KNOWLEDGE POLITICS
CONVERGING TECHNOLOGIES

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Final Newsletter Knowledge NBIC Project

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The Knowledge NBIC project has now been completed. The research team's report on knowledge politics in the field of converging technologies was recently submitted to the European Commission and will soon become available for downloading on the project website. All of the project outputs and publications are listed at the end of this newsletter. An executive summary of the main findings of the project can be found below.

Knowledge Politics and Converging Technologies: Summary of Findings

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The publication in 2002 of a National Science Foundation Report on 'convergent technologies' marked the beginning of a new era in the field of technology, but also the sociology of knowledge.[1] Technological convergence was suddenly back in fashion but this time the paired claim for a unifying science, which often accompanies convergence discourses, appeared credible. What was more, this claim was being made bottom-up, that is with reference to empiricism. Developments at the tiny nano level of reality, in conjunction with computational advances through modern information technologies, made it possible to imagine, for the first time realistically, a brave new world, in which engineering could be applied to both body and mind and also to their interface with previously undreamt of enhancement possibilities.

Biotechnology had already established itself as the leading science for technological development in the 1990s. Nanotechnology and cognitive science now appeared to make it possible to make the next quantum leap and integrate biology and physics. This development was not peripheral, nor simply one more fad in the never-ending struggle for more public and private research funding, despite displaying the characteristics of one due to presentation and rhetoric. As Steve Fuller writes in the first report of our KNOWLEDGE NBIC project (2008, published 2009),[2] the converging technologies or CT paradigm enabled the resurgence of the chemical worldview in science and technology:

> *'The physical and chemical worldviews can be regarded as complementary, especially from a theological standpoint. The physical worldview draws a clear distinction between Gods and humans, so that there are final barriers to our ability to predict and control nature. We aim to discover that beyond which we cannot turn to our own advantage. By contrast, the chemical worldview, much more heretically, envisages humans playing, if not replacing, the divine creator. Here matter is not treated as an insuperable barrier, but as raw material to be moulded – with more or less difficulty – to serve human needs. What matters is not the ultimacy of matter per se, but its moment of ultimate plasticity, the so-called edge of uncertainty that the nano-scale promises to provide.'*

Within universities and the R&D laboratories of private industry, the converging technologies paradigm supported the pre-existing trend towards application-driven interdisciplinarity. The last few years have witnessed the gradual decline of basic research in favour of applied research. This has happened despite the continuing symbolic hegemony of 'basic research' as the cradle of all scientific innovation. Linking scientific endeavour across disciplinary boundaries forces scientific questions to be treated from different angles. Add to this the interest in swiftly translating scientific findings into technological breakthroughs and, by extension, industrial products, and you get the modern service and technology paradigm. The converging technologies did not create this paradigm,

but they have contributed to its consolidation. Perhaps, more importantly, they have added a less materialistic or industrial-based ideology to go with it, i.e. that of human enhancement.

The human enhancement vision comes in different variations. The engineering variation characteristic of converging technologies has its philosophical origins in Saint-Simon's sociological vision of a society in which citizens are to be transformed into productive community members through 'moral education' so as to overcome dependence on religions.[3] The human enhancement vision of converging technologies replaces social engineering by body and mind-engineering enabled through nanotechnologies.

Not surprisingly, the scope and degree of this transformative element remains contested – both factually and normatively. Factually, the question is whether science and technology are capable of breaking through and away from the complexities of mind and body. Normatively, what is at stake is the ethical implications of these new powers as they gradually materialize. The boundaries between using technology to restore health and using it to enhance physical or cognitive capabilities are more porous than seems at first.

Enter knowledge politics. In the light of the opportunities and challenges of emerging technologies we are today witnessing a surge of 'arguments (...) motives, (...) consensus and (...) narratives' around science and technology. These are often as far removed from reality as the converging agenda itself.[4] Yet they are significant movers and shapers in debates about the assessment of risk, the better way to monitor or assess technologies, or the role of regulations.

> *'Today, a growing emphasis is placed on what is referred to as "anticipatory governance" and the implementation of processes which attempt to preclude the possibility of particular technological developments, uses of knowledge and even the production of knowledge. Within this context a plethora of debates emerges about the merits and possibilities of restricting or promoting innovation, freedom of scientific exploration, the "weight" given to the perspectives of certain stakeholders, the timing of governance initiatives, self-governance, global governance'*.[5]

There are presently several debates about converging technologies and, especially, nanotechnologies and, most recently, synthetic biology. Many of these also involve citizen participation. Jacquelyne Luce reviewed them in the second report of the KNOWLEDGE NBIC project, which was recently completed. Emerging knowledge politics activities include the following:

- First, there are the reports being produced by those platforms which initiated the CT debates, such as the National Science Foundation in the U.S. or the European Commission in the EU. In a second report on CT of 2006, the NSF looks at *Converging Technologies in Society*, seeking to identify anticipatory measures for 'taking advantage better, sooner, and in a responsible way for society' (Bainbridge and Roco 2006:1).[6] The European Commission is keener about 'responsibility' through self-regulation. Its *Code of Conduct for Responsible Nanosciences and Nanotechnologies Research* (EC 2008) calls for open debates within science and at the interface with the societal sphere in order to promote research in line with the precautionary principle. The European Code of Conduct follows the publication of a Code of Conduct by the UK-based Nanotechnologies Industries Association.[7] The International Risk Governance Council, bringing together representatives from several international organizations as well as national governments and industry, produced its own *White Paper on Nanotechnology Risk Governance*, calling for better communication strategies as a means of risk governance.[8]
- Much relevant information on CT is being provided by research projects such as the KNOWLEDGE NBIC project. For the European Commission, research projects often represent the only possible way of initiating a wide-based dialogue in those

areas in which national policies differ and there is no clear mandate for trans-national action. The situation is not very different at the national level, considering that there is no real institutional home for 'anticipatory governance'. Thus, in the United States, much of the work on the ethical, legal and social implications of nanotechnologies and converging technologies is being done within the framework of project activities by the Centre for Nanotechnology in Society at Arizona State University.[9] In the United Kingdom, similar work is being carried out by the think-tank DEMOS as well as by the Universities of Lancaster and Cambridge.[10] In Austria, the Academy of Sciences is running the so-called NANO-TRUST project[11] with support from the Ministry of Transport, Technology and Innovation. The delegation of information gathering and communication to academic or non-governmental organizations has the advantage of promoting pluralism and self-management within the scientific community. Its main disadvantage is the absence of a clear mandate for the provision of specific regulatory input.

- Within civil society two types of activities can be found, i.e. those directly supported by state institutions (through research projects or grants, as above) and those organized independently. The latter are usually the remit of large civil society organizations such as Greenpeace or the ETC Group.[12] These are also the organizations more likely to be critical of nanotechnologies with reference to the precautionary principle rather than anticipatory governance.
- All of the above institutional actors make extensive use of the internet and Web 2.0 to transmit their knowledge or views. The proliferation of this type of information dissemination has raised questions regarding reliability which, in turn, have contributed to 'the emergence of several "gateway" websites or internet certifications by which organizations claiming authoritative knowledge in a particular domain "approve" websites linked to or certified by them'.[13] The internet is also being increasingly used to organize deliberative forums on emerging technologies. One such example is the 'Synthetic Biology' Group,[14] which besides arranging conferences, runs its website on OpenNetWare, thus allowing active contributions from all those interested.
- Regulatory activity is currently still only limited to those application areas concerning public health. This is the case with food policy, medical instruments and medicine. In Germany, this led to the organization by the Federal Office of Risk Assessment of a consumer conference about the perception of nanotechnology in foodstuffs, cosmetics and textiles. At the European level, a new certification directive regarding products including novel (and nano) materials is under planning, whilst the recent regulation concerning health and nutritional claims is expected to contribute to the future avoidance of manipulative information regarding nanomaterials in food. Nano-specific labelling initiatives have also been initiated by private industry: two examples are the labels of the German ForumNano firm and that of the UK Soil Association. In the medical field, the existing framework governing the release and authorization of new medicines typically lasts 12 to 15 years and involves a series of medical trials in different settings. This is still considered appropriate, but social research on the subject of patient consent and security is on the rise.

Consumer conferences typically involve the direct participation of citizens next to representative stakeholders. The input of citizens has, however, also been sought in several different settings and chiefly by organizing focus groups, citizen juries or panels. Examples include the Nanodialogues project of DEMOS and the University of Lancaster;[15] the public debates on nanotechnologies organized by VivAgora in France (and specifically in Grenoble and Paris);[16] the EU-wide citizen consultation on the ethical implications of brain research arranged by the King

Baudoin Foundation[17] and the series of citizen panels on nanotechnologies held by the Centre for Nanotechnology in Society on behalf of the National Science Foundation in the United States. Participatory technology assessment enjoys wide legitimacy within both the science community and the ethics community. However, its organization often stumbles at the difficulties involved with respect to agenda definition and comprehensive follow-through in policy. A new form of participatory technology assessment is foresight, involving brainstorming and scenario-writing, and bringing together scientists and citizens to envisage the CT futures and, on this basis, outline strategies for dealing with their negative effects.

What much of the above knowledge politics sites leaves untouched – either entirely or in part – is the normative implications of nanotechnologies and converging technologies – in other words, not so much the question of 'how' to cope with emerging technologies, but rather, 'whether' at all, or to what extent. These discussions are usually pursued in political or academic publications and by bioethics commissions. Many of the issues raised concerning stem cell research or the human genome project are also being put forward with reference to converging technologies. However, the debates are less heated because CT is 'less advanced' and, therefore, not yet perceived as intrusive. A more relevant issue in this context is perhaps the question as to regulations to govern the 'dual use' of relevant technologies, i.e. the use of technologies in both military and civilian applications. Israel has been one of the first countries to come up with guidelines in this respect.[18]

