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Review

# Understanding science publics

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## Introduction

Exploring public attitudes towards science helps investigate the images of science and what the social representations of science are. In this regard, science communication plays a crucial role in its different ways of addressing different publics. Unlike communication between scientists, scientific information is often presented to the general public through non-scientific channels. It is therefore necessary to understand how non-specialist audiences and media perceive science.

An increasingly significant number of studies on scientific issues arise from an analysis of how science is perceived by both specialists – scientists, experts, technicians, and so on – and non-specialists, by which it is not only meant the general public as a whole, but segments of the public – such as teenagers, children, those who have a social role, are part of a group or members of a profession.

Thus, many recent studies focus on the image of science and scientists. The social representation of scientists, of their role, of the purposes, methods and results of science is shaped by individual and collective beliefs of our society, relating to the meaning of knowledge, technology, power, and so on.

Moreover, the character of the scientist provides many researchers with a baseline for social acceptance of science, its activities and its consequences. In particular, it indicates how likely people think it is that science will play a role in their life, with regard to their job opportunities, to improvement in their health and wellbeing, to their culture and education, as well as to their ability to tackle general problems.

Lastly, in analysing these images one must assume that science is part of our culture and that it is therefore not important to understand what notions, concepts and statements are shared, but rather what stories, tales, metaphors and beliefs are created. Images of science constitute science's deep roots in society and are studied and analysed by the researchers mentioned in this article. Their studies, however, have different aims, namely to understand the relationship between science and society, to spread the knowledge of new technologies, to fight disaffection from scientific studies, to give a set of guidelines for teachers, to raise awareness about scientific knowledge as a citizens' right, in particular a right of the weaker members of society – children, first-generation immigrants, etc – and so on.

## Four reports on science and its publics

Four reports published between 2000 and 2003 investigate the nature and origin of these deep roots. They give partly identical images of science and scientists, though they have different objectives and analyse different realities. However, they all deal with two main topics: the image of scientists – their work, efforts, social role, etc – and the public's interest in science.

The first two reports (*Science and the public – A review of science communication and public attitudes to science in Britain*[1] and *Europeans, science and technology*[2]) analyse the attitude to and perception of science among British people and Europeans respectively. Their aim is to describe the relationship between science and society: the first in order "to start a consultation process amongst the science communication community regarding priorities for future activity", the second to understand to what extent Europeans feel informed, what level of confidence they have and what causes young people's lack of interest in scientific studies.

The latter is also one of the objectives of the report *Scienza, un mito in declino?* (*Science, a myth on the wane?*')[3], which compares the Italian and French educational situation. The fourth report, *Science for the*

 

*children?*, [4] also deals with education and analyses the important factors in teaching and learning science and technology.

Analyses of the images of scientists and of public's interest in science also explore how useful science is according to samples of children, teenagers or citizens in general. Typically, of greatest interest to Europeans are the areas of technology and medicine, in which researchers found important gender differences. Instead, if we look at science in relation to personal expectations, it is interesting to study the individual's attitude to and interest in science and, consequently, the 'avowed' information and the confidence (or better, concern) that arise from them.

## Usefulness of science: technology and medicine

It is important to focus on technology, as it is one of the areas of greatest interest to Europeans, together with medicine and the environment.[5] Therefore, most of the respondents associate mainly science to technology and favour scientific research primarily if it is aimed at developing "new technologies". More importantly, technology and medicine show great gender differences. Results from the Sjoberg study suggest that girls are more person-oriented, while boys are ego-oriented. Biology and medicine enjoy, therefore, higher popularity among the girls, while technology among the boys. The same view is expressed by a 13 year old girl from Lesotho, who gives an example of how children associate science, technology and medicine: [6]

> "I think scientists help people by inventing modern technology, to help the blind to see and the crippled to walk, and to cure diseases".

