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Science, Society and Democracy

Freedom of Science as a Catalyzer of Liberty

Gilberto Corbellini

*Professor of Bioethics and History of Medicine,
Sapienza University of Rome*

Elisabetta Sirgiovanni

Research Fellow in Neuroethics, ISGI-CNR

Contemporary international political debates pick out a sort of tension between modern science and democracy which have been summarized as dilemmas between the symbolization of liberal-democratic values starting from the view of scientific community as an ‘open society’ (Popper) or ‘Republic’ (Polanyi) and the challenges of these values through scientific exclusivism and elitism. The caricature of science and technology as enemies of society gave rise to worldwide instrumental political interferences into the governance of scientific research that have been defined as ‘epidemics of politics’.¹ During the last two decades, a series of manipulations and censorship of scientific information has become quite frequent and peculiar in Italy.

The idea that science might lead to an illiberal and technocratic society emerged as a consequence of the philosophical wars during the past half a century between two opposite trends often featured as *scientism* (which came to be a negative epithet and that is why *naturalism* is often preferred), according to which science is a value-free inquiry becoming political only in its application, *vs. relativism* which sees science as value-driven in terms of political power and interest. Such a representation translates a cultural and cognitive conflict between scientific expertise and *folk* intuitive skepticism about its limits. The unsuccessful or limited use of scientific expertise in public life depends mostly on the increasing specialization of sciences and their complex languages. Nevertheless this is not all of the story. The ‘continual struggle between the expert and [...] the common man’,² which philosopher Otto Neurath had identified as characteristic of democracy,³ is almost always influenced by the social conservative functions of those religious faiths, philosophical views and political party lines, which are opposed to liberal values and implicitly

or explicitly take empirical sciences, which produce knowledge and technique that expand human individual wellbeing and self-determination, as a threat to society and democracy.

Scientists working in different countries recently expressed their positions to appeal to scientific freedom over illiberal science policy. Since October 2004, the Italian '*Associazione Luca Coscioni per la libertà di ricerca scientifica*' promoted the *World Congress for Freedom of Scientific Research*. Three International workshops about the main political and religious controversies to limit scientific research freedom have been organized in 2004, 2006 and 2009. Since the *World Congress for Freedom of Scientific Research* arose in Italy as a reply to the assaults against freedom of science raised by the Catholic Church in the use of medical reproductive biotechnologies, mainly it dealt with the issue of the Italian and international controversies over religious censorship in Western countries with regard to embryo and embryonic stem cell research.⁴ Under the George W. Bush administration, also the United States experienced several instrumental political interferences, and several politicians, associations, scientists, and scientific journals raised their voices against what was happening in the United States.⁵ Current President Barack Obama built his electoral campaign in part by advising that he wanted to change the attitude of the US administration toward science in general and more specifically to allow the scientific investigation on human embryonic stem cells.⁶ Appeals for scientific freedom produced positive outcomes in the United States⁷ but deafness in Italy, a country where the situation concerning science literacy and the freedom of research (as well as the freedom of individual choice) has become more than just worrying.

The idea that science poses threats to democracy and personal freedom is a disturbing misrepresentation being spread above all in the Western world, especially since the 1960s. This idea considers religions and aprioristic philosophies to be the main cultural and political defenders of the true and special human nature under the concentric attacks of techno-sciences, and it was the cause of the increasingly controversial and conflicting relationships between society, politics and science. In this paper we will demonstrate how the history of political and economic freedom in the North-Western hemisphere shows the potential of science for democracy. The Italian case will be taken as an illustration of the dangerous outcomes of espousing the contrary view. So we will defend the right of scientific research, and argue that democracy can only benefit from the dynamics of scientific production.

