European public deliberation on brain machine interface technology – five convergence seminars

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Appendix 7
ETHENTECH, Final report August 2012
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Abstract:

We hereby present a novel procedure to engage the public in ethical deliberations on the potential impacts of Brain machine Interface technology. We call this procedure a Convergence seminar, a form of scenario-based group discussion that is founded on the idea of hypothetical retrospection. The theoretical background of this procedure and the results of five seminars are presented here.

Keywords:

Brain machine interface, ethics, public deliberation, hypothetical retrospection, decision making under risk,

Introduction

The last decade has seen an astounding development of a range of technologies collectively known as brain machine interfaces (BMIs).\textsuperscript{1} These technologies involve an implant that connects the human nervous system via electrodes to a machine, thereby making communication between the two possible.\textsuperscript{2} BMIs are already used in treatments for profound deafness, Parkinson’s disease, and depression. BMI developments currently at the experimental stage include retina implants, which could provide some blind people with rudimentary visual orientation, and advanced prostheses, maneuverable by neural control, for patients with some types of paralysis.

The potential effects of BMI technology in our society may be substantial. Issues under discussion include human enhancement, military applications, privacy, safety and risk, as well as challenges to
the body and especially the brain. A need clearly exists for public participation in discussions regarding how and to what ends this technology should be used and on the risks and the ethical issues associated with it. The experience from public engagements of this kind is still relatively scant and somewhat mixed. In some countries, constructive dialogues have begun, whereas in France, some public meetings have been interrupted by activists. In this paper, we present the results from a novel form of public engagement that aims to discuss these issues in focus groups in an informed and deliberative manner. We refer to this form of public engagement activity as Convergence seminars.

This method was developed and used for the first time as part of the EC FP6 NanoBio-Raise interdisciplinary project on nanobiotechnology and ethics, which was the predecessor of ETHENTECH. It seeks to combine public participation with a systematic use of scenarios in order to ensure that several possible future developments are seriously considered. It should be stressed that the opinions of the participants that are not necessarily supposed to converge, but rather the participants themselves converge, as they test their views and arguments in different sub-groups.

The theoretical basis of the convergence seminars is a model of decision-making called hypothetical retrospection. The aim of these seminars is both to gather opinions on BMI, and to inform and engage the public with respect to these issues. We believe that public participation and deliberation on morally relevant issues is intrinsically valuable and that it also contributes to bridge the gap between the public and academia.

We chose four distinct cultural regions of Europe to conduct our seminars: two seminars in Stockholm (Sweden), and one each in London (UK), Warsaw (Poland), and Seville (Spain). We chose participants who were expected to approach the issue from widely different angles. This is because this methodology is intended to record a variety of (reasonably considered) opinions rather than to determine the representative public opinion. In Sweden, we consulted with members of the
Parkinson’s association and with philosophy students; in the UK, with students at a theological and philosophical college; in Poland, with medical students and practitioners; and in Spain, with schoolteachers.

1. **Theoretical Background of the Methodology**

Participative methods for technology assessment and decision advice have been developed within the broad tradition of decision-oriented technology studies that began with the introduction of Technology Assessment (TA) in the 1960s and early 1970s. The initial hopes of developing efficient means of predicting the consequences of emerging technologies were not fulfilled. The discipline was therefore reoriented towards tasks that were more realistic. In the 1980s, participatory Technology Assessment (pTA) emerged as an alternative to traditional, more expert-driven procedures, foremost in Denmark and the Netherlands. The purpose was to improve public influence and participation in decision-making on future technologies. Various participatory methods such as dialogue forums, focus groups, future panels, and consensus conferences were developed for this purpose.³

In our view, one of the weaknesses of most of these approaches is their insufficient attention to uncertainties and in particular to the several alternative future developments that need to be taken into account in most assessments of future technology. In a parallel development, methods based on the systematic use of several scenarios have been developed for expert-driven decision support. Scenario planning has its roots in post World War II defense planning in the U.S., with major contributions made since by Royal Dutch/Shell in the 1970s. Scenario planning is now used in corporations and increasingly by governments and international organizations (such as the International Panel on Climate Change, IPCC). The standard method is to develop a handful of external scenarios that cover factors and developments beyond the decision-maker’s control, and
then to combine them with various possible responses and actions by the decision-maker. Scenario
development often takes place in workshops that involve experts and stakeholders. The finished
scenarios are then used by decision-makers in exercises aimed at developing insights about future
uncertainties and possibilities that can be used to improve decision-making.

