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ORIGINAL PAPER

Why Science cannot be Value-Free

Understanding the Rationality and Responsibility of Science

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Abstract Against the ideal of value-free science I argue that science is not—and cannot be—value-free and that relevant values are both cognitive and moral. I develop an argument by indicating various aspects of the value-ladenness of science. The recognition of the value-ladenness of science requires rethinking our understanding of the rationality and responsibility of science. Its rationality cannot be seen as merely instrumental—as it was seen by the ideal of value-free science—for this would result in limiting the autonomy of science and reducing scientists to "minds to hire". The scientific rationality must be seen as practical rationality which takes into account the full horizon of values. The scientific responsibility must also be broaden in scope and type. On this basis I draw three practical conclusions concerning the organization of research and training of young scientists, appealing to Plato's claim that those most capable of healing are also those most capable of harming.

Keywords Value-free science · Value-ladenness of science · Instrumental rationality · Practical rationality · Responsibility of science

The Ideal of Value-Free Science

Two main theses which belong to the ideal of value-free science state that: (a) science is not entitled to formulate value-judgments in which any non-cognitive values are taken into account; any research in which such judgments appear

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constitutes a case of "bad science"; (b) science cannot provide goals, but it is able to provide efficient means to a chosen goal, or to show its ultimate or temporal unrealizability.[1] This ideal is taken as capturing the true nature of science. In this sense it is prescriptive, and not descriptive, for probably all researchers (sociologists, historians, philosophers) on real science agree that scientists in fact make non-cognitive value-judgments and that those judgment govern their research decisions.

The above view of the true nature of science entails a certain understanding of the rationality and responsibility of science. The rationality of science is seen as merely instrumental: goals are given, means are searched and then followed. The responsibility of science is limited to the responsibility for cognitive validity of research results and for reliability of applications. However, science is seen as not responsible for consequences of introducing any piece of knowledge into society and of using it, although the duty of warning against possible harmful effects and prospects of misuse is quite often indicated as part of the ethos of science.[2] The reason is—so the argument goes—that scientists *qua* scientists neither are permitted to evaluate (morally, socially etc.) goals achievable by means provided by science, nor it is their decision to set any goal and to use available means. As the dictum "science proposes, society disposes" suggests, such decisions are in hands of politicians, generals, medical doctors, firm owners, etc. Science discovers, but society (individuals and institutions) sets goals and uses scientific knowledge and science-based technologies. The issues of use, misuse, or dual use research are not problems to be dealt within science; a scientist's taking a stance on such problems would be considered unprofessional. Of course, scientists might serve as government experts, members of ethical committees, or religious leaders, but then they pass evaluative judgments while playing a social role different than a researcher.

Some Aspects of the Value-Ladenness of Science

The above-described view of science, its rationality and responsibility cannot however be maintained, once we see science not as a set of theories or instructions to apply, but as a social practice. Science so considered turns out to be by its very nature not value-free but value-laden. This last thesis is stronger than the claim that we must distinguish "pure" and "applied" research, and this is the latter that requires passing non-cognitive value-judgments; and it is stronger than the thesis that in the course of its development science has become intertwined with industry and government, and this is the reason why value-judgments appear to be necessary. To these arguments advocates of the value-freedom of science may—and in fact do—respond by claiming that applied research is not really science but technology, and that any such "intertwining" with other social institutions which assumes

[1] A classical formulation of main theses constituting the ideal of value-free science can be found in Weber (1992). .

[2] See, for example, Glass (1993). Some ideas can also be found in a booklet "Good Manner in Science. A Set of Principles and Practical Guidelines" prepared by the Committee for the Ethics in Science of the Polish Academy of Sciences.

participation in those institutions' decisions and practices is in fact a deformation of science as a knowledge-seeking and truth-discovering enterprise. I however claim that even if there were possible to distinguish pure and applied research, and classify only the latter as genuine science, and even if there were possible to disentangle science from all social institutions, by its very nature science would be value-laden, and non-cognitive value-judgments would constitute necessary part of scientific practice. The acceptance of this claim entails also a different understanding of the rationality and responsibility of science.

As arguments for my claim I offer three—out of many—aspects of the value-ladenness of science: participation of science in the social division of power by providing knowledge and knowledge-based technologies; providing basis for evaluation of ideas and policies; using non-cognitive value-judgments in scientific argumentation.