The view we will defend in this paper is quite different from the one espoused by the sociologists of science who have been analyzing relations between science and society in order to frame policies about science in constructivist terms⁸ or in deliberative democracy terms⁹. Those approaches set aside contemporary empirical knowledge on cognitive *biases*, which bar or influence individuals who have not got adequate levels of science literacy in the access to the scientific

procedure functioning or in the assessment of technological innovation. In brief, newfangled sociological approaches play on ideas about the relations between scientific procedures and other dimensions of socio-economic-political reality. Those relations are a-historical and decontextualized. Therefore they turn out to be misleading for the understanding of the functioning of socio-psychological dynamics, which canalize policies about science in concrete reality.¹⁰

We are not defending the ingenuous view that 'if science were left alone to speak truth to power [or to citizens, one could add], it would exercise a purifying magic on the miasma of politics'.¹¹ However, the prevailing ideas among social scientists, that science must simply be 'socially robust' and it will necessarily be 'politicized wisely' is quite an idealistic one. So we are not asking for a technocratic political decision system, but we think that scientific methods and sound data should represent the solid foundations on which to build the social transactions or trade-offs that in complex societies are necessary to share risks and benefits resulting from science and technological innovation, according to the different preferences distributed within a society. Moreover, it is an empirical fact that science appears more socially robust in those countries, such as for example in Scandinavian, where the level of scientific literacy is higher.¹²

Science on Western trial

It is quite paradoxical that, wherever people's wellbeing has greatly increased thanks to scientific and technological progresses, distrust and cultural opposition towards science and scientists are also very common, especially in Western countries. Periodic surveys on public perception of science – especially the Eurobarometer surveys, which allow analysts to compare public expectations of scientific research within the more and less affluent European countries – show that there seem to be greater worries towards science and its consequences just in those countries where social wellbeing is more widely spread and where good quality science is produced. The citizens of those countries tend to focus more on the limits of science than on its potential and they believe that scientific progress dangerously alters those natural balances which are necessary for true human and environmental welfare.¹³

Current political controversies over scientific and technological advancements demand a new kind of strategy to question or manipulate science's authoritativeness. It is no more possible to question science by appealing to magic or spiritual arguments. So there are two sleights of hand to question science when politically or morally controversial issues are at stake (for example abortion, in-vitro fertilization, stem cells, nuclear power, GMO): one is saying that scientists disagree or that they are 'split' as far as the soundness or usefulness of a new innovation is concerned; the other is objectifying anti-science against the idea of science as generating universal knowledge.

The role of the media is crucial in boosting the common sense misunderstanding of science epistemology. In their effort to dramatize even the scientific debate, journalists usually present scientists as having contrasting visions on a given controversial issue, or they compare empirically established theories with theories that try to prove themselves by diverting the debate on an ideological level. Normally, in the media the tentative and provisional – but evidence-based – characters of scientific explanations are misrepresented as epistemological limits, while the illogical and populist demands for definitive answers or certainties are instrumentally emphasized. A relevant and somehow recent aspect of these attacks against science and scientists is the manipulation of science by some scientists that often cynically contribute to circulate misleading information or endorse interpretations instrumental to religious or ideological biases.¹⁴ Both dispositions are consequences of a recurring *bias* in Western countries that consists in seeing science and its universal knowledge as static, despite the huge amount of evidence showing that science is a dynamic enterprise.

Yet in economically and socially less advanced countries, expectations towards science are indeed more optimistic. At the beginning of 2011 *Nature* announced the Tunisian scientists' rejoicing for the occurring revolution in terms of free thinking and innovation.¹⁵ Obviously, in this and in more disadvantaged contexts the impact of scientific progress on people's wellbeing is more tangible as it provides the opportunity to go beyond the typical constraints of a nature-dependent life. However, the development of an internal political and cultural environment to promote investment in scientific education, basic research and innovation is a difficult goal to attain for these countries. Also, their development still relies heavily on the import of technology from 'advanced' countries, a condition that cannot help these countries move spontaneously – thus more firmly – towards democratic forms of government.

