

The rock 'n' roll of knowledge co-production

SSS Science & Society Series on Convergence Research

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The governance of modern science requires a heightened sensitivity to societal issues in relation to, and in particular within, the life sciences. Current opinion about practices, potential achievements and applications of genomics research oscillates between hope and fear; promise and realization; intended and unintended consequences; knowledge and non-knowledge; understanding and misunderstanding—on all sides, including scientists. Governments, research funding agencies and industry seem to have learnt, to some extent, that what was once fittingly called “organized irresponsibility” (Beck, 1995) must be transformed into ‘organized responsibility’ if scientific research, new therapies and diagnostics, improved health care, and new consumer products and services are to stand any chance of being accepted by society.

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One reaction to this insight is to integrate social and humanist science programmes into large research programmes in the life sciences. The scope of this step becomes clear when we consider the amount of funding, infrastructure, administrative imagination and political will that are put into such double-track research policies, all of which are necessary to provide an adequate foundation for such endeavours. The Netherlands Genomics Initiative (NGI; The Hague, the

Netherlands), with a budget of €500 million to spend between 2002 and 2012, has given the Centre for Society and Genomics (CSG; Radboud University, Nijmegen, the Netherlands) €32 million to “understand and improve the relationship between society and genomics” by developing “interdisciplinary research as well as innovative communication and education activities” (CSG, 2008). The UK Economic and Social Research Council (ESRC, Swindon, UK) has €41 million to spend between 2002 and 2012 on the ESRC Genomics Network (EGN, Cardiff, Edinburgh, Exeter, Lancaster, UK) for social science programmes accompanying various biotechnology initiatives and investments. In the USA, the National Human Genome Research Institute (NHGRI; Bethesda, MD, USA) and the Department of Energy (DOE; Washington, DC, USA) together have been funding “an integral part of the Human Genome Project (HGP) to foster basic and applied research on the ethical, legal and social implications (ELSI) of genetic and genomic research for individuals, families and communities” (NHGRI, 2008) since 1989. Both organizations devoted 3–5% of their annual budgets to ELSI activities. In 2004, the NHGRI, in collaboration with the DOE and the National Institute of Child Health and Human Development (NICHD; Rockville, MD, USA), launched four Centers for Excellence in Ethical, Legal and Social Implications Research (CEERS) with a budget of US\$20 million for five years. With more emphasis on the environment and the economy, Genome Canada states that, “genomics research has profound ethical, environmental, economic, legal and social implications” (known as GE³LS), and has invested 2.4% of

its C\$537.3 million budget to “explore these issues and promote public understanding” between 2000 and 2008 (Genome Canada, 2008). Since the Fourth European Union Framework Programme took effect in 1994, the original ELSI label has changed to ELSA in Europe, with the ‘A’ standing for ‘aspects’, rather than ‘implications’.

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The money dedicated by these organizations does more than simply finance research, dialogue and education; it also helps to erect buildings of knowledge and practice: social institutions of intermediary character that are geographically and organizationally close—more or less—to the research centres with which they interact. These institutions serve as public and academic forums for dealing with the many converging sciences and various societal actors. The question of what is bottom-up—initiated by genomics or social researchers—and what is top-down—initiated by management or government—is hard to answer. Initiatives come from all sides and the top-down programmes, in particular, are brought to life by researchers from the bottom-up in ways that governance could never have foreseen. The successes and failures of ELSI are two sides of the same coin, depending on whose criteria are applied (Fisher, 2005; Nelis *et al.*, 2006; Yesley, 2008).

Here, we focus on the practicalities and some methodological implications of ‘doing society and genomics’, an arena in which social and natural scientists meet to discuss issues surrounding genomics research that relate to society, and vice versa. In doing so, we can get a feeling for the challenges that are faced by natural scientists, social scientists and others as they aim to converge their activities to mutual benefit, and even to give reasons why they should do so at all. These questions are somewhat similar to those faced by a new rock band in need of a shared understanding: what should they play, how should they play together and, ultimately, which audience do they want to play for?

