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Science Communication beyond the Standard Model: Selling Magic or Catalysing Cultural Growth ?

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Abstract. We discuss the limits of what is considered today the standard model of science communication, a model which seems more to address the selling of science than to catalyse cultural growth. We also outline the main features of a new model, in which science communication is not viewed as a top–down process, but rather a forum where to discuss the processes of science, its fundamental methods and its deep cultural implications.

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1 Introduction: the standard model

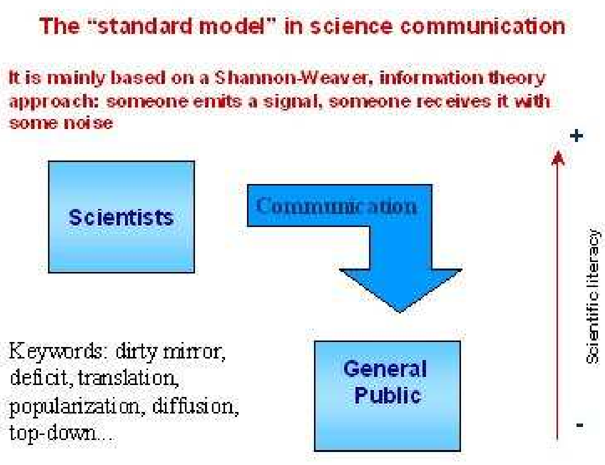
What we like to define as the "Standard Model" of the public communication of science began to develop in the second half of the nineteenth century, gained a clear structure in the first three decades of the twentieth century and dominated until the nineties[1–3].

Roughly speaking, the model tends to describe science as a compact social (and epistemic) corpus, largely separated from the rest of the society by a kind of semipermeable membrane: information and actions can flow freely from science to the rest of society (through the application of technologies and the spreading of scientific culture), but much less in the opposite direction (through science politics, or the influence of sociocultural events on science). The public communication of science becomes, then, popularisation: an action of in-forming, an action that is substantially wide-reaching, unidirectional, following a top-down approach, aiming at conveying the facts and the discoveries of science by translating complex terms and notions into simple ones.

From this point of view, science communication is just a "dirty mirror": the mere outpouring of some scientific knowledge, that inevitably becomes more or less approximated, degraded, no longer rigorous as a scientific message should be. From a Shannon-Weaver point of view, some information is lost because of banalization and "noise" introduced by the communication channel and by the public's limited ability to understand (see fig. 1).

We also like to call this approach the "Prometheus model" (see fig. 2), remembering how William Laurence, one of the first science journalists in the history, described the work of science writers in the 1930s:

Fig. 1. Schematic representation of the *Standard Model* in science communication



True descendants of Prometheus, science writers take the fire from the scientific Olympus, the laboratories and the universities, and bring it down to the people.

In the next section we briefly discuss limits and inadequacies of this model. The last section is devoted to an outline of the main features of a new science communication model, which is at present intensively investigated by a number of research groups.

Fig. 2. Prometheus bringing the fire to mankind: a good metaphore for science communication ?

Fig. 3. Prometheus punished by the Gods

2 Limits of the standard model

The Standard Model is, therefore, a subtractive, "deficit model", that tends to find communicative actions not so much on the skills, the beliefs, the needs of the public, but rather on their cultural and cognitive voids, whether they are merely hypothesised or measured. It is a good zero-level approximation, but has, at least, three big problems:

1. the fate of Prometheus is definitely not a happy one, at least from the science communicator point of view (see. fig. 3);
2. the model doesn't reflect the real mechanisms of science and of science communication today: osmosis between science and society are much more complex and cannot be predicted nor understood using the approximation given by the Standard Model.
3. the standard model has several practical and strategical drawbacks.

