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Open Questions in the Ethics of Convergence

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After historically situating NBIC Convergence in the context of earlier bioethical debate on genetics, ten questions are raised in areas related to the ethics of Convergence, indicating where future research is needed.

Keywords: *human enhancement, human/machine interface, NBIC Convergence, upstream ethics*

One of the prominent claims made about nanotechnology and Convergence is that our new found capacity to understand and directly manipulate the building blocks of life enables us to control aspects of human evolution that were previously subject to blind chance and natural selection. But this Promethian aspect of the Convergence project is not new. In fact, in the early days of recombinant DNA research, these claims were often advanced by leading scientists. In the 1960s and early 1970s, when the seemingly radical prospects of genetic science were on the immediate horizon but scientists did not yet possess the tools needed for more refined manipulations, some of the people who would found the modern discipline of bioethics brought their skills to this topic (Jonsen, 1998, ch. 6).

In many ways, the debate at that time was remarkably similar to the one now emerging around Convergence. Some scientists seemed overly optimistic about the rate at which our science would proceed, imagining that cloning and radical enhancements were only a generation away. Others, primarily philosophers and theologians, were more circumspect, and they raised questions about the scope and limits of science, about human nature and purpose, and about the appropriate way to understand our current place in history.

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Paul Ramsey was one of the most influential among these early bioethicists, and his arguments can be taken as representative (Ramsey, 1970). He was not antiscientific. He acknowledged the fruits of science, and even saw the activity of science as an expression of human dignity (glorifying the human as “thinking reed”). But Ramsey also questioned whether ethics could be sufficiently understood in terms of scientific categories and modes of reasoning alone. Challenging the sufficiency of Bronowski’s (1965) “science-based culture,” Ramsey attempted to draw on philosophical and theological insights that were integral to his Christian tradition. In those days, many of the leading philosophers, theologians, scientists, physicians, and politicians came into dialogue about the developments in science and human life. Bioethics was an arena where these titans clashed over the big questions.

As the science developed, and as techniques for reprobogenetics were refined, there was a marked shift in the form and character of ethical analysis. In 1991, Eric Juengst, then Program Officer for the ELSI arm of the Human Genome project, edited an issue of this *Journal* which was quite influential. In his introduction (Juengst, 1991), he characterized the earlier debates, and the views of people like Ramsey as “romantic.” He saw that discourse as primitive and anxious. People were struggling to take hold of the genuine ethical issues as they first contemplated the rich possibilities of the emergent science. But Juengst saw this imprecise, proto-scientific discourse giving way to a new stage of precision in ethical analysis, where careful distinctions and a scientific temper dominates (see also Jonsen, 1998, ch. 6).

With this shift, there was a movement away from Ramsey’s global, integrative assessment toward a piecemeal analysis. As this more scientific ethical discourse took over, people turned from grand questions about the nature of science and ethics, our place in history, and human nature and purpose. A single, entangled, somewhat fuzzy debate about the future of humanity fragmented into a host of smaller debates. Now one asked whether earlier bans on DNA cloning were warranted, whether the therapy/enhancement distinction can be sustained, or whether and how genetic information can be kept private, just to name a few of the new topics. These questions were no longer linked to one another. With Juengst’s “stage of precision” came an atomistic, fragmented approach to the issues. In these local, piecemeal questions, we find the temper of modern bioethics.

In many ways, the Convergence debate is similar. Juengst might say that we are now in the Romantic stage; we find similar claims made about the radically transformative character of our science. We also find the entangled, fuzzy, somewhat dreamy worries over the future of humanity. But I also think there are some striking differences between the debate then and now. Then, people started with the big questions. These provided a context, and introduced core principles and concerns, which were then refined in later debate. Today we start on the opposite end. We have our piecemeal, bioethical discourse. And we no longer know how to ask big questions.

Thus, when something new presents itself — something like Convergence — we want to get about our bioethical business, chopping the thing into manageable pieces that can be parsed out to our waiting hordes, all too ready to digest the allotted morsel. We ask if there is “anything new” here, and by that we mean: is there some topic that bioethicists have not already considered? And the answer is quick: No, we’ve looked at all these claims before (Litton, 2007). Thus we answer without first doing the really hard work of understanding the phenomenon at hand.