As a matter of fact, attitudes toward science and technologies in Western countries are heavily inclined to positively and quite uncritically address scientific achievements when they produce advantages, especially in terms of health improvements. See as a paradigmatic example the public attitudes of European citizens toward genetic testing, that was evaluated as very useful, not risky and morally acceptable.¹⁶ On the other hand, criticisms arise when scientific progress does not immediately yield perceived functional implications or when it happens to contrast with embedded ideas of the local cultural anthropology or with what is intuitively conceived as safer, if not sacred (see debates about public attitudes of European citizens towards agricultural GMO, that are perceived as useless, risky and morally unacceptable, or over the access of non heterosexual people to assisted reproduction technologies, which is assumed to be unnatural and therefore immoral). The implicit or common sense idea of 'nature' is becoming increasingly important in the cultural and political definition of some ethically controversial issues arisen by the discourse over the possibility for scientific progress and its technological applications

to improve the human condition, and on the related potential risks inevitably intertwined with any technological innovation.

From a historical perspective, scientists began debating the political issue of scientific freedom more than sixty years ago. Initially within the British scientific community that attended the controversy between the influential Marxist interpretation of the social function of science and a movement led by Michael Polanyi and opposing the politically functional view of science, which established in 1941–1942 the Society for the Freedom in Science.¹⁷ Moreover, in the aftermath of the Universal Declaration of Human Rights and within the activities promoted by UNESCO to communicate principles and values established in the 1948 Declaration, scientists raised the issues that the emergence of totalitarian regimes between the two world wars had severely threatened scientific freedom in terms of an increased dangerous intervention of the State and politics into the organization of scientific research.¹⁸ The conclusion which the debate came to was summarized by astronomer Bart Bok in 1949: ‘Freedom of science cannot be maintained unless in the presence of a positive climate in world opinion.’¹⁹ That is like saying that scientists must commit themselves to communicate to society that freedom of research is fundamental to achieve scientific and technological progress. That is why during the past half a century scientific communities became increasingly involved in science communication and in spreading the view that science relies on the best tools invented so far to solve problems in controlled and reproducible ways, or to increase the understanding of the natural phenomena. Unfortunately, results were fragile and uncertain. Science and scientists regularly face problems whenever new frontiers of knowledge open up but contrast, at the same time, the most popular and intuitive beliefs. As a consequence replies to defend such beliefs consist in joining either philosophical relativistic views (‘there is no scientific truth since there is no truth at all’) or religious dogmatic positions (‘science leads to evil when it goes against God’s precepts’).

In the 1960s and at the beginning of the 1970s a number of prominent scientists were pondering the impact that the new biomedical knowledge and technology could produce on society and on the public understanding of science. Prestigious researchers such as Jacques Monod, Joshua Lederberg, Francis Crick, Peter Medawar, Salvador Luria, Konrad Lorenz, Jonas Salk, and many others, tried to build a bridge towards human sciences, claiming a cultural humanistic statute for science against the drift of a world of knowledge divided into the ‘two cultures’.²⁰ Among the most important ideas of the time, that the scientific community sadly abandoned in the last three decades, we can see the demand for recognizing an ethical status of scientific knowledge. This claim was based on a tradition of sociological studies, which was theoretically much more solid and plausible compared with the most recent approaches inspired by the epistemological relativism of postmodern sociologists. In the light of the evolution of the relations between science and society Jacques Monod’s

message keeps, for instance, a non instrumental relevance to present – as he recognised it – an ethical choice in the scientist's support to the postulate of objectivity.²¹

In the past three decades, bioethics, postmodern relativist philosophies and humanistic sociological and political views have played a relevant role in trying to confine science and culture in a new totally marginal position within the latest debate about the regulation and the educational strategies which can guarantee and improve the contribution of science and scientists to the citizens' civic awareness and socio-economic progress.²² Inspired by traditional or predominantly anti-naturalistic moral philosophies and above all by medical ethics based on abstractly defined absolute values, bioethics has probably run out of its propellant push.²³ In their turn, science and technology studies (STS), that is the sociological approaches inspired by relativist epistemologies, naturally evolved towards an explicit politicization which is getting very close to an extremist view of science converging with that of the antiscientific political movements.²⁴

