

# Sensitization: reciprocity and reflection in scientific practice

**SSS** Science & Society Series on Convergence Research

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Bob Dylan sang that “the times, they are a-changin’” with reference to the profound social upheaval of the 1960s in the USA and Western Europe; but he could just as easily have been referring to the changes in the perception and conduct of scientific research in that period. Before and throughout the Second World War, science was regarded to be a somewhat disconnected, exclusive activity. Scientists, so the thinking went, would be most successful if protected from the influence of social demands. However, the increasing impact of scientific discoveries on society—for example, the invention of nuclear weapons, the arms race with the Soviet Union and the perceived dangers of genetic engineering—profoundly changed this attitude and, with it, the role of science in and for society.

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In response, there was a shift in science policy to try to re-connect science with society in an attempt to control and direct the perception of science’s merits. Nowadays, scientists are aware of the changes that are taking place to the role that their research has in modern society; the ivory tower is crumbling before our eyes. As Frank Gannon put it in an Editorial in 2006: “the changes that are taking place now are the result of [a] recognition that the old ways are no longer good enough” (Gannon, 2006).

Another indication of the increasingly intimate relationship between science and society is the space that leading scientific journals devote to discussing research budgets and national and international science policies. Today’s science is in stark contrast to the ‘old’ image of scientists conducting experiments and acquiring knowledge out of sheer curiosity, free from the influences of societies or governments.

Moreover, science is increasingly mobilized to address social problems. For this reason, it is argued that the natural sciences, the social sciences and the humanities need to work together (Penders *et al*, 2008). Science is no longer detached from society, as its products—both knowledge and technology—affect society in many ways. Likewise, most scientific research is now directly or indirectly influenced by society through policy, either through selectively financing research or by providing problems to address. These profound changes, which are still underway, raise the relevant question of how to shape the interaction between science and society. Here, we introduce the idea of sensitization to help understand, shape and guide this interaction between science and society.

Funding agencies and individual research institutes and organizations have created so-called ‘science & society’ programmes with several goals in mind, which include ensuring that science remains relevant to society, finding out how society might respond to scientific knowledge and new technologies, and understanding and improving the connection between science and society. Ideally, these

would facilitate interaction, understanding, exchange and reflection, and, eventually, action. Such action at the interface between science and society often takes place either upstream at the policy level—for example, through increased funding for specific research fields—or downstream at the regulation level. However, both upstream and downstream actions do not influence scientific activity itself; the majority of research, in which knowledge is being created and new technologies are being invented, takes place midstream—in laboratories, at meetings, or during discussions over lunch (Fisher *et al*, 2006). Therefore, we argue that ‘science & society’ initiatives would more effectively sensitize science to society, and vice versa, if they also took place midstream, at the work places of scientists.

**ELSI researchers had little influence on the policy-making that accompanied the Human Genome Project and the issues were largely debated without involving the natural scientists**

One of the first—and now famous—‘science & society’ initiatives was the Ethical, Legal and Social Implications (ELSI) programme that accompanied the Human Genome Project in the USA; however, the programme has not been without its detractors. Philip Kitcher, a philosopher at the University of California, San Diego, USA, is one of the outspoken critics of ELSI and has bluntly stated that it has failed

(Kitcher, 2001). Although ELSI produced a large number of research reports, Kitcher wrote, “virtually nothing has been accomplished” (Kitcher, 2001). Similarly, Erik Fisher, at Arizona State University (Tempe, AZ, USA), has noted that it “has been widely criticized for lacking the capacity to accomplish its charge” (Fisher *et al*, 2006) because science in general—and genomics in particular—is integral to our lives and does not create clearly demarcated ‘issues’ that can be analysed, discussed and solved. Instead, research raises much broader social and political questions that require far more fundamental discussions (Kitcher, 2001). This focus on particular issues is often regarded as a “piecemeal approach” and seems to be the dominant model to study “science & society” interactions and to re-acquaint both with each other (de Vries & Horstman, 2008). It allows researchers to identify and deal with real problems—such as whether or not to use a certain genetic test—but it does not necessarily lend itself to broader reflections on the practice of genomics or research strategies and goals in general.