In this *Journal* issue, I tried accomplish the opposite of what Eric Juengst did in his. He saw himself as a champion of the turn to precision. He brought together the scientists and philosophers who would provide the key distinctions for the piecemeal debates of the next decade. He was the champion of demystification and disentanglement. But I see a context where we no longer can ask deep questions; where bioethicists are trapped in a shallow mode of reflection; where, as Al Jonsen lamented, bioethics has become boring (Jonsen, 2000). Instead of chopping off new stuff for our bioethical machine, or providing a premature precision, I thus tried bring together those who might help us ask questions afresh; those who struggle at the edges of dream and reality, and who seek to discern the novel features of a science and technology that is similar yet also different from what came before. To this extent, I see the words of Alfred Nordmann (2007) as the most dangerous, not because they are unreasonable or radically disruptive, but because they are too reasonable; too much an echo of an answer we have always given. In essence, he counsels us to follow the path Eric Juengst has already laid out for us. In Convergence, we don’t find any science much different from what has come before. This is just a dream, a protoscientific illusion that must be broken up so we can get about the proper business of science. And if we look at the Artificial Hand project or the Brain Machine Interfaces for paraplegics, we will find traditional medical interventions, not Matrix-like trans-humans (Nordmann, 2004). We can then handle these in the same way we’ve handled all the other projects that have come before.

At one level, Nordmann is of course right. I have little doubt that most of the projects discussed under the rubric of Convergence will settle out exactly as he and Juengst suggest. But at this stage, I think we should also pause and ask whether there is something else going on, something new that is taking form, something that calls for a different form of reflection and analysis. And before we too quickly get on with our standard bioethics stuff, we should struggle a bit harder to understand what is at hand.

I think the authors in this *Journal* issue help us take some first steps. But only first steps. In closing, I want to try frame some of the questions that, I think, still need to be considered, questions that should be integral to the ethics of Convergence in this early stage of debate. I emphatically don’t think these are the only questions or even the most important questions.

Also, in many cases, I think the authors in this Journal issue have framed the questions much better than I have here. But it still seemed important to set them out in a more explicit way as ongoing questions, and as a good starting place for additional work. My hope is that they might elicit some interest among those who are usually too quick to get on with precision and forget about accuracy. I take these as open questions in the ethics of Convergence.

1. *What is Convergence?* Is it the specific NBIC initiative advanced by Roco and Bainbridge (2002) in the 2001 workshop, and the subsequent reactions found in Canada, the EU, and in other countries? Or are these various workshops and reports only partial expressions of some deeper, more pervasive phenomenon? Is there a fundamental difference between the US and EU initiatives? If so, how is this difference best characterized? Or do these initiatives share important features, and provide alternative accounts of a common phenomenon? Is it even appropriate to speak of a US or EU Convergence initiative, as if these were single, integrated phenomena? Weren't there many participants at these workshops, and don't these have different views of Convergence? Are there subtle but important differences between the views of Roco and those of Bainbridge, or among the diverse participants in the EU Group? How representative are the workshops that have already been conducted? And how do we situate them in relation to other important social and historical developments? If Convergence is nothing more than the diverse workshops, then we can make it go away when support for those workshops are withdrawn or when the effort is re-described. But if these workshops bring to language something deeper, and if they reflect a kind of science and technology emerging in different places and under headings like synthetic biology, artificial life, and so on, then attempts to make it go away only conceal it, and make it more difficult to understand and publicly discuss the challenges on our horizon.
2. *Is the enhancement of human form and function an essential feature of Convergence?* Is there something unique about the way the questions of enhancement are framed, and about the challenges posed by NBIC Convergence? Or are these like the questions bioethicists have been considering all along? "Enhancement of human performance" was a defining feature of the US initiative. The US organizers included the kinds of enhancements that have been prominently featured in bioethical debate; for example, brain-machine-interfaces, genetic enhancements, and psycho-pharmaceuticals. But they also included under the rubric of enhancement many things that would not qualify in the bioethics discussions; for example, the use of information technology for enhancing team performance, nanotechnology for environmental remediation, and conventional medical technologies. For the US workshop "enhancement" seems to be