The UNESCO people are no longer defending scientific freedom. Obviously influenced by the new climate, UNESCO has issued two documents about bioethics in the last decades, i.e. the *Universal Declaration on the Human Genome* and the *Universal Declaration on Bioethics and Human Rights*. These documents strengthen a negative political and cultural perception of science since in some parts they exaggerate the risks related to genetic, genomic and cell biotechnology research developments which are in fact very minimal compared to the benefits that could be generated with regard to human life quality. This kind of position is voiced in most Western countries in debates on the social impact and ethical implications of biotechnologies. In Italy however, much more than in other Western countries, the attack against research freedom has become prominent and influenced by a series of legislative choices aimed at limiting freedom of scientific research and individual freedom at the same time. Over the last decades Italy has been suffering from a particularly severe form of political interference into various areas of science. This unilateral interference by politics into science deserves to be known.

The Italian nightmare

Italian science has often been the subject of political controversy since unification in 1861,²⁵ during the fascist regime,²⁶ and after the Second World War through the influences of Catholic and Marxist ideologies. The strong politicization and weak objectivity of Italian cultural or intellectual discussions prevented the rise of an autonomous scientific community so that Italian scientists had and still have little or no cultural or political influence. Nevertheless, the situation has been worsening since the early 1990s. Even though most of the political and

legislative attacks against the freedom of research came from Silvio Berlusconi's center-right governments, the interposed center-left governments often did not reveal much more progressive political attitudes, as far as science policy is concerned. Indeed, many factors have come together to make Italian science prey to political influence, including the predominance of non-transparent and nepotistic approaches to the public funding of research, the chronic cultural and political impotence of Italian scientists, and the waning professional quality of the national political and intellectual élites.²⁷

The following are some episodes that occurred in Italy, involving forefront scientific areas and testifying therefore the political reluctance to scientific procedures and evidence in a country where politics and humanities, or social sciences knowledge, counts much more than empirical science or experimental knowledge.

The Di Bella affair (1997–98)

As a consequence of populist media campaigning, a pseudo-cure for cancer called Di Bella Multitherapy (DBM) was provided by several local health authorities to patients despite the absence of any scientific basis or clinical evidence of its efficacy. Instrumentally supported by right-wing politicians and major media, the clinical experimentation of the supposed treatment was approved by the Italian Parliament despite most oncologists' holding the contrary view, and DBM's then being evidenced as therapeutically ineffective in 1999. Some people have died prematurely as a result of the fact that they accepted to enroll – by giving a consent that certainly could not be called 'informed' – in the clinical experimentation, and the Italian medical community got exposed to international scorn.²⁸

Animal cloning: A five-year ban (1997–2001)

A few weeks after the announcement of Dolly-the cloned sheep's birth, the left-wing Government Ministry of Health imposed a five-year ban on animal cloning. The given justification was that animal cloning would have been the preliminary stage towards human cloning, and some leading Italian laboratories that cloned or hold the technology to clone animals for scientific or commercial ends endured police searches by the Italian military corps of Carabinieri.²⁹

GMO research and commercialization boycotts (2000–2005)

In late 2000 center-left Minister of Agriculture Alfonso Pecoraro Scanio tried to legally ban GMO research for food and agriculture. In early 2001 Italian plant biotechnologists and most Italian scientists protested against Pecoraro Scanio's decree that would have banned funding for any plant research involving genetic

modification. The decree was eventually withdrawn as a political move to prevent the opposition from exploiting the dispute. However, when the center-right coalition came to power later that year, the new ministry of Agriculture Gianni Alemanno carried on with a prohibitionist policy against GMO. As a result, research in the field of plant genetics remains virtually devoid of public funds in Italy, and a series of byzantine regulations still prevent Italian farmers from using GM seeds, without scientific evidence of their danger, despite the fact that the Italian law does not explicitly ban their use and that GM crops are imported to feed farm livestock.