Here, we explore further this approach towards reflection and mutual sensitization by using the European Nutrigenomics Organisation (NuGO; Zeist, NL) as an example. The NuGO is funded under the European Commission’s Sixth Framework Programme and from the beginning it has devoted funds to a small ‘science & society’ component, which has allowed a few social scientists to work alongside natural scientists. Both coordinators of the NuGO programme have fully supported the inclusion of the ‘science & society’ component although, as one pointed out, “it has always been a marginal part of NuGO; [...] we have chosen, from the very beginning, to frame NuGO as a science programme because we thought that the scientists had to prove first that they could do their job and then a few social or societal issues would come out of that.” Despite this support, the initial inclusion of a ‘science & society’ programme was not completely voluntary. The programme coordinators acknowledge that “it was enforced by the European Union”. Nevertheless, it was recognized that “we do have a responsibility there.”

Despite the small scale of the ‘science & society’ programme, the few social scientists involved have not felt marginalized

and have firmly established their own roles within NuGO. One of the communication experts involved stated that this was possible by positioning themselves strategically: “[o]ne has to be clear: [nutrigenomics] is the core business of NuGO and we have to provide additional value to that. We should not think, based upon a normative ideal, that ‘social science should be involved’ [...] With that kind of attitude, we wouldn’t have made it.” Providing additional value as a social scientist required conforming to the existing research agenda.

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In fact, the programme has been running for several years, and has been reorganized from time to time with the changes of the research agenda imposed on both the natural and social scientists. The ‘science & society’ component has similarly been subject to reorganization, as the NuGO’s work packages ‘Dissemination’ and ‘Nutrigenomics & Society’ were integrated into a single package named ‘Communications’. Although the work of some of the social scientists in the NuGO remained largely unaffected, the amount of ‘science & society’ work was reduced significantly. “I did not want any ivory-tower social science work within NuGO. At a certain moment, we just called it strategic communication and daily communication, in which strategic communication was directed more at researching the stakeholders. Who are they? What can dieticians do with us? What can doctors do with us? What does [the] food industry think of us? [...] That is strategic communication in which some social science and some ethics remained,” one of the programme coordinators explained.

The social scientists working for NuGO would argue that there is room for them to hold a more critical position within the organization. However, there are clear limits to the ‘science & society’ programme: there is some room for criticizing goals and approaches but, at the end of the day, the distribution of power between natural and social science is strictly upheld. The result is that social science has to conform to an existing agenda of discussing

specific issues, a situation that one of the NuGO communications experts described as a compromise. NuGO’s focus has thus remained on conducting scientific research first, and discussing the social, ethical and political issues in its wake—a clear piecemeal ‘science & society’ approach. The power to set the research agenda lies almost completely with the natural scientists and, although they do not exclude ‘science & society’ from their research programme, it is they who prioritize a specific subset of issues to be tackled alongside the standard subset of social science topics: communication, and bioethical guidelines and procedures.

Yet, there is a difference between the piecemeal approach as adopted by ELSI in the USA and the piecemeal approach used within NuGO. ELSI researchers had little influence on the policy-making that accompanied the Human Genome Project and the issues were largely debated without involving the natural scientists. As Kitcher has argued, this resulted in too much detachment and too little internal reflection (Kitcher, 2001). The ‘science & society’ component within NuGO is not as detached, as the social scientists are fully integrated into the organization. However, the NuGO programme leaders, rather than the social scientists, have prescribed the ‘science & society’ research agenda. This is in contrast to ELSI professionals, who were able to articulate their own research agenda. Both ELSI and the NuGO ‘science & society’ component had little or no influence on the societal agenda at large. In other words, while the ELSI programme was characterized by too much detachment, the ‘science & society’ component of NuGO was characterized by too little power to set its own agenda.