contrasted with “diminishment.” Believing that Convergence is already taking place, their goal was to catalyze and direct this process so it works for enhancement of human life. But even here, we should not simply see this as a synonym for “human flourishing.” To make sense of the diverse research initiatives that are included, we need to more carefully consider how human flourishing is interpreted in terms of enhancement of human performance. The EU Expert Group explicitly rejected the US goal, attempting to define Convergence in a way that is independent from enhancement. They also contrast “enhancement of the mind and body” with “enhancement for the mind and body” (Nordmann, 2004, pp. 7, 21). Implicit in this distinction is the idea that there is some invariant human nature, which should not be altered. We roughly think of this as the underlying “hardware.” Science and technology should then be used as means of engineering *for* human life, not as a means of altering or putting at risk such life. But is this really so different from the US goal? True, the EU Group is quick to reject the kind of enhancements that bioethicists like to discuss (and that depend on the therapy/enhancement distinction in medicine). But when they look to social technologies as the means for enhancing life, and when such enhancement is closely wed to the Lisbon agenda for a European knowledge economy, they seem to frame the purposes in ways quite similar to US efforts. We thus have several contrast classes: therapy vs. enhancement (traditional bioethical distinction, medically oriented); enhancement vs. diminishment (US NBIC contrast, but defining human flourishing in terms of enhancement); and enhancement of the body/mind vs. enhancement for the body/mind (EU Convergence contrast). Additional work is needed to clarify these and other meanings of enhancement, and to more carefully specify how these might, should, and should not be viewed as the goal of Convergence efforts. To provide this clarification, questions of enhancement need to be discussed in the context of a richer account of human flourishing, human nature, and the human condition.

3. *Are there topics or specific kinds of enhancements that might be taken as representative of Convergence?* If so, what are they? What is the current state of the science, and who are the leading researchers? What ethical issues are raised by these developments? The EU Group sees the research of the MIT Nanosoldier Institute as representative of the US effort; and they advance the Lund Artificial Hand Project as representative of EU Convergence. The examples are clearly chosen to present the US efforts as militaristic, oriented toward a super-soldier; and as crudely commercial, spinning off tradable goods from the military-industrial complex. How appropriate are these examples? A whole section of the 2002 US report was dedicated to national security, and prominent examples in subsequent reports are drawn from the military and US National Labs. But much of this research also has clear medical and broader nonmilitary

benefits. It does seem important to provide a more sustained ethical analysis of these military enhancement projects, especially when they involve radical enhancements of individual or team performance that might be misused in civilian or governmental contexts. But is this just a problem with US efforts? What kinds of military enhancements are being advanced by European nations or other countries? If these developments are taking place, isn't it better to have them visible and at least partially open to public scrutiny? Also, my discussion with European researchers involved in NBIC areas indicates that many of them also have more radical visions of human enhancement. Is it the case (as the EU Group suggests) that medical research in areas like tissue engineering, brain machine interfaces, and new prosthetics are not easily extended into nonmedical enhancement projects? Or is the enhancement agenda simply overlooked by those who drafted the EU report? If a few, well-chosen examples could be developed, these might provide a grounding for higher level discussion of the ethical issues.

4. *How should we understand the human/machine interface? In what form should such an interface be advanced?* This may, in fact, be a good candidate for a representative Convergence research area. Advanced brain-machine-interfaces (BMIs) evoke concerns about transhuman, Matrix-like transformations, yet they are also central for research oriented toward treating medical conditions like blindness or paraplegia. The topic thus involves the ambiguity associated with many Convergence projects, and some of the prominent researchers in the area clearly have both medical and nonmedical aspirations. Consider, for example, the work of Miguel Nicolelis. In his contribution to the US Convergence report, he contrasts a BMI with a mouse that requires external motor control to mediate the intentions of a computer user. Unlike the mouse, the BMI offers a seamless interface between humans and machines (Nicolelis, 2002). (The 2002 Convergence report also has an essay by the original developer of the mouse; Spohrer and Engelbart, 2002; on Engelbart's role see Barddini, 2000.) How might the recent BMI work be best situated in the broader context of reflection on the human/machine interface? How might this work be historically situated? And what linkages might be worked out between this research and other important work in bioethics? To give just one example of an unexplored linkage, consider earlier human factors engineering associated with "improving the human-system interface." Such human factors and operations research informs the influential Institutes of Medicine Report on human error. There we find language of human enhancement, but it is not of the traditional kind associated with the therapy/enhancement debate. The following quote is representative:

