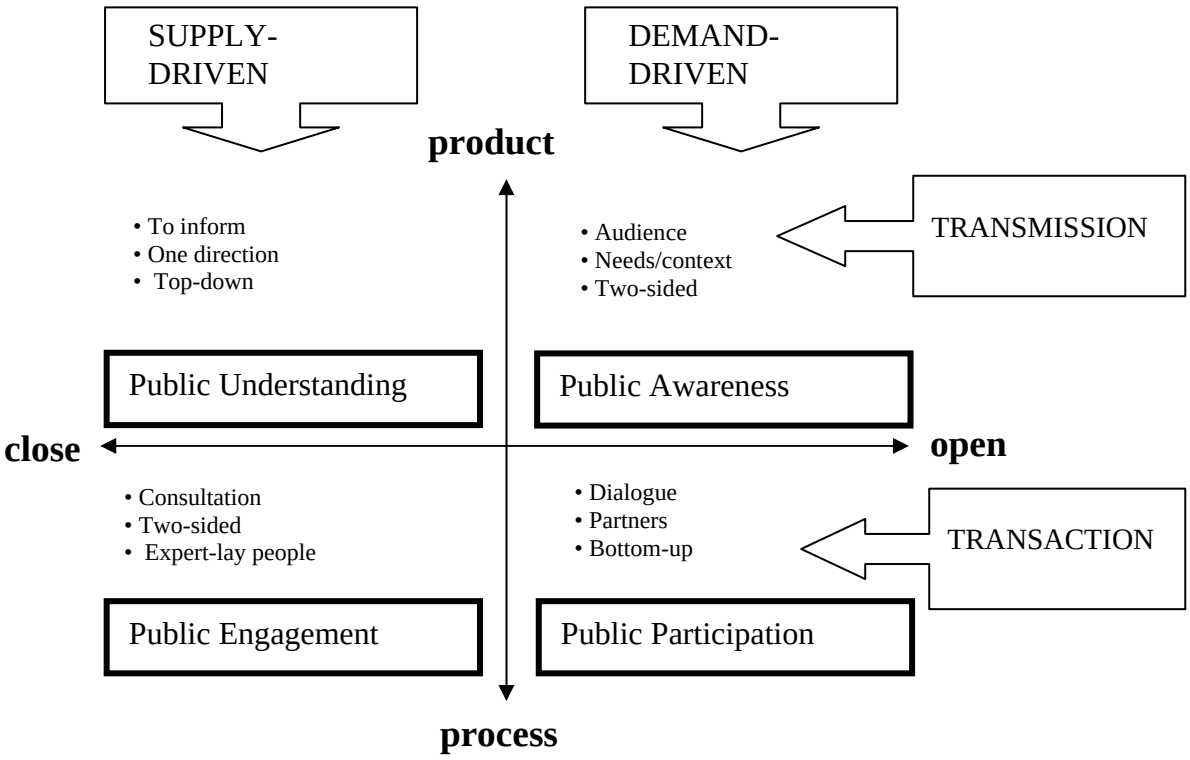

Figure: different Interaction-modes for science communication

All these 4 approaches of science communication are important to build a sustainable relationship between science and society!

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SCIENCE COMMUNICATION AND SOCIAL PARTICIPATION

TO COMMUNICATE SCIENCE FROM THE SOCIOCULTURAL APPROACH

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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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CONCEPTUAL SPACE:
A NEW UNDERSTANDING OF POPULAR SCIENCE

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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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Parallel Session 9: Framework evolution around Pcst

WHEN SCIENCE COMMUNICATION SETS THE AGENDA FOR CITIZENSHIP

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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.

Parallel Session 9: Framework evolution around Pcst

SCIENTIFIC POPULARIZATION: A POSSIBLE INSTRUMENT OF LITERACY IN SCIENCE

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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?