Assisted fertilization bad practices and stem cell research prohibitions (2004–2010)

The Law 40/2004 on medically assisted fertilization enacted by the Italian Parliament under the second Berlusconi government limited not only scientific freedom but individual reproductive rights as well, and imposed on Italian physicians the use of a *bad clinical practice* in the field of assisted reproduction, that was strongly criticized by the European Society of Human Reproduction and Embryology (ESHRE). Beyond limiting access to artificial reproduction to heterosexual infertile couples (banning the access to non-heterosexual couples, single people and to couples who want to avoid conceiving a diseased fetus and then undergoing an abortion), this law prohibited gamete donation, cryopreservation of embryos, pre-implantation diagnosis and any kind of research on human embryos aimed at generating embryonic stem cell lines. So in Italy not only the ban of some technique denied safe benefits to sterile couples (as in the case of heterologous fertilization), but also exposed women to severe preventable harms (such as multiple pregnancies and repeated hormonal stimulations). A Referendum in 2005 promoted against this law was invalidated because of the unreached quorum, which was the outcome of a manipulation of the public debate by the Catholic Church. Law 40/2004 supporters adopted the strategy of denigrating the accountability of scientific methods and of manipulating scientific facts, by spreading misleading information like claiming that pre-implantation diagnosis did not work, that the cryopreservation of embryos was not clinically necessary, and that research with embryonic stem cells was pointless because adult stem cells had already proven effective for treating dozens of diseases.³⁰ Finally, in 2009 the law has been revised concerning pre-implantation diagnosis and cryopreservation of embryos, now permitting them under some circumstances, thanks to a series of decisions in the Italian Constitutional Court.³¹ However, embryonic stem cell research is still stopped: in 2009 the Ministry of Health arbitrarily excluded projects involving human embryonic stem cell lines, the experimental investigation of which is not forbidden under the Law 40/2004, from a call for proposals on stem cell research funding.³² As a matter of fact, because of

the political influence of the Vatican and of a widespread science illiteracy, in Italy the research in the field of regenerative medicine is under a tight political control. For example, in 2010 the Ministry decided *motu proprio*, which means bypassing any peer review process, to grant €3 million to a private foundation that announced itself to have created human adult stem cells for treating neurodegenerative disorders.

These episodes, only briefly summarized here, highlight how and why the competitiveness of Italian research on the international stage has been dramatically jeopardized.³³ However, more importantly, they highlight an important issue relating to the procedures in which freedom of scientific research should take place. Among these, it is essential to scientific progress and to guarantee that science improve human condition and that a process of serious public involvement, based on proper information, and peer review, takes place. Since its very beginning scientific research has demonstrated to be safe and useful in those countries that allowed the scientific community to implement internal controls on the results of empirical investigations such as try to reproduce observations or regularly review the accountability of scientists who submit requests for grants to pursue researches.

Maybe few people in Western countries know that in Italy governments allocate chairs of public research institutions and scientific directors in research hospitals and that funding is often granted *top-down* by governmental decree to specific institutes, without resorting to public calls or peer review.³⁴ It is a fact that Italy lacks both an independent agency for research and compulsory, transparent and unbiased selection processes. As such, the risk of political interference depends on guidelines and criteria that determine which research activities receive public funding by the ministries and tend to favor research groups to which politicians often show conflicts of interest.³⁵ Whether or not the Italian circumstances are a mere case of local deterioration of the relationship between science and politics, the scientific community has been largely silent. In the next section we will contrast the ideological view underlying this state of affairs, according to which scientific freedom is a threat for democracy and society.

Science gave rise to liberal democracy: A defense of the right to research

The most relevant feature to be mentioned while dealing with science and democracy is their parallel, firstly as a *historical* one. The achievement of civil freedoms came after the revolution of thought brought about by the invention of modern science. However democracy – as today we understand it – was not *just* born at the time of scientific revolution. Better still scientific revolution actually promoted the rise of democratic values ('The science of Liberty', according to

Timothy Ferris.³⁶) The main mistake shown by those who highlight a tension between the two is the oblivion of the *causal* relation which went from the rise of modern science to the rise of modern democracy itself.

