

Mobilisation and Meaning in the Field of Emerging Technologies

Narrating Converging Technologies

Defining the concept of converging technologies is an ongoing process of mobilisation and meaning-making in various spheres. It is associated with Nano...science and ethical debates about human enhancement. The concept may serve as an impulse for novel forms of science and innovation governance.

By Jacquelyne Luce

Although used widely in relation to communication technologies during the 1990s, the phrase “converging technologies” as it will be discussed herein was brought into the public, but primarily political, sphere by the proceedings of workshops jointly sponsored by the U.S. National Science Foundation and the U.S. Department of Commerce.

What are Converging Technologies?

A report edited by Mihail Roco and William Sims Bainbridge and published in 2002 under the title of “Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology and Cognitive Science” drew significant attention to the economic potential, societal implications and visionary specificities of the convergence of nanotechnology, biotechnology, information technology and cognitive science (NBIC). In the overview of the report, Roco and Bainbridge (2002:ix) write:

The phrase “convergent technologies” refers to the synergistic combination of four major “NBIC” (Nano-Bio-Info-Cogno) provinces of science and technology, each of which is currently progressing at a rapid rate: (a) nanoscience and nanotechnology; (b) biotechnology and biomedicine, including genetic engineering; (c) information technology, including advanced computing and communications; (d) cognitive science, including cognitive neuroscience.

The descriptive definition of convergent technologies that is offered by Roco and Bainbridge covers a broad spectrum of science and technology fields with the synergism of core competencies acting as an innovation beacon. It is a glimpse of what could be possible if, more so than a reflection of what is happening now. The report features futuristic visions of an improved future in which individuals will benefit from technological enhancement and society will benefit from enhanced individuals. In Roco and Bainbridge’s words, some

“[e]xamples of payoffs [of NBIC convergence] may include improving work efficiency and learning, enhancing individual sensory and cognitive capabilities, revolutionary changes in healthcare, improving both individual and group creativity, highly effective communication techniques including brain-to-brain interaction, perfecting human machine interfaces including neuromorphic engineering, sustainable and “intelligent” environments including neuro-ergonomics, enhancing human capabilities for defense purposes, reaching sustainable development using NBIC tools, and ameliorating the physical and cognitive decline that is common to the aging mind.” (Roco and Bainbridge 2002:ix)

The integration of nanosciences and nanotechnologies in and with other fields, as well as the new blurring and refashioning of so-called disciplinary or domain boundaries with respect to, for example, computing, biology, physics and chemistry was also noted in future and foresight studies that were being carried out in other jurisdictions. A European Commission communication regarding the implementation of strategic action to support the development of nanoscience and nanotechnology research in the European Research Area referred to the establishment of a High Level Expert Group that would address NBIC convergence in and from a European context (European Commission 2004).

When the High Level Expert Group Foresighting the Next Technology Wave published its report “Converging Technologies: Shaping the Future of European Societies”, the group placed an emphasis on goal-oriented enablement, defining converging technologies as “enabling technologies and knowledge systems that enable each other in the pursuit of a common goal” and introducing the acronym of CTEKS which stands for Converging Technologies for a European Knowledge Society (Nordmann 2004).

Is Convergence a Reality?

Whether one talks about NBIC, converging or convergent technologies, questions will be raised as to whether or not the terminology reflects the realities of contemporary practices of scientific and technological knowledge production. At the present time multiple workshops are held with “converging approach” or “converging technologies” in their title, for example the European Forum on Nanosciences - A Converging Approach Across Disciplines 2006, Converging Technologies for Food 2006, Neuroscience Biomarkers and Biosignatures: Converging Technologies, Emerging Partnerships 2007, and Converging Technologies for 21st Century Security 2009. At the same time →

research attempts to map and keep track of emerging and potential clusters of convergence and to test the so-called reality of converging technologies.

In some cases, researchers have identified one of the four NBIC technologies to use as a base, followed by bibliometric studies aimed at determining the extent to which this one particular technology platform is converging with the others (Van Lieshout 2008). In other projects and institutions an application-oriented approach has been employed as a means of identifying technological clusters by which to categorise these developments and to provide evidence of such NBIC or NBI, BI, IC convergence and to identify emerging trends in need of possible policy support (Anderl 2008; Smith 2008). Debates continue to ensue about whether a pairing of two of the four NBIC areas constitutes a converging technology, whether there is any indication of synergism between all four fields, and whether converging technologies must involve any of the four areas. Keeping these debates in mind, in the areas of both innovation policy and research support, efforts are being made to understand what would be necessary to support a sustainable converging approach and convergence is being represented as self-evident and a marker of the transition to 21st century participation in the knowledge society. Two examples are the nano-bio-info technology convergence cluster of the Silicon Valley Economic Development Alliance and the mission statement of the Converging Technologies Bar Association.