The first aspect of the value-ladenness of science is connected to the fact that research costs money; and funds are usually given to develop an answer to particular questions, probably with a close eye to possible use of results. Accepting funds and doing research under these conditions is not free from non-cognitive values, regardless of whether scientists are ready to admit this or not. As Stevenson and Byerly rightly stress:

"By accepting funds from certain sources—and agreeing to make their results available to those funding them—scientists are participating in social processes by which knowledge, and hence power, is given to certain social groups rather than others, for example to industrial corporations, defense departments, or national institutes of health. They may even have to face a difficult choice between doing their research under these conditions or not doing it at all. If they participate in the process as actually institutionalized, they display tacit acceptance of those institutions' values".[3]

Thus, maybe science does not explicitly provide goals, but it tacitly accepts them by agreeing to provide means, what is as value-laden as providing goals itself. This decision cannot be treated as external to science, for the decision to take funds amounts to the decision to start research for which funds were given. This does not mean that science must be in any way engaged in decisions of fund-providing agencies (although it may be). And a piece of knowledge searched does not need to be "applicable" in any direct or technological way. For example, scientists might see research on the relation between intelligence and genetic endowment as significant from a purely cognitive point of view. However, a political leader of a certain country is ready to support such a research project, for if the connection between intelligence and genetic endowment is established, this result will allow him to promote eugenics.[4] Accepting funds from him would then be an implicit acceptance of the eugenics ideology as something that from a moral point of view is allowed to be promoted. The fact that sometimes scientists do not know or may be mistaken about values supported by funding agencies does not justify pretending that providing research results has nothing to do with those values.

[3] Stevenson and Byerly (2000, p. 253).

[4] For analysis of such cases see Root (1993).

The latter point is strengthen when technology is at issue. Science-based technologies are increasingly end-specific: "it is no longer so easy to separate the origins of a tool from its intended use. What does it mean to "abuse" a cruise missile or a neutron bomb?"[5] We deal here not with the case of abusing or misusing something already existing and having a certain function, but with developing a new technology which opens new possibilities of acting. Science creates those possibilities and providing social institutions with new technologies carries with itself a presupposition that those actions are—in principle or at least in certain circumstances—morally permissible. The view that nowadays science and technology merged into one techno-scientific system makes this fact quite visible. Even if we agree that science does not provide goals, it facilitates achieving some goals and makes more difficult to achieve others; and it ranks goals, thereby shaping the course of social development.

Shaping social development is not however limited to providing technological means—and this discloses the second aspect of the value-ladenness of science. I already pointed out to the fact that scientific ideas may be used to support political programs (the case of eugenics); and they serve as a basis for evaluating social ideals and policies For example, social equality—seen as a value—is understood as the equality of opportunities to realize one's ideal of good life. This idea has given rise to educational programs designed to compensate for past discriminations and exclusions of various social groups. The grounding presupposition is that innate differences in abilities are uniformly spread throughout social groups. Yet, if scientific research established a biological basis of observed group differences (for example differences in mathematical skills between boys and girls), those programs would be evaluated as pointless; and the idea of social equality as the equality of opportunities which theoretically supported them would be considered erroneous. Thus, science may change our understanding of basic values.[6] Let me add that in the case of a clash between our understanding of values and a scientific claim a usual postulate is that it is the former that should be abandoned. Thus, science works as *the* epistemic authority, and so it is not neutral with respect to values.[7] This line of argumentation may be extended: as Philip Kitcher rightly observes, various research projects "give rise to moral debate because the acceptance of some scientific doctrines would affect the lives of people".[8] This does not refer only to affecting lives through technology, for scientific claims are not socially inconsequential in the sphere of ideas. Any decision to open a certain research project is at the same time a decision to bring about consequences in the form of new beliefs concerning values, people, the world, etc. And such a decision is justified by a non-cognitive value-judgment that those consequences are morally acceptable.[9] The idea that opening a

[5] Proctor (1991, p. 3).

[6] See, for example, Longino (1990).

[7] See, for example, Lacey (1999). Lacey explicitly states that in the case of any clash between scientific theses and theses justifying an accepted value-complex, either the value-complex must be abandoned or a different justification for it must be found.

[8] See Kitcher (2001) .