In broader terms, scientists are highly respected because they make a valuable contribution to society,[7] as science provides more opportunities for the next generation and makes life better for the average person. This is so because scientists can make suggestions to people without being (however legitimately) biased. There may of course be scientists who work to earn high salaries, but they are however attributed a share of social responsibility "as members of society". [8] Another way of viewing the responsibility of scientists is, on the contrary, to disavow it by subscribing to the idea that a scientific discovery is neither a good or bad thing in itself and that what matters is the use made of it. This idea is very widely held by Europeans: 84.4 per cent agree with it.

Results from the project *Science And Scientists* (involving 21 countries) show that children in developing countries have a very positive image of scientists, whereas children in developed countries have a negative and stereotyped image ("the crazy scientists"). In addition, children in developing countries consider science to be more useful for everyday life than children in developed countries. Therefore, children in developing countries express a greater interest in science, while children in rich countries have less interest and are more selective. New technologies may have a key role to play in determining how large this difference can be.

There are also differences in job expectations of girls and boys. While boys hope to "make and invent new things", girls put considerably more emphasis on "working with people instead of things". This confirms the gender differences in the areas of biology (together with medicine) and technology. In addition, results from *Science and the public* study[9] show that almost everyone of those questioned was interested in medical and health issues (87 and 91 per cent, respectively), 74 per cent claimed to be interested in technological inventions, and 71 per cent in new scientific discoveries. These percentages are very high if compared with 60 per cent of the same sample with an interest in sport and 48 per cent in energy issues.

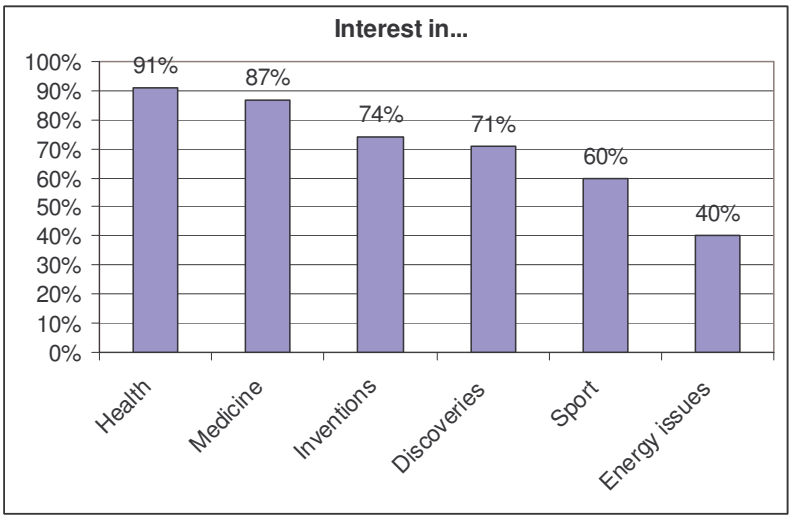


**Table 1**: Interest in different issues.

## Girls and Boys, two different views

Another point to be raised concerns the 'gender question', namely the attitude of girls and boys towards science and the differences in how they identify with scientists and how they perceive the (positive or negative) role scientists can play in their life. Results from Svein Sjoberg study[10] seem to indicate, on one hand, the large difference in interests between girls and boys and, on the other, that a higher degree of "gender equity" is strongly related to equal opportunities – of work, learning and, more generally, care. Gender differences on this aspect are rather small in Scandinavian countries and greater in developing countries.

Gender equity is of course a deep-rooted cultural phenomenon. Therefore, a change in education is not sufficient to narrow the gap between the two genders. In the *Scienze, un mito in declino?* research, it is stated that "girls, who outnumber boys in the educational system, did not change their traditional attitude towards science".[11] In the Italian and European secondary schools and universities, girls increasingly outnumber boys, perform better and finish their studies in a shorter period of time – but still very few of them choose science and technology studies. The study confirms that their own perception and image of science play a major role:

> "The ideas about disciplines young people are going to study at university may arise from their previous knowledge of the subject, from their 'passion' for the subject at school and from the chances they think they have of completing successfully their degree. These elements, based on previous school experiences, are combined with public 'images' of the disciplines". [12]