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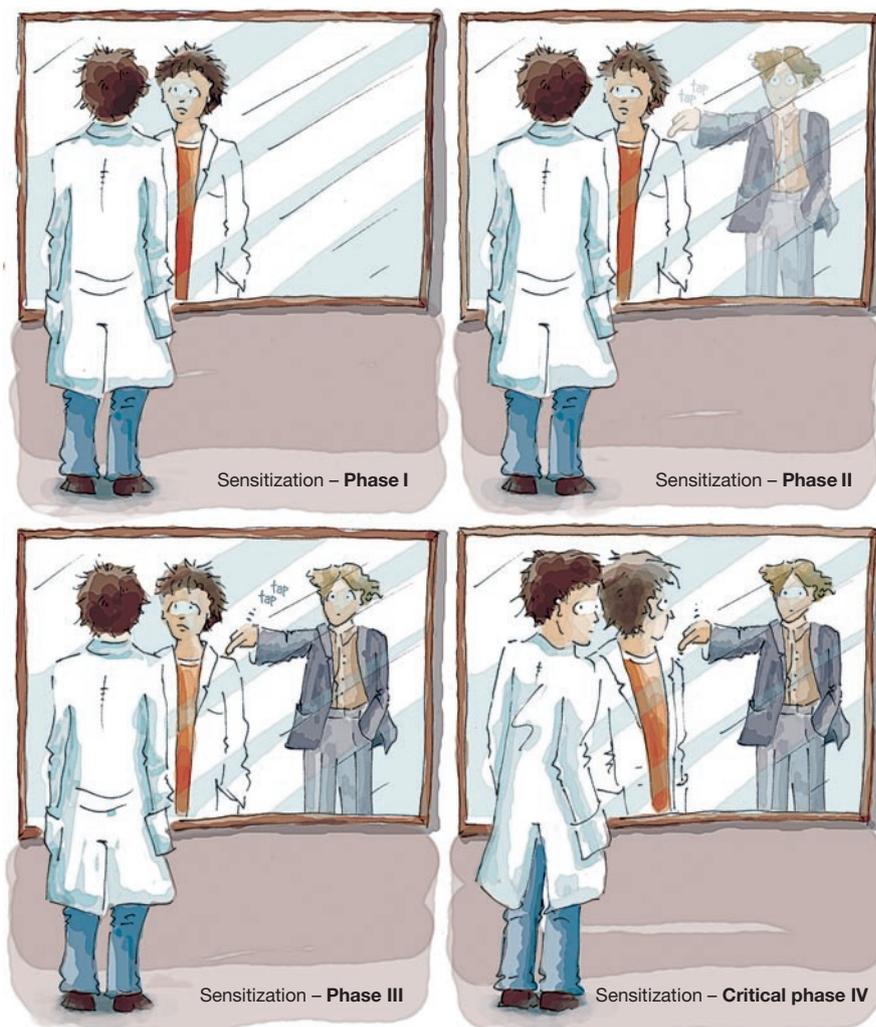
Kitcher has therefore argued that ELSI was a failure because of the piecemeal approach that it was forced to adopt. To ensure that future initiatives are more successful, he has suggested that it is the “scientists’ responsibility to engage in socio-political reflection and to let that reflection inform one’s

actions" (Kitcher, 2001). Science & society scholars are therefore increasingly calling for a new relationship between their own work and natural science; one that would allow them to move beyond cooperation as part of a piecemeal approach towards full interaction or perhaps even integration. Integration is the ideal goal, but it is not considered feasible. Although interaction is hard to achieve, many argue that it is worth pursuing nevertheless.

This is easier said than done. There is no handbook that describes how to achieve reflection, and how social scientists and scientists might productively interact or influence each other's research agendas—let alone at a level where they can be said to truly work together. Yet, we can learn from examples in which individual researchers were able to invoke some degree of reflection. During our work with NuGO we experienced two forms of interaction that invoked reflection, and that we present as narratives.

The first takes place in the animal testing facility of a Dutch university where Bart Penders, one of the authors of this Viewpoint, was able to help optimize an important laboratory experiment. A trial run had shown that there was not enough time to collect the intestines of a large number of sacrificed mice, put them individually into buffer and shake them vigorously for 30 seconds to extract nucleic acids—a process which had to be repeated six times. Penders proposed two alternative strategies to the biologist conducting the experiment: he asked whether they could either save time by pooling the mice intestines, or by pooling the extracted nucleic acids. During the rest of the day, the biologist and the laboratory supervisor discussed the advantages and disadvantages of each alternative—this was an expensive and crucial experiment, and the various alternatives required careful consideration—and eventually decided that they would pool the mice intestines, as proposed by Penders.