The idea of representative democracy as equality under the law and in the access to power arose with modern science and took place not before the late Enlightenment, spread by the American and French Revolutions. Even if the etymology and concept of democracy had their origins in Ancient Greece and developed in Ancient Rome, those systems were not democratic in the present meaning. Among the missing features were exactly modern science ideals in terms of scientific method foundations such as reproducible experimentation and the peer review process. Ideals that translated in political terms mean anti-dogmatism, critical thinking and anti-authoritarianism for all of us.

Today the values of democracy are being exploited to distort science and its public perception, and in this way the grave of democracy itself is being dug. Scientific culture and education, as fathers of modern democracy from Spinoza to Thomas Jefferson understood, are the source of the fundamental values of democratic life. This also means that promoting scientific education and culture – that is, exporting science – is probably a much more effective, as well as less violent way, to spread well-being and democracy in the countries where they are still lacking.

At a political and social level few seem to understand that to preserve what has been achieved so far in the Western world scientific research must progress. The reason is retraceable in history, by looking at the dynamics which allowed science and its technological applications to free a significant portion of humanity from ignorance, poverty and disease. Politically limiting freedom of research by arguing that science is a threat to democracy means much more than a lower productivity of science and technology: it also leads to an impoverishment of the civic sense in the general population, which we can broadly understand as an awareness of having to respect some explicit social rules in order to better enhance individual freedom. Indeed, scientific information and education have a key role in the preservation and development of a clear perception that Western wealth depends on the superiority of constitutional or liberal democracy as political and economic value system. Admittedly, supposed tensions between science and democracy are also likely to be consequences of the poor impact of all the rational arguments presented in the last decades to refute prejudices against science in favour of the relativist ‘demonizers of science’. It is to be thoroughly considered that the neuropsychological traits we possess because of our evolutionary origins may have a role in the general attitude to refuse or regard science as threatening to human dignity and democracy. In fact, if science is uncommon sense,³⁷ and also democratic values are in some ways unnatural,³⁸ it could be quite difficult for people who are illiterate about scientific epistemology and human socio-psychological nature to catch up with the tight connection between scientific and liberal thinking.³⁹ After all, in recent

years cognitive and evolutionary psychologists along with neurobiologists have indeed been competing to highlight the limits of our much praised rationality.⁴⁰ Nonetheless modern naturalistic or scientific thought provided conditions to develop rational behaviours leading to the emergence of democratic forms of social organizations. In fact, adequate education fosters the level of individual autonomy needed to fully appreciate the advantages of freedom and self-determination. Consequently, underperforming educational systems, especially in the scientific training, which are typical of countries where education is led or influenced by religious institutions, do represent a relevant risk factor. That is the case in Italy where science literacy remains poor and debates' results are influenced by Vatican positions or by left and green technophobic ideologies. Sometimes in other contexts this may combine to maintain or to bring about totalitarian regimes and anti-scientific movements.

At present the ways religions or political ideologies confront themselves with science has become more complex. In other words the recallings of Galileo or Lyssenko stories as representative of science freedom censorship and antiscientific orthodoxy in general, turn out to be no more eloquent or effective in addressing the issues concerning the autonomy of science in the era of big science and knowledge-based economies.

Science and scientific culture have historically faced many hurdles throughout the modern and contemporary age. Such history shows repeating trends, like the anti-authoritarian and anti-traditionalist nature of science as a triggering factor of conflicts. Political, religious and cultural opposition thwarted scientific progress when it challenged cultural beliefs or grand visions favouring the acquisition of socially normative values, or when it had an impact on embedded cultural customs.

What should be clear is that science and democracy are not 'natural' needs. As human inventions they are products of a social evolution through cultural and economic processes. Besides they are interlaced enterprises. Since cultural developments do not integrate in the genetic heritage of species, with every passing generation some achievements may also get lost, especially in terms of capability to communicate the importance of both democracy and freedom of scientific research to society and to political actors. The advantages of being free to discuss everything and of not considering freedom of thought as an anomaly to retrieve, matches the role of science in society in terms of a lack of censorship and exploitation for illiberal plans, which happens only in totalitarian regimes. That is why the political exploitation and censorship of science endanger democracy itself. Scientists are called to protect not just scientific freedom, in order to guarantee the survival of science within society. They also have a higher duty, as they are called to safeguard the cultural conditions for the survival of democracy itself.