## Behaviour, attitudes and interest

Public perception of science is one of the main background elements of science communication. Dialogues between scientists, between scientists and the public or between non-specialists are related to an individual's attitude to science. This attitude represents the context in which people gain access to information on new sciences, evaluate it and examine its implications. Therefore, an 'engagement model' of science communication – a two-way dialogue between specialists and non-specialists – is more appropriate than the 'deficit model', which just gives people more information about science.[13] This thesis is backed by the so-called "Japanese paradox": [14] pupils who come out on top on most international tests on scientific knowledge show a low interest in science. In Sjoberg's report,

affirmative answers to the question “Science is: interesting, exciting?” were, on average, more than 60 per cent, compared with only 30 per cent in Japan.

The favourable perception of the benefits that science and technology bring indicates the strongly held belief that science has a positive role in our society. Nonetheless, people want to feel better informed on research contents and results. For instance, the Euro research shows that the degree of knowledge and information possessed is not accompanied by the same level of perception. In the analysis, a question of “avowed” comprehension was followed by a second series of specific questions on topical scientific subjects – such as ozone layer, GMOs, mad cow disease, and greenhouse effect – to which interviewees did not give a correct answer, thus showing the discrepancy between real and avowed knowledge.[15]

**Avowed information and concern**

It is interesting to combine results about information and interest, as in the following table: [16]

| | |
|---|---|
| Informed and interested | 29,1 |
| Interested but not informed | 14,7 |
| Neither informed nor interested | 45,8 |
| Other | 10,4 |

Europeans state that they are often poorly informed about science (see also the Wellcome Trust study).[17] Television remains the preferred medium for obtaining information on scientific developments, in particular on the two areas of greatest interest, medicine and the environment. The preferences for the other media hardly vary from one country to another and are arranged in such order: written press, radio, school or university, scientific journals, and the Internet:[18]

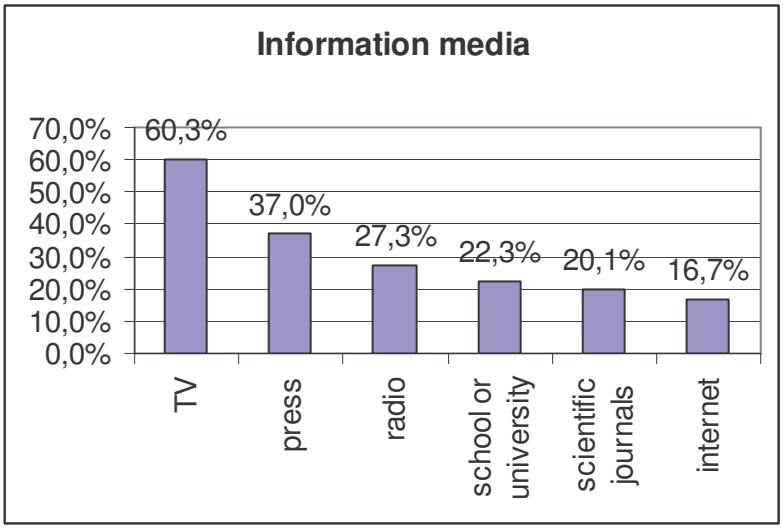


**Table 2:** Information media.

The European public perceives the consequences of scientific research in a highly diverse way with scientific activities being credited for preventing disasters, improving daily life and increasing knowledge. Science and technology are not considered a panacea for a series of problems, but this is unimportant, as a large majority of Europeans favours basic research even if “it only helps knowledge to progress”. Complete confidence is, however, given to science: in the case of a “disaster in your

neighbourhood or district", the public places most trust in scientists. Furthermore, the three professions held in the most esteem are those with a scientific or technical dimension: doctors come first (chosen by 71.1 per cent of respondents), followed by scientists (44.9 per cent) and, in third place, engineers (29.8 per cent, data from Eurobarometer).[19]