One of the advantages of technology is that it can enhance human performance to the extent that the human plus technology is more

powerful than either is alone. Good machines can question the actions of operators, offer advice, and examine a range of alternative possibilities that humans cannot possibly remember. In medicine, automated entry systems or decision support systems have this aim. However, technology can also create new demands on operators. . . . Equipment may not be designed using human factors principles to account for the human-machine interface (Kohn, et al., 2000, p. 62).

Might this human factors and operations research work provide the context for discussing Convergence related enhancements, as Jean-Pierre Dupuy (2004; 2007) suggests? Andy Clark's (2003) account of humans as natural born cyborgs provides another valuable way of thinking about these issues, and he correctly notes that "the very idea of such an interface remains surprisingly under-explored" (Clark, 2007). Much more work is needed to appropriately frame and address the philosophical and ethical issues integral to this topic.

5. *Are there changing conceptions of nature? Of the distinction between the natural and artificial? Of technique and technology?* These questions are, of course, deeply intertwined in philosophical accounts of technology. Do our accounts of nature come from our science, or are our sciences informed by deeper metaphysical notions? Some of the literature suggests that our concepts of nature come from (or are associated with) our sciences. Nordmann contrasts a US engineering model of nature with what he sees as a more biologically inspired EU account. But we also find behind these science and engineering models other, more philosophically informed accounts. Clearly, Heidegger's critique of technology and his contrast between a more nurturing vs. imposing stance toward nature (or rather, Being) informs some of the European criticisms. We even find his terms of art when Nordmann (2007) speaks of "converging technologies as a means of *gearing* emerging capabilities towards common goals" or when Dupuy (2007) speaks of *enframing* and draws on Hannah Arendt, Guenther Anders, and Hans Jonas (for these terms of art in Heidegger, see Rojcewicz, 2006). What is the best way of posing these questions about nature, the natural, and technology? What other sources might inform the emerging Convergence discussion? Consider, for example, the contrast between the *physical technologies* integral to the US report and the *social technologies* emphasized by the EU Group. How can we best understand this distinction? How might critical reflection on the character of technology inform the way ethical issues are addressed?
6. *How do we best understand and address the problem of embeddedness? Is technology becoming more transparent? If so, how? Are there other aspects of science and technology that are becoming transparent, and if so, what are they? What problems are raised by this transparency? Are the problems best understood in terms of privacy or are there more*

appropriate ways of framing the ethical issues? What issues of privacy are raised, and how should they be addressed (van den Hoven and Vermaas, 2007)? Are there radically disruptive or transformative aspects raised by Convergence, or are the issues sufficiently like those we have addressed in the past?

7. *How should we understand the scientific developments that are prominently featured in Convergence?* Today many speak of a new kind of science, of technoscience, mode-2-science, or post-academic science (Jotterand, 2006). We also see extensive discussion about the role of values in science, with some attempting to shore up a more traditional view of science as value-free, and others seeing values as integral to any science. In the US NBIC Convergence initiative, Roco and Bainbridge (2002) have suggested that the older fragmentation of sciences can now be overcome by new insights arising from studies of systems, information, and complexity; from study of the meso-realm integral to nanotechnology, and from new developments in cognitive science. Nordmann (2007) rejects this claim, advancing a more traditional view of pure and applied science, with the former taken as value free (or only involving epistemic or constitutive values) while the latter is governed by extra-scientific ends, with the associated means/end reasoning found in engineering or medicine. I agree with Nordmann that Convergence science is value laden, but don't think we can neatly tease out the values from the facts, and, with such division, neatly divide the science work from the ethics work (Khushf, 2004a; 2004b; 2006). I think they are entangled all the way to the root, and any disentangling is itself entangled in counter-agendas. We find here a debate similar to the one over values in health and disease concepts, and much depends on how we resolve it. Do we try identify a value neutral core, and then protect this core from corrupting, distorting influences? Can we clearly divide our vision and values from our facts? Or will our scientific and normative reflection be more deeply intertwined, and does the way we now do our science call for a new way of reflecting upon and critically revising our norms?
8. *Can science save us?* If so, what is it saving us from and how does it accomplish this salvation? Or does science depend on broader social and ethical frameworks that make it possible? How are we to understand the role of science in society? Bainbridge (2007) presents an impending crisis for the West, one arising from the combination of technological development and older, faith-based visions. He presents Convergence as a science-based alternative. Convergence is his name for a fully scientific worldview, one that has put behind the last vestiges of older, faith-based accounts. For Nordmann (2007), Convergence is not problematic because it involves an over-reaching of science, but because it is not scientific enough. Instead of embodying a new kind of science, Convergence represents an applied science that thinks it is fundamental. Such pseudoscientific