[9] See Lekka-Kowalik (2000).

research project is a moral decision which requires justification opposes the Galilean Imperative: "inquire into anything accessible through scientific methods". And only against the background of this idea the question of "forbidden scientific knowledge"—knowledge which we should not search in science—may be formulated.[10]

The third aspect of value-ladenness reveals itself when we consider the fact that in research scientists must gather and elaborate data. First, they need to decide when they have sufficient evidence to accept a hypothesis under consideration, what amounts to the decision to stop research. However—as Richard Rudner rightly pointed out[11]—taking into account that scientific knowledge informs action, this decision depends on moral evaluation of consequences of making the cognitive error—accepting a false hypothesis or rejecting a true one. To give an example: a hypothesis that a certain substance is not lethal poison for human organisms requires stronger evidence than a hypothesis that a certain kind of flowers grows only in the Alps, precisely because the moral weight of consequences of making a cognitive error in the first case—i.e. killing a person by administrating the substance investigated—is greater than the moral weight of imaginable consequences of being mistaken about the place of finding a particular kind of flowers.

Moreover, even classification of data depends on the non-cognitive (basically moral) evaluation of risks connected to the cognitive error. Heather Douglas, analyzing the case of research on carcinogenic and toxic effects of dioxin, shows that the moral evaluation of risks connected to a cognitive error influences that how borderline data are classified. Since exposing people to carcinogenic substances carries a great moral weight, uncertain cases are classified as "cancer", and therefore the level of dioxin's carcinogenicity is estimated as higher than it would be, if those cases were dismissed from evidence or treated as "non-cancer". And the research results bear for example on legal regulations concerning the use of dioxin, security measures undertaken when using it, etc., thereby also shaping social reality.[12]

The above-indicated aspects of value-ladenness of science are not the only ones science possesses. They are nevertheless sufficient to show that non-cognitive judgments appear in justification of various decisions which are necessary to carry on research, and that those judgments cannot be treated as external to science, as contaminating science, or as a kind of "weakness" which will disappear in the course of scientific development. On the contrary, it seems that new science's

[10] The question of whether there might be cases of research that should never be undertaken obtains various answers. For example Nicholas Rescher claims that there are such pieces of knowledge with which we, people, are not sufficiently suited to cope, and therefore it would be imprudent and even immoral to search for such knowledge (see Rescher 1987). Peter Gärdenfors claims that there is no such knowledge (see Gärdenfors 1990). Deborah Johnson discusses the issue in (1999). However, this very question—as well as follow-up questions such as who should make deciding, and how decisions should be taken—can be posed only when we accept the idea that the fact that a research leads to knowledge by itself does not ultimately justify the decision to carry research on and that social consequences of acquiring knowledge matter in justification. And it is this idea that is important for showing that science is value-laden and that non-cognitive values-judgments constitute part of scientific practice. .

[11] See Rudner (1953).

[12] For a detailed discussion see Douglas (2000).

research paradigms which put research directly into the context of application, reveal the role of non-cognitive value-judgments (including ethical ones) in science even more vividly.[13] So—contrary to the ideal of value-free science—scientists *qua scientists* make value-judgments in which non-cognitive values are taken into account, either consciously or by acting as if they made them; ignoring this fact makes science neither more objective, nor more autonomous, nor more free. What consequence follows from this?

Towards an Adequate Understanding of the Rationality and Responsibility of Science

One of many consequences of realizing the essential value-ladenness of science is that a different understanding of the rationality and responsibility of science is required. The rationality governing science must be seen as practical rationality in the classical sense, and not merely instrumental. That is, when decisions are made what is to be investigated and how research is to be organized, the whole spectrum of values must be taken into account, not only cognitive values. Any action should be considered under the aspects of its aim, means, circumstances, and consequences. Each of those aspects must be treated separately.[14] Thus, a research project evaluated as morally permissible under the aspect of its aims and means, might nevertheless be evaluated as morally forbidden under the aspect of circumstances in which it would be realized or under the aspect of consequences which providing its results to a certain institution, state, or society would have. The task of doing such an evaluation remains first of all in hands of scientists—those who are to perform actions constituting research. Reducing the rationality of science to instrumental rationality would result in treating scientists as "minds to be hired" by those who can afford them; and it would result in reducing them to "machine-like" creatures that act following means indicated as necessary by instrumental rationality without asking whether an action they are to perform is morally acceptable.