Nonetheless, today's society is facing a scientific vocation crisis. This lack of interest in scientific studies and careers is attributed to a complex series of factors: young people, (real and avowed) scientific knowledge, school, university, research, and so on. The analysis of these factors requires a multidisciplinary approach. Psychology describes young people's incapacity to plan for their future. Sociology describes the deep changes in working conditions, in particular with regard to academic disciplines. History describes the context in which cultural traditions evolve. However, key questions are: how did ideas about science change? What are the widespread images of science and knowledge? How is the relationship between science and daily life seen? This highlights the important role played by public perception of science in the scientific vocation crisis.[20]

According to the Italian data, concerns raised over job opportunities are unfounded, as science graduates have more opportunities than any other graduates – 19 per cent against 26 per cent of graduates in other disciplines – and enjoy higher job satisfaction thanks to greater job security, high salaries and the possibility to use their acquired knowledge.

As job opportunities are not a cause of concern, Mariano Longo suggests that one cause could be the incapacity of young people to plan ahead in choosing their education and knowledge. So "students take longer to complete their degree" [21] because of unclear vocational guidance and uncertainty about what to do after university. It is the other side of the scientists' work, characterised by efforts and willingness to make sacrifices.

According to Sas report, scientists are still believed to have a good job, in that it is exciting and leaves time for family, friends and hobbies. However, the report also states that scientists "work hard long hours every single day for a whole week", "their work is dull and boring", often "dangerous" and "destructive" and "it may even cause damage". [22]

The Mariano Longo and Sjoberg reports indicate that culture and local environment influence to a great extent children's and young people's perceptions of science and scientists.[23] Their ideas and beliefs mostly arise from the cultural context in which they grow up and which they mirror. Prejudices, feelings, ideals and values as to these topics may be even more important than pure cognitive factors. It is possible to do so only by adopting different approaches to young people – different from the 'subtractive' approach of measuring the degree of their scientific knowledge. Hence, it is important to study scientific culture not just within science itself, but in the broader social dimension, where representations of scientists, of their role, purposes and methods, of the results and people's expectations are included and created.

## Notes and references

[1] *Science and the public – A review of science communication and public attitudes to science in Britain*, Office of science and technology – The Wellcome Trust, October 2000.
[2] *Europeans, science and technology*, Eurobarometer 55.2, European Commission, December 2001.
[3] T. M. Longo, "Scienze, un mito in declino?", *bollettino dell'Associazione nazionale insegnanti scienze naturali*, XII, numero speciale, estate 2003.
[4] T. M. Longo, "Scienze, un mito in declino?", *bollettino dell'Associazione nazionale insegnanti scienze naturali*, XII, numero speciale, estate 2003.
[5] *Europeans, science and technology*, Eurobarometer 55.2, cit.
[6] Svein Sjoberg, *Science for the children?*, cit.
[7] *Science and the public*, The Wellcome Trust, cit.
[8] *Europeans, science and technology*, Eurobarometer 55.2, cit.
[9] *Science and the public*, The Wellcome Trust, cit.
[10] Svein Sjoberg, *Science for the children?*, cit.
[11] T. M. Longo, "Scienze, un mito in declino?", cit.
[12] *Ibidem.*
[13] *Science and the public*, The Wellcome Trust, cit.

[14] Svein Sjoberg, *Science for the children?*, cit.
[15] *Europeans, science and technology*, Eurobarometer 55.2, cit.
[16] *Ibidem.*
[17] *Science and the public*, The Wellcome Trust, cit.
[18] *Europeans, science and technology*, Eurobarometer 55.2, cit.
[19] *Ibidem.*
[20] T. M. Longo, "Scienze, un mito in declino?", cit.
[21] Va detto che quest'affermazione descrive la realtà prima dell'introduzione delle cosiddette lauree brevi. Non sono ancora disponibili dati relativi all'ordinamento al momento vigente in Italia.
[22] Svein Sjoberg, *Science for the children?*, cit.
[23] *Ibidem*, and T. M. Longo, "Scienze, un mito in declino?", cit.