Given the view we are defending, it would be interesting to discuss Martha Nussbaum's thesis that liberal democracy needs the teaching of humanities,

because such disciplines help students learn critical thinking and how to understand others, including others who are quite different from themselves.⁴¹ We definitively disagree with Nussbaum's view, and think that modern cultural tools that help students to learn critical thinking and develop the capacity for tolerance are humanities plus scientific literacy. Humanities alone are not enough to protect or promote liberal democratic values. As a matter of fact, most attacks to those scientific and technological advancements which allow people to amplify their individual choices in emotionally laden events like reproduction, illness and death, come from religious, political and philosophical doctrines. In other words from intellectuals who are mainly educated in the humanities. In order to provide bad reasons to control scientific research, cultural and religious oppositions to science play philosophical tricks. Mostly they confuse science and technology. Freedom of scientific research does not correspond to bad applied science being imposed on society, but means a more effective possibility of finding limitations to some applications during research, which will improve safety technology. Besides these views in their relativistic expression aim to persuade people that political pluralism is threatened by science, which is not ontologically pluralistic (over *facts*). Yet they obscure how political pluralism and science belong to different domains and pertain to different kinds of investigations (normative *vs.* descriptive) over different objects (values *vs.* facts), and that at the same time science can provide tools to rationally deal with both.

Do we also have some reasons to be optimistic? Conceptual and methodological progresses of neurobiological, psychological and evolutionistic research offer considerable opportunities for science to gain a more functional and constructive relationship with human sciences. This is remarkable within the field of *neuroethics* where the most original and important developments do not originate from the so called reflections on the *ethics of neuroscience*, but from the *neuroscientific studies of ethics*⁴² aimed at empirically investigating the origin and the physiology of human morality, also from the social psychology and evolutionistic point of view.

There are ways to stimulate a general debate about the freedom of scientific research by taking into account the differences. That is firstly scientists' duty. Those who are involved in scientific careers and institutions promoting science and its cultural implications should commit to socially useful values as a means of diffusion of individual freedom, trust and respect among people.

So, as an incidental comment, we would like to point out that the social historian of science Steven Shapin has recently shown how the uncertainties attending scientific research make the virtues of individual researchers more and more intrinsic to scientific work. In *The Scientific Life*,⁴³ he argues that the radical uncertainties of much contemporary science have made personal virtues more central to scientific practice than ever before, and he also reveals how such novel aspects of late modern science have deep historical roots. Shapin's history of the scientific career and character encourages the reader

to reconsider the very nature of the technical and moral worlds in which we live today, and offers reasons to be more positive about the scientific life in our commercialized culture. Against Max Weber, Shapin illustrates that scientific entrepreneurs have, in common with early modern natural philosophers, a sense of vocation, and that their more altruistic ambitions (typically, to save lives) are counted in their favor when venture capitalists decide which business plans to back. Shapin stresses that like business life, scientific life depends deeply on personal relationships of trust. We have learnt from social psychologists that trust is rarely absolute, and in business and science as in most human affairs it is important to also develop a nuanced sense of when and how to withhold trust. For an outsider, however, it is difficult to know how seriously to take the scientists' avowals of intention to do good in the world.

