

Extended abstract

SCIENTIFIC INTEGRITY AND SCIENTIFIC CULTURE:
TELLING THE TRUTH TO THE PUBLIC

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Science – the discovery the human being has been making of the world around him and of himself - is one of the most demanding human endeavours. Along the history scientists have always tried to find and discard errors in their statements about the world and men. They are therefore very sensitive to the error, to all kinds of errors, and they know that truth may only be achieved in a continuous and progressive way. Although truth is and has always been a mere ideal, in many practical cases it is relatively easy to recognize the lack of truth.

The scientific method, where peer review plays a determinant role, has been created and improved precisely to accomplish the mission of science in the best possible way. It has accomplished a lot: it is never too much to emphasize its power: in fact, society has completely changed after the Scientific Revolution and this is justified by the simple fact that we may live better in a world we know better. It is hard to live in the dark!

What is the role of ethics? Some essential ethical norms belong to the scientific method. In my view, they are not an external imposition to science but an important element of the scientific method. Scientists may be imaginative with respect to theories but they have to respect facts. Theory has to be adjusted to facts and not the other way around. In the experimental sciences it is clear that Nature is the Supreme Court which announces its decisions in the results of experiments. Any manipulation of data leads immediately to discredit. It represents professional death as it has happened in the well-known cases of cold fusion announced by an English and an American chemists or in the nanodevices announced by a German physicist or, more recently, with the cloning research done by a South-Korean doctor. Moreover, the creation and dissemination of science discoveries obeys to a set of strict rules: for instance, scientists should be aware of other peoples work and cite it properly.

On the other hand, besides proper research and its publication through recognized channels, scientists have strong duties to the society which commit them their mission: scientific knowledge should be as open as possible so that everyone should have access to the basic teachings of science. Furthermore, the acquaintance with the scientific method is nowadays viewed as a component of modern citizenship. Scientific culture, as the imbedding of science in society, should transmit to the public not only the contents but also the methodology of science.

Now, as ethics belong to the method of science, the disseminators of scientific culture should also convey ethical norms. In my opinion, although the public is much larger, ethical issues in scientific culture are basically the same as in scientific practice. For

instance: respect to the truth and to the others should be shared by the creators and by the disseminators of science. This having been said, it is clear that many problems remain with respect to assuring scientific integrity in practice.

Let us consider the Portuguese case. The situation in Portugal is not, with respect to integrity, much different of that in other European countries. Any differences may relate to the size of the country and to the late arrival of scientific research here. Unfortunately, and despite the light provided by some illuminated people in the past, only recently a big investment has been made in science and technology, allocating to it considerable material and human resources. And I am not aware of any serious case of misconduct in Portuguese scientific research.

At the same time, an important investment has been made to promote science in schools and in society. It is with reason that the Portuguese “Ciência Viva” program has been internationally recognized as a model in science outreach. But Portuguese scientists have been feeling the same difficulties as their foreign peers in the interaction with the public. These difficulties, but at the same time the necessity of scientific integrity in transmitting science, may be better understood with the help of some examples:

- In the much publicized Madeleine McCann case, how to tell to the public the meaning of an 80% match of DNA material and therefore convey the message that science cannot, in general, offer certainty? In fact, people have some trouble with the notion of probability. They would like to have answers in terms of yes or no, when in almost all cases scientific evidence can only offer a probabilistic indication. Of course, to complicate things, the same percentage value has a different meaning in different contexts.
- Recently a radical group defending ecological positions – some called them “ecoterrorists” - invaded and partially destroyed a transgenic plantation in Alentejo. Besides all political and legal issues, the discussion centred, as in other countries, in the danger of genetically modified organisms. How to tell to the public, with limited knowledge in genetics, what is transgenic corn? Is it really dangerous to public health? The public has, in general, a poor notion of risk. People are normally afraid of the unknown. Again they demand from science certainties that simply cannot be given.
- Also recently, controversies have been taking place in Portugal on the construction of a new dam in North Portugal (there are many in the country but one relevant river has not been used for that purpose) and on the construction of the first nuclear power station (there are none in Portugal, in contrast to our neighbour Spain). Again: how to present people the advantages and disadvantages of new energy centrals? Of course scientific aspects are not the only ones to be considered when taking decisions on energy and one of the questions is to disentangle the scientific aspects from the others. Is it that really possible?
- Al Gore has been recently in Lisbon. Portugal, which may suffer the effects of global warming (namely a desertification of the South), has signed the Kyoto treaty and is trying to reduce CO₂ emissions. In a world where global

warming is a hot issue and where a consensual position seem to be emerging about the reality of the human origin of global warming, what can and should be said to public? Here the public is confused by the fact that there is no unanimity in the scientific community (some controversy persists) and that the predictions are based on computational models with big margins of error.

- One of the variants of bird flu, that which is mediated by the H5N2 virus, was detected some days ago in Central Portugal. In a world which is afraid – and rightly so - of pandemic diseases, how to inform people about the different danger of different diseases? How to explain that, contrary to H5N1 (the difference in the name lies only in the last digit), the detected virus is not dangerous to humans, but about 100 000 wild ducks have to be exterminated?

One sees that one of the difficulties of the diffusion of science is to talk or write clear on sometimes very complex issues. People want to know and simple and honest answers should always be given. Uncertainty and discussion belong to science and this should not be hidden. Discussion helps to reduce uncertainty!

Scientists are obliged to tell the truth, although it is impossible to tell the non-existent ultimate truth. It is possible to be rigorous avoiding cumbersome details, which can only be understood by experts.

Science is also largely transmitted by **journalists**: these also have their own code of rules, which in some cases is identical to that of the scientists. Clearly, respect to the truth is a common value. They have to interact more.

Of course scientists are humans and their opinions or acts may be influenced by all kinds of non-scientific pressures. Some people want to use science due to its prestige and it is not easy to disentangle science from the rest. Scientists should remember that they have a strong commitment to science and the scientific method in all cases, but mainly when others factors – political, economical, journalistic, religious, etc. – are at stake.

In science research as well as in science outreach, the scientific community has been the best keeper of integrity. Everyone in that community is looking for errors. Also the public, knowing the scientific method, is looking for errors and may get some.

To conclude, and although we can and should do better - in particular, schools can do better! -, I do not see the need to make big modifications in a self-regulated system, which, after all, has been working well.