projects are seen as the primary threat, as the monsters that must be slain. And Nordmann is confident that the way to address these problems is by further advancing the demystifying activity of science itself. Can science play this central role? Or will it necessarily be informed by broader metaphysical commitments, which then remain implicit and unexplored? Dupuy (2007) challenges us to consider how the advancement of certain forms of scientific explanation might, at a key stage, end up undermining the very stance of the human subject and agent, and, in this last step, involve a negation of the very freedom and humanism that is initially advanced. Is there a darker side to our current confidence in, and exclusive regard for science? Can it protect us against more problematic, dehumanizing developments? Can it itself be dehumanizing?

9. *Are there resources within older religious or philosophical traditions that might inform deliberation on NBIC Convergence?* If so, what are they? How might we develop a broader debate that explicitly integrates these insights? These questions are obviously the flip side of the earlier ones about the sufficiency of science and its social role. One of the most striking differences between the 1960s/70s debate on genetics and the current one over Convergence concerns the role given to broader ethical and religious traditions. A large part of Ramsey's reflections (and of many others in that early debate) concerned the scope, limits and character of science, with an explicit attempt to show how science and ethics must draw on insights and forms of reasoning that cannot be grounded by science alone. In that day, philosophical and religious accounts played a prominent role in framing the ethical issues and in public debate. Today, by contrast, they are marginalized. No religious traditions were represented in either the US or EU working groups. When such views are prominently featured, as they were recently in the Kass President's Council, then the whole proceedings are viewed as antiscientific and parochial. But it is not just religious viewpoints that have been marginalized. In the US workshops, the traditional humanities were also not represented. Do we have a diminished debate when these alternative traditions are absent? How might the aspirations of Convergence be understood within different religious traditions? What insights might be drawn from more traditional philosophical and ethical sources?
10. *What form should up-stream ethical engagement take?* Today many are arguing that traditional, down-stream, post hoc modes of ethical reflection are no longer appropriate for addressing the issues integral to Convergence. We can no longer wait until some technology pops out at the end of the research and development process, before starting to think about the ethical implications of that technological product. Two reasons have been given for this. First, technology is now developing at too rapid a rate for such post hoc reflection. By the time public debate is

initiated on one technology, an even more radical new technology comes on line. The rate of such post hoc reflection thus is not adequate to keep up with the need. Second, technologies are being developed that increasingly do not fit precedent for a technology type. When, for example, a new pharmaceutical or chemical is developed, we already have established protocols for health and safety, and we know how to handle these new technologies. While they are new, they nevertheless fit precedent associated with a given technology type. But if we get a hybrid technology, neither drug, nor chemical, nor device, but exhibiting some aspects of each, we do not know how to assess it and also don't have public consensus on how the problematic aspects of the emergent technology should be handled. Emergent technologies in Convergence areas by definition transcend these traditional categories and precedents. They also have potentially disruptive social impacts. To mitigate potential ethical problems in a proactive way, many now advocate addressing them at the earliest stage, when the research is still under development. The National Science Foundation and other national funding initiatives are thus providing strong incentives for research teams to incorporate ethics work into their broader efforts. But how can this best be done, and what does such an up-stream ethic entail? While there is an emerging consensus on the need for such an up-stream ethic, there are few models of how this can be effectively advanced and even fewer cases where these models have been effectively implemented. What lessons can a Convergence ethic learn from bioethics? In what ways are the challenges new, requiring a fundamental rethinking of the ethics of emerging technologies? What topics should be first addressed? What are the open questions that are most pressing?

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