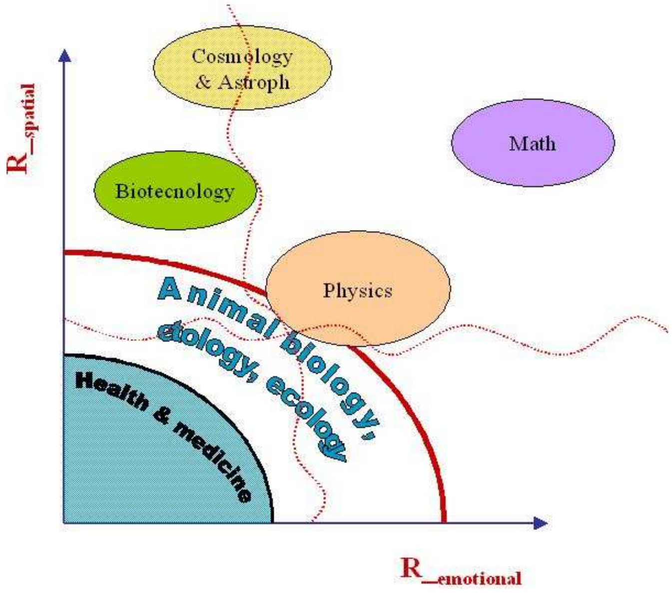
The first two points were studied and discussed by several authors, and over the last twenty years the model has been enlarged, redefined and has also been criticised radically: on the one hand, through mass communication theory, cognitive psychology and pedagogy, we know that *the public* is not a homogeneous and passive body, a sort of tabula rasa needing in-forming and shaping through a *hypodermic* or *silver-bullet* output of information. It is, in fact, a community of people with different interests and skills. It is an active subject, which can use (or reject) and reinterpret the information it receives, interact with it and negotiate its meaning[4].

On the other hand, over the last few decades, sociology, history and philosophy of science gave an increasingly polychromatic view of the scientific institution, showing that it interacts radically with other social institutions, and has many different, complex and bi-directional osmoses with the rest of culture[5].

As a consequence, especially in very recent times, traditional top-down programmes to raise scientific literacy and awareness in the community have been repeatedly criticised and several modifications have been proposed [6–12]. Various scholars have begun tackling the issue of how the public communication of science can accompany traditional transmission methods (*one-up versus one-down* methods) with new ways of interaction: the key words in this context have become *interaction*, *engagement*, *bi-directionality*, *involving communication*, *debate*.

In this paper we want to focus also on the third point: a problematic consequence of the social transitions in science and science policies, as well as of the top-down model

Fig. 4. Emotions versus closeness to our life. Things that people feel closer in space–time or in the emotional sphere can be communicated more easily. $R_{spatial}$ indicates the distance of a scientific sector from our needs. $R_{emotional}$ measures its emotional distance.



in communication, is that one feels forced to *sell science*, camuflating it with its technological applications. If we study genetics, we feel ourselves forced to say that we discovered *the gene of X*, and that it will give us *the therapy for illness Y*. If we study wave-function collapse, we say that it will be useful *to make super-computers*. If we study photons, is *to develop new cryptography* or for a *teleportation machine*. And so on.

Of course, this seems to be useful from the strategical point of view: attention and memory are strongly linked to emotion, and emotion is best stimulated by things or concepts that we feel *close* to our life, as pictorially shown in fig. 4. Instead, this strategy has several strategical drawbacks:

1. It doesn't show that the primary output of science is knowledge and culture, rather than technology and applications.
2. It doesn't show that science has several non-instrumental roles: it's against authority principle, it follows a democratic rational thinking, etc.
3. People could think that the science is worthwhile receiving money because (and only because) it gives back applications.
4. It focuses more on beautiful facts than on difficult and slow processes, on discoveries instead of hypotheses. Doing so, it depicts an image of science very similar to magic. And magic can be fun and can be dangerous, it can be interesting but it seems also unreachable: anti–science is the other side of the coin of spectacular science.

3 Beyond the standard model

Standard Model, then, is not enough. We need to consider not only deficits, but also beliefs, goals, needs, attitudes of the public. Facts and notions are not enough: we need processes, context, social meanings of scientific discoveries. To know "what" is being studied or discovered is not enough.

We need to know how, why, in which situation. We can show technological and practical output of science, but being proud also of its non-instrumental roles.

A popularisation of science which builds a temple and adorns it with the brilliant beads of discovery, invention and progress, should today go hand in hand with a communication that is also a forum, where one can discuss the processes of science (tormented, rather than linear), its method (still evolving), its deep cultural implications and its social, ethical, political, often controversial, sides.

Science as an institution seems to have realised that internal communication among scientists is fundamental for science[5]. In fact it is more than that. Communication to the public has also become a necessity. Not only for the public, but for the science itself too. Interesting research work along this direction can be found in the new, on–line, peer–reviewed journal *Jekyll.com*[13, 14].

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