Invoking Ethics

The concept of converging technologies exists in somewhat of a state of tension that is engendered by the different understandings of envisioned futures and scientific and technological practices that the use of the phrase is understood to infer. Thus, the convergence of disciplinary knowledge, institutions and technologies are highlighted as keys to promoting and achieving scientific and technological innovation by taking advantage of the significant advances that are foreseen to result from the integration and interface of core technology platforms. Visions of the potential developments simultaneously raise questions about the role of such technologies in society.

In a number of cases, definitional boundaries have been drawn, rendering a distinction between practices of science and technology, e.g. technological, disciplinary and institutional convergence, and applications in need of ethical deliberation. This distinction is striking, for example, in the Nano-Initiative Action Plan 2010 which was introduced in Germany in November 2006. The action plan identifies the multiple areas of research and development within Germany that could benefit from the strategic integration of nanoscience and nanotechnology know-how. The final page contains the following paragraph under the heading of converging technologies:

“The nanotechnology, biotechnology, information technology and cognitive science research fields will converge increasingly in the future. Expectations of the results that might be achieved by imple-

menting converging technologies range from healing paraplegics to developing new therapies and artificial organs and significantly extending life expectancy whilst retaining an equal or better quality of life. In the long term, more and more functions of the human body might be taken on by products and procedures resulting from converging technologies. One day, we might even be in the position to improve the mental and sensory capabilities of mankind. Fundamental ethical issues arise in conjunction with these kinds of developments since they have a bearing on human self-perception.” (BMBF 2007:28)

Identifying the same core fields of NBIC as set out in the Roco and Bainbridge report, converging technologies are portrayed as of the future, with such future developments being the potential subjects of ethical deliberation. The developments that are foreseen to raise questions are those that are related to intervening with the mind or body and which are often the subject of human enhancement debates which focus on life extension, mind manipulation, et cetera.

Between 2002 and 2009, a fairly significant number of publications have emerged, especially within the disciplinary parameters of technology assessment, science and innovation policy research, science and technology studies, and social science studies of science and technology which compare the rhetoric and imagery employed in the initial report and the responses to it and the means by which “converging technologies” and notions of “human improvement” might or might not communicate with the cultural and societal values of various geo-political jurisdictions (Ferrari 2008; Giorgi/Luce 2007; Kuschoff 2007; Luce/Giorgi 2009).

European Policy

Concurrent, although not explicitly related to these debates, the use of the phrase “converging technologies” has moved in and out of public and policy sight over the past number of years. As mentioned above, the need to explore the concept of converging technologies from a European perspective was identified in Communication of the European Commission regarding the development of a Nanotechnology Strategy to support innovation within the European Research Area and fully elaborated upon in the reports of the High Level Expert Group Foresighting the Next Technology Wave. The First Implementation Report on the European Commission Nanosciences and Nanotechnologies Action Plan 2006-2009 does not contain or retain any reference to converging technologies. On the other hand, coinciding with the launch of the Seventh Framework Programme, the Nanotechnology Unit has been renamed the Nano- and Converging Sciences and Technologies Unit and convergence is explicitly mentioned within the European Commission Recommendation of 7th February 2008 on a code of conduct for the responsible development of nanosciences and nanotechnology research.

In contrast to the conflation of converging technologies with human enhancement technologies, the code addresses the po-

ints separately, stating in section 4.1.16 that “nanosciences and nanotechnologies research organisations should not undertake research aiming for non-therapeutic enhancement of human beings leading to addiction or solely for the illicit enhancement of the performance of the human body” and in Section 4.2.7 that “nanosciences and nanotechnologies research funding bodies should launch and coordinate specific research activities in order to gain a better understanding of ethical, legal and social impacts of the new fields opened by nanosciences and nanotechnologies. Information and communication technologies and biotechnology should receive particular attention as well as the convergence between these fields and cognitive sciences and nanosciences and nanotechnologies.”