This challenge was the subject of the “Doing Society and Genomics—Convergence and Competence Building” workshop, organized by the CSG in September 2008. The workshop, which included practitioners from leading institutions in the Netherlands, Switzerland and the UK, tackled various approaches to converging scientific and social issues, as well as the interaction of life science and social science in the area of genomics research. The speakers presented their various methods and strategies, and discussed whether these had been successful in educational campaigns, public dialogue and collaborative projects. The workshop thus provided an opportunity to take stock of the current efforts and programmes, and to explore future directions of convergence work.

This multi-way dialogue is now an integral element of science communication and science studies, which have, by and large, given up on one-way ‘communication’

This *EMBO reports* Science & Society Series on Convergence Research—which this article introduces—was inspired by the workshop and I am grateful to the experts who participated at Nijmegen and for their contribution. The rationale for organizing the workshop was my own observation of a particular way of generating knowledge, which can be called convergence work. On the basis of empirical research on the network of the CSG in the Netherlands and on the EGN in the UK, I have found that research centres and researchers in the social sciences and the humanities, who

are involved in “big science” programmes (Weinberg, 1961; De Solla Price, 1965), are expected to “contribute” to science governance, “provide” knowledge to various interested groups, “support” inter- and transdisciplinarity, and adhere to academic “robustness”, as well as stand for societal “serviceability” and “visibility”—the quote marks indicate typical governance semantics. On a practical level, convergence work is the joining of research with dialogue, analysis with advice, different academic disciplines with one another and with non-academic practices, and communication with critique, in order to realize and balance the interests of various stakeholders. In this context, convergence does not mean to merge different points of view, but rather to approximate perspectives, issues and practices from various fields (Ott & Pappaloud, 2007).

Although the participants of the workshop were a heterogeneous group—about half of them received a formal academic degree in the natural sciences—they had in common their roles as intermediaries, or ‘the third party’, at the intersection of natural sciences, social and humanist sciences, schools, companies and policy-makers. These individuals are often linked through programmes and project collaborations, and use interactive methods based on a give-and-take attitude, which is often associated with the co-production of knowledge. They are more or less struggling to find—at least some—shared languages, which would allow them to mediate between distinct worlds of knowledge and practice.

Indeed, their work requires that they cross the boundaries between different areas of expertise and could therefore be described as “boundary work”. This concept, developed by Gieryn (1983) in science and technology studies, refers to “when, how and to what end the boundaries of science are drawn and defended” (Gieryn, 1995). Star & Griesemer (1989) empirically became aware of the use of “boundary objects” in intermediary practices. This term and the concept behind it were coined to denote something that is plastic enough to be interpreted in various ways across social worlds, yet sufficiently stable, in terms of content, to be identifiable and recognizable: “[T]he creation and management of boundary objects is a key in developing and maintaining coherence across intersecting social worlds” (Star & Griesemer, 1989).

Importantly, the participants at Nijmegen are a group, in part, who radicalize this idea to ‘convergence work’ by de-emphasizing what is divisive and emphasizing what, in their views, needs to be brought together: actors, issues, institutions and initiatives that deal with concerns so complex that mono-disciplinary treatment seems to be insufficient. When they describe the aims of their communication efforts, they use such terms as “moderation”, “mediation”, “translation”, or “collaboration”, indicating the intention to overcome boundaries, rather than simply to make them a subject of discussion. To describe this attitude, convergence work is the correct term.

The participants also discussed how much ‘boundary maintenance’ is necessary to assert academic authority, or to establish a career as a ‘convergence worker’. Are the people working for the society and genomics programmes themselves boundary objects or, rather, ‘boundary subjects’? Can one actually make a career as a convergence worker—a mediator between science and society—and is there a job market for people with cross-competence who have, for example, trained or worked at the University of Lausanne in Switzerland, the London School of Economics’ BIOS Centre in the UK, the GE³LS programme of Genome Canada, at the CSG, or in the ESRC Genomics Network? Convergence workers have both a unique competence in dealing with processes of supreme complexities and a large mobility, as they are able to traverse intellectual and other boundaries. The society and genomics programmes might therefore have several effects: they will have an impact on policy decisions, create academic knowledge, meet the demands of the job markets and, potentially, create a ‘new’ profession (Gieryn, 1995; Penders *et al*, 2008) to serve the needs of modern science governance.