The second example took place in 2006 in New Zealand, when Penders was attending a conference on 'Nutrigenomics, from science to the supermarket' in Auckland. The conference was a great opportunity to talk informally during breaks, lunch and dinner, but Penders had also submitted an abstract in which he argued that the goal of personalized nutrition is not particularly feasible—using



empirical data from the field of nutrigenomics itself to strengthen his argument. The abstract was selected for both a poster presentation—the intended goal of its submission—and for an oral presentation at the conference, which gave Penders the opportunity to talk about nutrigenomics for 20 minutes. When walking to the venue the next morning, he was stopped by one of the conference organizers who asked him to take part in a panel discussion at the end of the conference about the future of nutrigenomics and personalized nutrition in particular. "You represent a different position and a different generation in nutrigenomics," Laurence Melton from the

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University of Auckland had commented. The panel members were mainly nutrigenomicists with a largely positive opinion about what nutrigenomics could and should achieve—and they were all middle-aged. The organizers had decided that Penders, a man in his twenties, had a sufficiently fresh and relevant argument to be allowed to put it forward once again. Later, the arguments that Penders had presented in New Zealand were published (Penders *et al*, 2007) and, a few months after that, the Australian biologist Sir Gus Nossal opened the 3rd International Asia Pacific Nutrigenomics Conference in 2008 by quoting the conclusion of this paper.

The first narrative shows that a social scientist can become so familiar with natural scientific practice that interaction comes naturally and easily, and the second demonstrates how an external viewpoint can actively stimulate reflection. These

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narratives both describe forms of sensitization—a term inspired by its biological definition of sensitizing an organism to a particular compound by repeated exposure. It nicely describes the same process in 'science & society' interactions: frequent exposures are a prerequisite to interaction and sensitization. Scientists continuously expose themselves to the field that they study, which gives them a deeper and clearer understanding of it. As the objects of study in 'science & society' work are science and the scientists, the actors—the social scientists—are similarly exposed to the researchers. Penders could never have proposed to modify the mouse intestine experiment had he not been sensitized by the scientists to see the world in their way. Similarly, the conference organizers in New Zealand would never have invited him to join the panel had they not been persuaded to look at the world the way he did. Such cross-fertilization is the raw material that 'science & society' programmes work with and that has the capacity to invoke change. However, it also requires professionals to exercise responsibility, so as to guide sensitization towards a state of mutual benefit, otherwise it might just lead to irritation.

By allowing social scientists to roam laboratories, 'science & society' can be applied to this midstream domain. Through sensitization of both natural and social scientists to each other's worlds, reflection can be invoked. Sensitization contains both cognitive and normative elements, and involves crossing the boundaries between science and society. It requires a lot of effort and goodwill on both sides of the divide, and failure—not being able to invoke sensitization from interaction—is a real and imminent possibility. It is not limited to the actions of and reactions to single participant observers and their objects of study, but can also refer to the interactions between groups at

the institutional level, or to entire research programmes.

When we compare sensitization to the piecemeal approaches described earlier, it becomes clear that sensitization is not restricted to single issues, technologies or experiments. It is, at least in our example, the goals and the practice of nutrigenomics that matter as a whole, rather than a specific subset of issues relating to the field. Sensitization represents a general strategy to invoke reflection in practitioners (Fisher, 2007), not a framework for directed critiques.

However, a piecemeal approach in 'science & society' programmes is still relevant, as is action at the upstream and downstream levels. Research and technology inevitably create new questions, problems, challenges and risks, which cannot and should not be ignored—for example, the question of whether to implement and how to regulate routine genetic tests that could predict personal disease risks (de Vries & Horstman, 2008). Yet, restricting 'science & society' to a piecemeal approach is too limiting. If we want to allow science in general to follow a more responsible course in terms of societal relevance and embedment, or if we want scientists to create new and socially responsible innovations, simply discussing issues is not enough. Sensitization allows scientists and 'science & society' professionals to reflect on scientific practices at a time when the possibility of changing the course of research—and hence the knowledge and technologies produced—is still an option. For this to happen, societal agendas and scientific research agendas, as well as research in different disciplinary practices, will have to be intertwined.

This does not imply that every laboratory or research programme needs its own 'science & society' employee or sub-programme—although those who can afford it might consider it. Sensitization can be contagious, and reflection promotes debate and discussion among scientists who, in

turn, will sensitize others. Even among the sensitized, reflection and debate need maintenance, so there will thankfully be little rest for 'science & society' professionals in the foreseeable future.

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