Commenting on the views, especially coming from academic social scientists, that industry is a problematic environment for science, Shapin says that he is 'not at all sure that's right. If we compare, so to speak, apples with apples, and look at the pure research done in industry and that done in academia, many of the most popular contrasts describe the situation rather poorly. If autonomy is the issue, many industrial scientists from early in the twentieth century enjoyed as much of that as their academic colleagues. And the same applies to notions of secrecy and openness. A clear contrast of *quality* between university and industrial science similarly seems not to hold, while a presumption that applied research and development requires less brain-power than pure research is just dogmatic. But most of all, I am impressed that *both* industrial and academic scientists seem to want environments in which they can do *interesting work* and, perhaps, to enjoy a degree of freedom in doing that work. An apparently banal idea, but one which is very widely ignored. Many other commentators have also rightly pointed out that academia and industry have for some time been *converging* in their mores, structures, and conditions for doing science. I agree with that, but I also suggest that there are ways in which some sorts of modern industry can offer more propitious conditions for scientific inquiry than some sorts of universities and colleges. There are interesting implications here for the contemporary tendency to make universities more "business-like": we should have a better understanding of how industry now seeks to manage and motivate creative people. If universities, indeed, now see themselves as managing and motivating creative people, they might have much to learn from high-tech and biotech businesses, and academics might then have little to fear. What worries me is just that administrators' ideas of what it is to be "business-like" misrepresent pertinent business realities.⁴⁴

Scientific diffusion should provide citizens, especially children and adolescents, with cultural instruments to fully take advantage of civil rights, instruments to understand the terms of controversies and acquire the knowledge of the best procedures to deal with empirical problems as well as a way to evaluate scientific information once presented with it.

By declaring freedom of research as a fundamental right of individual researchers the contribution of science to democracy would be clear. How can we make it so? Before suggesting a solution, a further present difficulty about the social dimension of science should be taken into account. A couple of decades ago, some experts on the relationships between science and politics highlighted a problem that sees journalism playing a growing role within the prescriptive credit of political action and shortening this way the temporal perspective of politics itself.⁴⁵ Maybe journalism only acted as a catalyzer, but it is true that a peculiar aspect of today's political dynamics are very short time frames for the appreciation of any decision's practical outcomes.⁴⁶ This now represents a compulsory requirement also for science to justify its utility considering its great demand for investments. As a result, financing public bodies become very demanding about every research project, in terms of applicable outcomes and technological transfers having the task to solve some economic or social problems. However, this condition has threatened scientific authoritativeness at more than one level, including the reliability of internal professional standards.

In other words, the political perception of science is faced with the overwhelming tendency to assign a '*normative superiority of the present over the past and the future*'.⁴⁷ This kind of attitude surely facilitates the evaluation of the level of reliability with regard to democratic decision making procedures about social and institutional dynamics whose results are rapidly scattered. On the other hand, they also produce a condition of a-historical fallacy that culturally impoverishes science and misleads the perception of its epistemological basis. The a-historical fallacy, which can be seen as a diffused inability to perceive scientific problems within a wide temporal perspective, leading to the understanding of phenomena and a healthy sense of modesty in scientists, has become a chronic condition for scientists and a large part of the population making use of scientific information in different ways.⁴⁸

Most experts debating the reasons for the fall of scientific vocations, the students' inability to understand how to scientifically face a problem plus the poor quality of scientific education, believe this fall to be due to the correlation between scientific education or communication and notions and facts.⁴⁹ There is a lack of cognitive tools to generate and assess scientific tests and explanations leading to a deeper understanding of the nature and development of scientific knowledge and a constructive participation to scientific communication and issues.

Sciences' communication and teaching should aim at improving young people's awareness when they are still in the course of their active cognitive development, that human judgments are '*naturally*' *biased* because of the shortcut heuristics that biological evolution has wired in our brains.⁵⁰ Such an approach would be of a fundamental importance in providing the useful tools to appreciate the liberating value and effectiveness of scientific rationality, that is to say to make emerge a sense of autonomy and self-determination in individuals.

Conclusions

Scientists must become aware – and make Western citizens aware – that, for historical and other reasons depending on the behavioral predispositions of our species, freedom of scientific research and advancement of scientific knowledge and methods are among the essential requisites (together with others, of course) for the democratic functioning of political and social systems. Science provides individuals with autonomy, self-determination and critical thought, which are the basis for protecting democratic thought and political pluralism. This is exactly what we mean when we say that freedom of science *means*, rather than threatens, democratization.