One main focus of convergence work involves education at all levels, from school to university to the education of professionals. At the Nijmegen meeting, Jacques Dubochet, from the University of Lausanne, emphasized the need to educate scientists about the public’s concerns and gave examples of how young scientists can be encouraged to develop an interest for issues “beyond the bench”. Similarly, Roald Verhoeff, from the Freudenthal Institute for Science and Mathematics Education (Utrecht, the Netherlands), discussed various campaigns to educate the public about

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the concerns of scientists. As Annemarie Teunissen, from both Radboud University and ARCADIS consultancy ('s-Hertogenbosch, the Netherlands), pointed out, such efforts should also be extended to scientists and other professionals in the private sector who, burdened with the requirements of science and business, can often fail to consider social implications.

Other convergence workers serve as moderators and facilitators in the exchange of information between scientists and other stakeholders. This concept of a dynamic, pluri-directional flow of information—in essence, a proper discussion—is in contrast to traditional models of unidirectional flow of information from scientists to laypeople, or vice versa, which have infamously failed; for example, in regard to genetically modified crops.

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Claudine Anderson, for instance, is a Public Engagement Officer at the Wales Gene Park (Cardiff, Wales) and uses a game-style approach in her *Discuss DNA* project; she organizes mock trials for her *National DNA Database on Trial* project to get people involved in thinking about these topics. She involves both school students and adults on the basis of common knowledge and the additional information she provides. Eefje van den Heuvel-Vromans, and her colleagues Maud Radstake and Ninne Jeuken, from the CSG, stage online discussions in order to bring interested parties—for example, readers of certain magazines such as parents with autistic children—together with scientists to discuss the goals and concerns of other stakeholders and researchers. Some social scientific knowledge is provided to both the 'laypeople' and the scientists, but it is intended to raise

issues, rather than to educate in a real sense. Actually, these online discussions do not frame non-scientists as simply 'laypeople', but rather as knowledgeable actors who bring invaluable competence.

This multi-way dialogue is now an integral element of science communication and science studies, which have, by and large, given up on one-way 'communication'. This was also obvious from Emma Frow's presentation, in which she described the EGN Genomic's Policy and Research Forum (Edinburgh, Scotland, UK) as a "boundary-spanning organization". The Forum is funded by the ESRC and seeks to connect work streams both within the EGN and between the EGN and science, politics, business and other areas of society. Frow's core activity for the Forum is to map and frame issues that are crucial for policy representatives and natural and social scientists. She has also received funding for transdisciplinary network activities on standards and characterization in synthetic biology; for collaborative mapping and framing of the issues at stake in this emerging field. Indeed, the Genomics Forum has taken responsibility for a public engagement programme that could act as a "translational unit," as Frow put it, "to engineer projects or events across different groups." As Nijmegen-based genomicist Joop Ouborg, from the Dutch Ecogenomics Consortium (Amsterdam, the Netherlands), made clear, in order for such cross-disciplinary exercises to create added value, it is important that the definition of tasks and goals fits well into the daily work of all member parties.

Frow is certainly not the only 'boundary subject' attempting to connect the social sciences with the life sciences. Jane Calvert, a social scientist from Innogen (Edinburgh, Scotland, UK), participates in several British synthetic biology networks, which, she explained at the conference, ask her to "contribute to and facilitate the progress of science". She said that the rationale for inviting her was to avoid another GM debate. At working parties and conferences,

she therefore represents—in the eyes of the scientists—as she put it, "the social, legal, philosophical and ethical perspectives" as a "member of society", and facilitates reflections on scientific values. In return, she gains access to meetings that are valuable for her own research on the inception of the synthetic biology networks. She sees her role as oscillating between "contributing to and facilitating the progress of the science" and "potentially influencing the knowledge that is produced". Rabinow & Bennett (2007), for instance, explained their role as "embedded" social anthropologists within the Synthetic Biology Engineering Research Center (SynBERC), a programme of the California Institute for Quantitative Biosciences (QB3; University of California, Berkeley, CA, USA) in similar ways.

Both Frow and Calvert are examples of the broader trend of the blurring boundaries of expertise in society and genomics projects. Although synthetic biology is still to have an impact on science and society, the two women are already involved in the first phase of transdisciplinary activities.