In the last decade, nanotechnology and brain-machine interfaces have become the focus of an
increasing number of public participation activities in several different countries. The methods used
in these attempts include many classic educative methods such as lectures, seminars, and question-
hours with experts. They also include some of the participative methods developed in technology
assessment, such as focus groups. However, just as in previous work in technology assessment, the
combination of participative methodology with the systematic use of different scenarios to deal with
uncertainties and divergent possibilities seems to be absent (or at least very uncommon). Our desire
to improve previous work in this respect led to our decision to develop the method of Convergence
seminars.

Convergence seminars are based on a theoretical approach to rational decision-making under risk
and uncertainty, which has been described more in detail in a recent article by one of the authors. Like many other philosophical ideas, it consists in the refinement and systematic application of a
pattern of argumentation that is prevalent in non-philosophical discussions. One of the most
common types of arguments about future possibilities consists of referring to how, in the future,
one might come to evaluate the actions one takes now. These arguments are often stated in terms of
predicted regret: “Do not do that. You may come to regret it.” This is basically a sound type of
argument; from the viewpoint of classical instrumental rationality, it is irrational to perform an
action whose effects will be unsatisfactory. Decision-stability, in the sense that we continue to
consider a decision correct after we have made it, is clearly a desideratum. Just as we can improve
our decisions by considering them from the perspectives of other concerned individuals, we can also improve them by considering them from alternative future perspectives; i.e., hypothetically seeing them as we will see them retrospectively in the future. However, although the idea of regret-avoidance is a reasonable starting-point, such hypothetical retrospection cannot just be accounted for in terms of avoiding decisions that one may come to regret. Regret is often unavoidable for the simple reason that it may arise in response to information that was not available at the time of decision. Hence, in a systematized application of hypothetical retrospection, regret-avoidance has to be replaced by more carefully carved-out criteria. We consider this methodology to be particularly useful in areas where considerable uncertainty exists and where standard quantitative methods for risk assessment are not applicable. Brain machine interface technologies are clearly such an area. This makes BMI technology an excellent testing-ground for the development of a methodology that employs hypothetical retrospection.

2. Method

3.1 The Structure of Convergence Seminars

Convergence seminars have been constructed as a practical decision-aiding method that employs hypothetical retrospection. For that purpose, it is necessary to achieve the following two main criteria:

(i) Several different scenarios should be discussed individually, where each scenario explores possible future consequences of decisions that we might take now or in the near future.

(ii) A comparative discussion should take place whereby each of these scenarios is taken into account and evaluated against the others.
Many of the available methods for technology assessment are so resource-consuming that specific funding is needed for each procedure. Consequently, these methods are very seldom used in practice. Our desire was to develop a method that is practically useful and capable of being used, for instance, at evening meetings of voluntary organizations. This amounts to a third criterion:

(iii) The procedure should be easy to apply, and performable in a few hours.

In order to satisfy criterion (i), a set of concrete scenarios has to be developed for the discussions. These scenarios should be constructed in accordance with the requirements for hypothetical retrospection summarized above. Hence, they should all lead to some future point in time, but each scenario should lead to a different branch of future development. Each scenario should outline the respective branch in its full length, not only the “final state” at the point in time when the hypothetical retrospection is enacted. The focus should be on some decision in the present or near-present time that the participants are asked to evaluate from the viewpoint of their scenario. The different scenarios should also be selected so that they represent branches in which different alternate decisions give rise to problems that make them difficult to defend in hypothetical retrospection. Ideally, a large number of scenarios should be included in the procedure. However, in order to satisfy criterion (iii), the standard procedure proposed and used here employs only three scenarios.

For the same reason, participants are divided into groups and each scenario is discussed in detail by only one group. In order to satisfy criterion (ii), i.e. the comparative analysis, this first phase of discussions is followed by procedures whereby participants from the different groups in the first phase exchange experiences. The seminars were therefore conducted in three distinct phases. In phase one, the participants were briefly introduced to modern brain implants and were then divided into three groups: A, B and C. Each participant was handed a scenario that corresponded to the
assigned group. After carefully reading their scenario, they discussed within their own group the ethical aspects of that scenario. In phase two, participants were divided into new groups, whereby each group contained at least one person from each of the scenario groups of the previous phase. The discussion now focused on comparing and assessing the relative value and risks of each scenario. The third and final phase consisted of a discussion among all of the participants, where the topics could be synthesized into a more general discussion about what advice they would like to give decision-makers who decide on the development of BMI. The term “convergence” thus refers to the converging structure of this seminar model—not necessarily to a convergence of opinions among the participants.