The responsibility of science must in turn be broaden in scope and in types. It is obvious that scientists are responsible for the cognitive value of research results and reliability of technologies. The above considerations show however that they are also responsible for consequences of executing their decisions concerning organization of research, since all such decisions directly influence the realization of not only cognitive but also non-cognitive values. This type of responsibility is the

[13] There seem to be a general agreement that we are witnessing a change in both an organizational and epistemic form of doing science. That new form is named *Mode 2* (M. Gibbons, H. Novotny, P. Scott et al.), post-academic science (J. Ziman), the Triple Helix (H. Etzkowitz et. al), post-normal science (S. Funtovicz, J. Ravetz), grassroots science (T. Hansen), and some other. Some authors treat their ideas as a description of the development of science, some take them as prescription to steer the scientific development. I do not intend to enter into discussion on similarities and differences between various diagnosis of this change. One can find such a discussion and relevant literature for example in Hessels and van Lente (2008). What I want to stress is that this new form only makes the presence of non-cognitive value-judgments in scientific practice more visible, not that this presence is a consequence of the change of science's research paradigm.

[14] For a detailed analysis of practical rationality see: Agazzi (2004).

responsibility for actions already performed and it burdens scientists, regardless of whether they recognize and accept it, and regardless of whether consequences stemming from their activities where intended.

Yet, once we notice the crucial role of science in shaping our life, another type of responsibility reveals itself: the responsibility for human persons and societies. Hans Jonas in his book *The Imperative of Responsibility*[15] points out that certain beings—recognized as values or bearers of values—make claims on acting agents, because their existence and development depend on agents' power and will. This fact creates an obligation to execute that power for the good of those beings. The good of beings-values becomes the criterion which sorts out possible actions into those required, forbidden, and permitted. Jonas lists some conditions of ascribing this type of responsibility to agents: real power to execute causal influence onto the world, some reasonable control over how a given action develops, ability to foresee up to a certain extent results of intended actions. The more power, control, and ability to foresee consequences of action agents have, the greater responsibility for beings-values occurring within the realm of their causal influence they bear.

There is no doubt that science holds a special position among human practices: it creates knowledge and technologies which allow us to execute ever more power over the world and to foresee consequences of actions more accurately; and at the same time it distributes power among other social institutions. Thus, following Jonas' analysis we should say that science bears some special responsibility for those beings over which that power is executed. The condition is of course that those beings are recognized as values—as beings which "demand" existence and flourishing.

The development—and now maybe the existence—of human societies depends on the power and will of scientists; and—as Plato says in *The Republic*—those most capable of healing are also those most capable of harming. Human societies and persons are beings who are bearers of values. These two facts create for scientists a special obligation to work *qua scientists* for the good of human persons and societies. This explains the source of questions concerning dual-use science and technologies. Those questions arise not because the same research may be jointly financed and then results used for different ends by different social institutions (for example army and industry), but because in the case of certain research dangers arise, dangers which might direct science against its own obligation to work for the good of human persons and societies. The best illustration is probably biotechnology research which may develop both effective cures for terrible diseases and terrible weapons. Yet, biotechnology is only an example. The rule of considering scientific research under the aspect of whether its results will serve the flourishing of persons and societies—not just in principle but in given circumstances—is general.

The phrase "in given circumstances" is important here. For there is no one model of human flourishing, so what and under which conditions will serve it must be each time determined, and this applies to any research, even if the distinction between pure and applied research could be maintained. As Ziman rightly stresses, "the path to the solution of many urgent and practical problems, such as finding a cure for

[15] See Jonas 1984.

AIDS, surely lies through many remote and apparently irrelevant domains of fundamental research. But the mere fact that such paths can be traced back into past human needs, and forward into a future where these needs might be met, gives them an explicit ethical dimension. Even the "purest," "most basic" research is thus endowed with potential human consequences, so that researchers are bound to ask themselves whether all the goals of the activity in which they are engaged are consistent with their other personal values".[16]

The development of research paradigms such as *Mode 2* I mentioned earlier makes the issue of understanding the responsibility of science even more pressing, when we realize that science is largely being developed by teams of researchers, often networked over different institutions. Thus, the issue of shared responsibility and institutional responsibility emerges. Moreover, teams are often temporary. Who and for what should take responsibility? What mechanisms of executing responsibility in such cases should be developed?

I do not intend to formulate all questions emerging with regard to the rationality and responsibility of science. The ones I listed serve to show that they arise in consequence of the change in the philosophical view of the nature of science: from its value-freedom to its value-ladenness.