Two further examples of practitioners with expertise in convergence work at the meeting are Daan Schuurbijs, from the Working Group on Biotechnology and Society at Delft University of Technology in the Netherlands, and Bart Penders, from the CSG. Unlike Frow and Calvert, Schuurbijs and Penders partly systematize and legitimize their work approach by referring to the standard methodologies of empirical field research. Schuurbijs, a philosopher by trade, visits scientists in their laboratories to offer an 'outside world' perspective on the social implications of genomics research. Penders, trained in both biology and science studies, pursues a similar course but emphasizes the ethnographic approach, so-called fieldwork, through participant observation, interviewing and the collection of everyday documents from the field of research. Both position their approach at the midstream level (Fisher *et al.*, 2006), between upstream policy and downstream regulation, where, through on-site engagement, genomicists and social scientists ideally undergo a mutual sensitization process.

An ethnographical approach means that a social researcher studies a field of human practice through actively participating in the everyday life of this field. Yet, although both Schuurbijs and Penders want to inculcate the idea of social responsibility



among scientists, they themselves change during the course of their fieldwork: they do not remain 'critical outsiders' and their expertise begins to incorporate elements of the various fields and boundaries they traverse. Ideally, then, these approaches can lead to mutual sensitization in scientific practice. Therefore, beyond mere research through participation, they follow an engaged approach of fieldwork that aims not only to carry out scientific observation, but also to give something back to the field.

Thus, it seems that society and genomics has a future. Dubochet reported that the programme he initiated in the 1980s (Dubochet, 2008) at Lausanne is still expanding even after his retirement; society and genomics has become a theme repeated throughout the entire biology course at the university. Similarly, Verhoeff noted that his *DNA labs for Citizenship* project could be a perfect contribution to the standard science curriculum in the Netherlands, as requested by the Dutch Biology Curriculum Innovation Board (Nijmegen, the Netherlands). Researchers at the CSG are also confident about their future because of their competence to

organize interactive, collaborative discussions, and to link their work with regular academic teaching and research duties. The last word on society and genomics, boundary and convergence work has certainly not yet been spoken.

Hub Zwart, Scientific Director of the CSG, invoked a historical perspective in his comment on society and genomics programmes. The debate on ELSA genomics, he said, could be regarded as a follow-up to the 1980s debate about bioethics in which bioethicists were addressing similar issues in various ways. Proximity was important to adopt a participant-observer perspective rather than talking about general principles and grand theories; conversely, ethicists had to contribute their own expertise to dialogue and discourse. Zwart then asked to what this type of ethical expertise amounts; his answer was that ethicists could extrapolate from previous debates to broaden perspectives and point out relevant issues, rather than prescribing solutions in a top-down manner. This is comparable in many ways to ELSA researchers, he said, who want to combine proximity to research and researchers with

maintaining a critical and academically robust point of view.

According to George Gaskell, from the London School of Economics' BIOS Centre, the latter point raises the important issue of how society and genomics work should be evaluated and judged. He warned against persevering in self-reflective exercises, no matter how important they might be, while neglecting the inevitable moment of justification. Indeed, the issue of evaluation is crucial for deciding whether a 'society and genomics' or 'science and society' programme performs boundary maintenance or, rather, convergence. The issues of what criteria will be used to measure the quality and success of these programmes, as well as who will have the last say—the funding agencies or the researchers—remain to be properly addressed. Moreover, the question of whether the centres will be able to define and pursue their own criteria or whether they will be accountable to external criteria remains unanswered. This is an important point, as it will decide whether 'science and society' programmes are servants of a greater project or can work autonomously. The self-understanding of the intermediaries will be different, either way. Similarly, the

target audience—be it life-scientists, or other members of the public—will have to decide to what extent they want to participate in boundary-crossing activities and to what extent they will support them.