The scenarios were written with the aim of provoking controversy and debate. The value statements expressed in the scenarios do not represent the judgments of the authors or the project. The scenarios were written with the aim of identifying trends and driving forces in the commercial and developmental aspects of BMI technology. Some outcomes were more unlikely than others, but they were chosen for their potentially high costs. The scenarios were constructed by the authors after a thorough analysis of the current and emerging development of BMI technology. The scenarios were not chosen to create an exhaustive matrix of possibilities or to include the most likely outcomes, but rather to introduce some extreme “worst-case” scenarios. For example, Scenario A describes a situation that imposes strict regulations on the application of BMI technologies, with consequences of relative economic and technological decline. Scenario B imposes regulations that are very permissive, with consequences that include medical failures and massive workplace surveillance. Scenario C also has very permissive regulations, but the consequences are social in nature, where widespread use of BMI technology leads to intergenerational conflicts, social unrest, and the deterioration of social norms. The text of the scenarios can be found in Appendix 1.
3. Results

4.1 Seminar 1:

This seminar took place in Stockholm in September of 2010, with a total of 9 participants (7 men and 2 women), who were all members of the Parkinson association, an organization for patients with Parkinson’s disease.

4.1.1 Phase 1:

In phase one, BMI technology was briefly introduced to the participants and the scenarios were handed out. Group A considered primarily the regulation of the potential military applications of BMI. According to the participants, no investment in military technology is justified, and the use of BMI by military personnel in combat should be restricted. However, a consensus was reached that such technology should be allowed for war veterans who have been crippled or otherwise harmed in battle.

Group B emphasized the importance of empathy as a priority for research efforts. These participants stressed that human enhancement should focus on enhancing moral sensibilities, rather than cognitive and physical performance. They also pointed out the limitations of even the most advanced forms of BMI. For example, deep brain stimulation might delay symptoms, but could not cure Parkinson’s, as one participant pointed out. The long-term goal should be not only to reduce symptoms to a minimum, but should also cure the disease (i.e., Parkinson’s disease in the participants’ cases).

Group C pointed out the inherent problems of long-term predictions and regulations, when moral beliefs may vary significantly over time. The participants were not sure whether society should try to
actively bring about these changes or if it should resist them.

4.1.2 Phase 2:

The participants’ reflections on the “virtual reality-game” proposed in scenario C were mainly negative. They argued that it crowds out real life human interaction.

The participants argued that most technology is beneficial—even technologies that today may be useless or have dangerous applications. One participant mentioned military technology that subsequently has been used for commercial or civilian purposes. One participant asserted that 90% of all technology was useful, but the rest was problematic. Nevertheless, most participants agreed on the importance of having strong institutions to regulate research and development of new technologies.

Some participants felt that the “big picture issues” were not sufficiently discussed in contemporary debates. They wanted a wider discussion on disabled and “abnormal” people, as well as the meanings of these terms. They questioned whether the attitude of wanting to “fix” things constituted a kind of hidden intolerance against anyone who does not conform to the norm, as asked by one participant.

Coercion and intimidation can take many forms, as pointed out by another participant who asked, referring to government interventions potentially possible with BMIs, “It is fine to treat a disease, like Parkinson’s, but what about dyslexia?” Another participant asked, “Should we really intervene in such an arbitrary diagnosis?”
The notion of quality of life was thoroughly discussed. Some participants agreed that the sense of belonging to a community and of feeling included in a social context was very important. Displaying symptoms of Parkinson's in public places made many participants feel disconnected to "normal people." They felt that this sense of alienation was due to a lack of shared experience. Therefore, the brain implants were viewed by many participants as a mixed blessing. In some situations, they made some participants feel more "normal". However, they felt that by being normal, they made other people with Parkinson's feel less normal. Other participants said that too much focus was placed on trying to be an overachiever. They argued that perhaps they should concentrate on their innate talents.

One participant pointed out that the potential military applications that were suggested in scenarios B and C were no better than the brainwashing found in religious cults. Most participants agreed that BMI should be used only for medical purposes, although considerable disagreement ensued regarding the precise definition of "medical" in this particular context. Most participants thought the greatest benefits from BMI would come from making better and earlier diagnoses. They also agreed that if BMI procedures were to become safer and less invasive, then their wider use would be acceptable. Some participants pointed out their own experiences with psychological side effects from their own implants.