At the philosophical level, most debates continue to struggle with definitions, as it is not always clear, not even among scientists, what nanotechnologies or converging technologies are, or rather how broadly or narrowly they are to be defined. Defined broadly, converging technologies could be anything and, in that, they are not substantively different to knowledge produced at the interdisciplinary interface. The advantage of this approach is that it downplays the novelty of converging technologies and, in so doing, relativizes and demystifies their possible implications. If converging technologies are nothing new, then there is also no necessity for a new approach to their external or self-regulation or their ethical assessment. This view prevails within the scientific community and also the liberal ethics confraternity. The counter-argument is to define converging technologies much more strictly either with regard to their scientific characteristics or in philosophical terms. This narrative tends to split into two: those who define CT as NBIC – that is as technologies combining nano-, bio-, info and cogno-science – will tend, like the first group above, to dismiss the potential dangers as not really existent. Indeed, as yet there is little evidence for a fully fledged four-fold integration among these fields, with most real integration taking place between two and only rarely three fields. The argument for strict regulation or, at least, a rigorous rethinking of present regulatory approaches comes from a third group, i.e. those who look into the philosophical foundations of the new discourse. For this group, converging technologies are risky not because of their technological applications alone, but also owing to their underlying new mode of thinking about enhancement, transformation or engineering.

Whether the knowledge politics on converging technologies will follow the same route as that for GMOs, stem cell research or genetic engineering remains to be seen. From the normative perspective, key issues are the timing of the intervention, the sufficiency of existing frameworks and the scope of and for exceptions. Insofar as new initiatives are concerned, the view gained by the KNOWLEDGE NBIC project through its review of existing activities and discussions with relevant actors is that new initiatives would be difficult to specify even if desirable by some. Restricting scientific research is generally rejected as an option, and even most NGO representatives will not go so far as to call for major restrictions on scientific endeavours. The reason is that such restrictions would prove obsolete in practice, unless embedded in constitutional frameworks which

are overall restrictive and hence undemocratic. Greater transparency in communication and timely risk assessment are advocated by many, but not explicitly linked to specific organizational formats. A general impression is that more institutional mechanisms might be needed for processing and analyzing new information as it emerges. The exponential increase in new information and our inability to transform this into knowledge for action might be the biggest risk of emerging technologies.[19]

Notes

1 NSF (2002), Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology and Cognitive Science (with an introduction by M. Roco and W Bainbridge), NSF
2 For full references, see below under project outputs.
3 See Fuller 2008, published 2009.
4 See Stehr (2005), Knowledge Politics: Governing the Consequences of Science and Technology, Paradigm Publishers.
5 For full references see below under project outputs.
6 See NSF (2006), Managing Nano-Bio-Info-Cogno Innovations: Converging Technologies in Society, NSF, introductory chapter (by Bainbridge and Roco, p.1).
7 See www.nanotechia.org/content/activities/nanosafety.
8 See www.irgc.org/Nanotechnology.html. The White Paper was published in 2006.
9 See http://cns.asu.edu/.
10 See www.demos.co.uk/themes/~nanotechnology.
11 See http://nanotrust.ac.at/.
12 See www.etcgroup.org.
13 See Luce (2009), Main Report D2, KNOWLEDGE NBIC project – for full references and publication dates, see below under project outputs.
14 See http://syntheticbiology.org/
15 See www.nanodialogues.org.
16 See www.vivagora.org.
17 See www.meetingmindseurope.org.

Project methodology and outputs

The KNOWLEDGE NBIC project had three main components:

1) It looked at the emerging discourses on converging technologies (CT) and traced their impacts on research trajectories
2) It mapped the various settings currently emerging for debating CT at different levels – what we have referred to in our project as 'knowledge politics'
3) It organized external workshops for discussing converging technologies and the role of social science research.

The project made extensive use of desk-review research and also performed expert interviews with representatives of science, industry and ethics. A series of case studies in different countries have looked into the national debates on the topic.

The project has produced the following outputs:

- A report by Steve Fuller (2008) on how converging technologies affect research trajectories. A revised and shorter version of this report was published in Innovation; the European Journal of Social Science Research (Vol. 22, No.1, 2009).
- A report by Jacquelyne Luce (2009) mapping the emergence of knowledge politics around converging technologies. This report will become available for download on the project website in May 2009.
- Country reports on each of the above subjects are available in the annexes to each of the above reports.
- Two thematic publications on converging technologies in journals:
  a) Liana Giorgi and Jacquelyne Luce (eds.) (2007), Converging Science and Technologies: Research Trajectories and Institutional Settings, Special Issue of *Innovation; The European Journal of Social Science Research*, Vol. 20, No.4.
  b) Jacquelyne Luce and Liana Giorgi (eds.) (2009), Knowledge Politics and Converging Technologies, Special Issue of *Innovation; the European Journal of Social Science Research*, Vol. 22, No.1.
- Five issues of the project newsletter.

The project website www.converging-technologies.org includes information on the project and its outputs as well as links to other relevant sites in the field.

Contacts

The KNOWLEDGE NBIC project will remain online after the contractual end of the project and continue to provide updated information on converging technologies from the social science perspective. Please contact Liana Giorgi at l.giorgi@iccr-international.org or Jacquelyne Luce at jacquelyne.luce@zeppelin-university.de with comments, suggestions or requests.