Another neglected issue is the question of normativity, although this was mostly discussed implicitly, rather than explicitly, during the workshop. Dubochet, for example, emphasized the education of “responsible scientists” and “citizen scientists”, whereas Verhoeff spoke of “critical citizens”. Yet, it is not only important to ask to what extent the world needs society and genomics intermediaries and for what purpose, but also to ask how these intermediaries can claim, on the one hand, to contribute to scientific work, and, on the other, that science has deficiencies. It now seems that some vague “democratic mandate” is taken as the implicit basis for entering laboratories, classrooms and “policy rooms” (Webster, 2007). Large research programmes now often include some sort of treatment of the “societal component”, and policy documents confirm the necessity of a democratic, interdisciplinary “vaccination” of the programmes (MEA, 2004; Cabinet Office, 1999). But, how do agents of society and genomics define their own roles? Moreover, with which arguments do they translate such commonplace ideas into their missions? It is all too often left unclear as to who and what can entitle intermediaries to intervene, to what degree public engagement initiatives are democratic, what is a democratic debate, and which conceptions of publics, moralities and ethics are included (Wynne, 2007).

In fact, the normativity aspect is twofold. It is important to define and explicate the normative standpoints, assumptions and theories that underlie and support current society and genomics initiatives; conversely, it is also crucial to explicate the values and norms that the convergence workers, as individuals, use during communication in the field—the institutional and the personal sides of the coin. There is a serious gap in research when it comes to questions about which values and norms, including economic ones, undergird ‘science and society’ programmes, which values are held by the individual researchers taking part, and how both sets of norms and values interact; to what extent are they the same, or are the view of researchers even influenced by official institutional standpoints? For example, workshop participant

Arno Mueller, from Maastricht University in the Netherlands, asked Verhoeff whether his *DNA labs for Citizenship* project in schools would not bias students towards genomics. Verhoeff answered yes, but pointed out that the project is trying to build a social scientific environment around genomics through the use of mobile DNA labs. The goal, he said, is to educate students to make them better-informed citizens and decision-makers, but also with a view to their potential professional engagement in the life sciences.

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As Verhoeff argued, the technological fascination and lure of genomics ultimately needs to be balanced against its consequences in order to evaluate the field in terms of a holistic understanding of biology. Part of such a holistic view is an awareness that life-scientists and social and humanist scientists tend to be normative in some respects when they promote or justify their work. Both natural and social scientists are in situations in which they actively wish to give orientation—both in terms of what is a matter of fact and what is the right thing to do—however authoritatively this might come across. They talk about desirable things such as “improving health care” and “leading to a better understanding of humans”, or “improving stakeholder interaction” and “fostering informed democratic decision-making”. In fact, the entire machinery of making science socially responsible might even function on the basis of underdetermined value assumptions that can be handled more easily as long as they are taken for granted.

We are perhaps seeing a new academic field emerging at the nexus of society and genomics, although not a distinct discipline in its own right. Some would refer to it as ELSA, but there are too many examples where ELSA is neither used as an idea nor as a cognitive framework for practices and institutions, for this to be an accurate label. Elsewhere, the rise of the post-ELSI era has been announced (Rabinow & Bennett, 2007). We prefer to speak of “doing society and genomics” because we

find different modes of working that bring together many jobs and affiliations within science faculties and research programmes, not only those under the flag of ELSA. Indeed, there are many approaches, institutions, job-hybrids, biographies and practices, and it will be instructive to follow these emerging phenomena and their frames of society and genomics work. Through their success or failure, we will be able to investigate the careers of boundary objects and boundary workers, and the future of intermediary institutions for learning.

Convergence work in the area of society and genomics has certainly not come to an end. It represents a huge field trial with all sorts of social actors and institutions. Practitioners from various disciplines must balance many different interests in order to pursue knowledge co-production (Jasanoff, 1987, 2004). Yet, before knowledge co-production will sound like “making music together”, to use a famous metaphor (Schütz, 1964; Luckmann, 2008), more must be accomplished than just balancing interests. Shared concepts of collaboration need to be developed that function as common denominators, just as the accentuated backbeat and the melody motif work together in a good rock tune. Returning to the metaphor of the rock band: ‘convergence’ needs to sort out who is going to play the drums, who is going to play the lead guitar, and who is going to be the singer. Rock ‘n’ roll music evolved out of blues, gospel, folk and jazz; it has been through many fashions and has had good and bad years, but it is still around. The society and genomics movement will be much the same.

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