A Few Practical Conclusions

At least three practical conclusions follow from the above considerations. First, the issue of use, misuse, and dual use science is a moral issue within science itself. Considering it cannot be delegated only to policy-makers, governmental agencies, ethical committees, and the like. It is part of scientific obligation to consider possible implications of obtaining and disseminating research results, accepting funds from certain institutions, developing certain technologies. The fact that research is done by many teams and that projects are often divided into small units, so the whole picture of a project and its implications disappears from view does not justify limiting the responsibility of scientists. It is rather a call for more extensive and deeper reflection on science and its relations to society.

Secondly, the education of young scientists should be reshaped, and for two reasons. Scientists should understand science and this means not just giving them the latests knowledge and training skills necessary for research, but also developing the consciousness of what the rationality and responsibility of science consists in. And the recent development in organizational forms of science tends to include scientists into funding and policy-making bodies. However, scientists must be prepared to participate in them—prepared not to search for a "compromise" between cognitive and non-cognitive values, but to see and take into account the full spectrum of values involved in doing science.[17] This requires that they understand the nature of science, of its rationality, and its responsibility. Contemporary

[16] Ziman (1998, p. 1814).

[17] There of course arises the question of how decisions in such bodies should be taken. The answer to this question depends however on the view whether science is value-free or value-laden. .

attempts to include research ethics as necessary part of curriculum in various science and engineering departments seem to be the step in the right direction.

Thirdly, scientists who accept the responsibility for cognitive values of research results but ignore the obligation to work for the good of persons and societies are not great scientists, because they in fact ignore the nature of science. Thus, science should both promote the ethos of responsibility for all kinds of values involved in science (through education among other things), and at the same time develop institutional mechanisms of dealing with such scientists who ignore the responsibility for social and moral values, as it has developed mechanisms of dealing with those who ignore the responsibility for cognitive value of research results (and for example forge data). This is—I believe—the best path to solve the dilemma of dual-use, misuse, or abuse of science.

References

Agazzi, E. (2004). *Right, wrong and science*. Amsterdam & New York: Rodopi.

Douglas, H. (2000). Inductive risk and values in science. *Philosophy of Science, 67*, 559–579.

Gärdenfors, P. (1990). Is there anything which we should not want to know? In J. E. Fensted (Ed.), *Logic methodology and philosophy of science* (pp. 63–78). New York: Elsevier.

Glass, B. (1993). The ethical basis of science. In R. E. Bulger, E. Heitman, & S. J. Reiser (Eds.), *The ethical dimensions of the biological sciences* (pp. 43–55). Cambridge: Cambridge University Press.

Hessels, L. K., & van Lente, H. (2008). Re-thinking new knowledge production: A literature review and a research agenda. *Research policy, 37*, 740–760.

Johnson, D. (1999). Reframing the question of forbidden knowledge for modern science. *Science and Engineering Ethics, 5*, 445–461.

Jonas, H. (1984). *The imperative of responsibility*. Chicago: University of Chicago Press.

Kitcher, P. (2001). *Science, truth and democracy*. Oxford: Oxford University Press.

Lacey, H. (1999). *Is science value free? values and scientific understanding*. London & New York: Routledge.

Lekka-Kowalik, A. 2000. 'Le Choix des themes de recherche en tant que decision morale' In P. Proellochs and D. Schulthess (Eds.), *Y-A-T-il Limite Ethiques Recherches Scientifique?* (pp. 31–46). Geneve: Editions Médecine et Hygiène.

Longino, H. (1990). *Science as social knowledge. Values and objectivity in scientific inquiry*. Princeton: Princeton Univesity Press.

Proctor, R. N. (1991). *Value-free science? purity and power in modern knowledge*. Cambridge MA: Harvard University Press.

Rescher, N. (1987). Forbidden knowledge. In *id., Forbidden knowledge and other essays on the philosophy of cognition* (pp. 1–16). Dordrecht: Reidel.

Root, M. (1993). *Philosophy of social science. The methods, ideals, and politics of social inquiry*. Oxford UK & Cambridge USA: Blackwell.

Rudner, R. (1953). The scientist *qua* scientist makes value judgement. *Philosophy of Science, 20*, 1–6.

Stevenson, L., & Byerly, H. (2000). *The many faces of science. An introduction to scientists, values, and society*. Boulder: Westview Press.

Weber, M. (1992). Value-judgments in social sciences. In R. Boyd, Ph. Gasper, & J. D. Trout (Eds.), *The philosophy of science* (pp. 719–731). Cambridge MA: MIT Press.

Ziman, J. (1998). Why are scientists now expected to be so much more ethically sensitive than they used to be? *Science, 282*, 1813–1814.