The concept of convergence is separated here from questions of human enhancement; human enhancement being identified under the sub-heading of “Prohibition, restrictions or limitations“ and attention to convergence as a means of achieving “Due respect for precaution“. This discursive separation is taking place in other domains as well. There is, therefore, the potential for a number of the ethical deliberations and broader social and philosophical debates that have been associated with the converging technologies debate to shift from a focus on converging technologies which is now constituted as technological and disciplinary convergence to a focus on human enhancement. The complexities that converging technologies may embody beyond human enhancement are thus potentially deferred to other spaces of debate, which may not capture additional pressing issues concerning technological development as access, distributive justice, resources, sustainability and risk.

Convergence as Dialogue Impulse

When shifting to a discussion about innovation and science and technology governance – that is, the multiple manners in which scientific practices, applications and even the pursuit of particular knowledge might be formally and informally regulated – the distinctions that can be witnessed in terms of the shifting and mobilisation of various definitions of converging technologies as discussed above take on yet another character. When ethical, legal and social aspects (ELSA) questions are raised with respect to converging technologies, a strong critique is that one can not talk about converging technologies in such an abstract way, given that they could be almost anything. Converging technologies per se would thus be ungovernable, with the ELSA debates confined to reflecting on broader dimensions, e.g. the morals of human enhancement and the development of technologies for military use, rather than addressing what might be considered to be more concrete issues in manners that may result in translation into policy. Preference is often given, especially at the policy level, to addressing the specifics of particular applications. This is a debate which is similar with respect to nanotechnology taken on its own.

Another realm of dialogue is opening up, though, which takes converging technologies as a concept that is indicative of

changing patterns of knowledge production and, thus, governance and dialogue needs. The convergence of technologies is that which is seen as in need of emphasis, as it is the converging dimension which destabilises previous and current means of governance, the implementation of the precautionary principle, the fostering of public discussion, participation in decision-making and so forth. The questions to be posed, whether with respect to a particular application, an emerging specialty area of research, or more general research directions, transcend disciplinary borders according to which various civil society organisations have been founded. A civil society organisation representative I interviewed as part of the Knowledge NBIC project described the transitions in the foci of the institution with which he is affiliated from agriculture and biotechnology to genomics more generally, then to nanotechnologies and synthetic biology and, increasingly, the interrelatedness of technologies, commenting:

“We look across new technologies and also new corporate alliances, corporate trends, and consider, what are the impacts of those two things – on the one hand, the new technologies and, on the other hand, the new trends in corporate organisation – for society?...I think we as much look at convergence as a corporate strategy, as a business strategy, as a sort of science system strategy...”

Another interviewee who was working for a non-governmental environmental organisation stated:

“What I would say, just as a prefix, is that the main challenge of emerging technology and converging technology is that, by its very nature, it is challenging the way government has been set up to deal with issues – health issues, environmental issues and so forth. [The challenge is] a combination of things – of privatisation, of the public policy world, cuts in government capacity to do independent research – and, at the same time, an unwillingness to put a governmental structure and policy in place that would address the challenges of things like nanotechnology, which is actually crossing all known boundaries: not only biological but also in terms of, is it science, is it health, is it environment, is it air, water...?”

For the individuals I interviewed who were working in civil society organisations the rapid commercialisation of novel technologies was considered to be a significant factor in the call to develop awareness about the boundary crossing that is taking place. Whether by implementing discussions which emphasise the relationship between converging patterns of industry alliances and converging technologies and critically addressing these, or by attempting to initiate conversations across regulatory sectors by emphasising the converging factors of new technologies, convergence is being taken up by some as that which reveals the limitations of current governance structures.

Concluding Remarks

A concept such as converging technologies assumes the flexibility of everyday language, proving to be both malleable and stubborn in the face of attempts to define, perform and contest its meaning. Its synonymisation with NBIC in one context, its →

expanded terms of interdisciplinary referents in another, its defiance as a description of knowledge production patterns in the name of divergence, or its associations with human enhancement discourses and visions offer the possibility to take note of the processes and practices which are shaping contemporary science and its governance.

It is perhaps in paying attention to the mundanity of convergence and converging technologies, for example the inability to classify technologies according to even recently sensible categories such as medical device or pharmaceutical, that the concept will provide a foundation for the explication of contemporary complexities and the impetus for novel means of engaging questions concerning the interrelated social, legal, ethical, political, economic and environmental dimensions of innovation and science policy and knowledge governance.

Annotation

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