4.1.3 Phase 3

During the last part of the seminar, the discussion was centered on technology and risk. Some participants pointed out that values and norms vary, and that publicized accidents may sometimes cause previously accepted technology to be viewed with more suspicion. Some technological advances were also ambiguous. They might benefit some, but impose costs on others, as some participants argued. Assessing the impact of yet unrealized technologies, or their potential
development, was difficult. Some participants said that technological development could be delayed by politicians and regulators, but never stopped. One participant argued that the primary aim of new technologies should be to improve the quality of people’s lives.

Living with and defeating disease was also argued to be part of the human condition, and that curing a disease could have costs. “What will happen to us if they find a cure for Parkinson’s?” one participant asked, and argued that it would be difficult to adapt to a healthy life and to the responsibilities and possibilities that this implied. Someone who was ill, another participant argued, learned to value the moments of life when symptoms were less severe.

Participants also agreed on the importance of equal access to the benefits of medical technology. However, they emphasized that compliance on the part of the patient could be required. Patients had rights, but also duties, such as to obey recommended lifestyle changes.

4.2 Seminar 2:

This seminar took place in London in November of 2010, again with a total of 7 participants (2 men and 5 women) who were all students at the Heythrop Philosophy and Theology College of the University of London.

4.2.1 Phase 1:

Group A participants said that they would have chosen differently than the politicians in the scenario. The regulations made an unfair distinction when choosing to treat neurodegenerative diseases but not depression or other psychopathologies.
The consequences for Europe’s economy outlined in the scenarios were clearly disadvantageous, as group 1 argued. One participant made an analogy with the current debate on whether or not to regulate drugs. She argued that the banning of drugs has resulted in loss of control by the regulators over consumption and a lack of the necessary tools to deal with addiction. The participant argued that the same problem was evident in scenario 1. Group A argued that some regulations were adequate, but that some flexibility was needed. One participant proposed that regulations should initially be restrictive, but then be relaxed over time as risks were better assessed.

Group B worried that if decisions would turn out as in their scenario, then the widespread commercialization of BMI products could lead to substantial loss of personal autonomy. “We already have a strong perfectionist tendency in society today,” said one participant, arguing that these tools would make advertising and marketing too powerful. Group B agreed that although all advertisements create false (i.e., less authentic) desires, the desires created by brain stimulation would be even worse. Brain implants are contrary to humans’ “essential nature,” as one participant argued.

The participants also agreed that the intrusions on privacy should be limited. However, to the greatest concern was not about government intrusions, but rather what use terrorists might find for these devices. “It introduces an element that carries with it a long term risk,” one participant argued. The participants were also concerned with the relationship between employers and employees. This relationship currently is based largely on trust, but it would be undermined, as one participant argued.

In conclusion, Group B argued that more research needs to be done on side effects, long-term effects, and possible social consequences. In particular, they argued that the introduction of this type of technology could have “slippery slope effects,” by changing social norms in ways that lead to disastrous consequences in the long term.
Group C participants were mostly concerned with what they perceived as the risk of moral decay. They referred to the BMI-based virtual reality game described in scenario C. In this world, participants argued, the consequences of one’s actions were not real. People living large fractions of their lives in this type of game would lose their moral compass, the participants argued. However, group C did not believe that future BMI technologies would undermine freedom; rather, they felt that the opposite was more likely. Too much freedom was much more dangerous, as one participant argued. However, some disagreement existed regarding whether this game would be beneficial overall. Some participants, while recognizing the problems with Virtual Reality games, pointed to the positive value in the pleasure that these games or other BMI applications could generate. “We could satisfy any desire,” the participant argued. However, the whole group was appalled at the notion that this technology could be used to remotely control people. This was “the worst possible offence,” as one participant argued.

4.2.2 Phase 2 and 3:

Most participants agreed that rather than imposing a monolithic regulation on BMI technology, the EU needs a regulatory authority with experts who could keep up with the changing technological landscape. Most participants also suggested that the preliminary regulatory framework should have a restrictive approach to commercial applications of BMI technology.

Participants also agreed that further research should not be restricted by new regulations, but that it should be monitored, and ethical rules on human and animal experimentation should be carefully followed. Both research and the legislative process should be more transparent. Some participants noted that the European legislative process and the allocation of EU funds are difficult to follow. “The EU is democratic, and the people should know,” one participant stated.
One participant said that since uncertainty about the risks is so great, it was reasonable to start with quite restrictive legislation. If initial laws are too permissive, then re-regulation may be difficult.

However, another participant was unsure whether we could “actually know if we start carefully if we don’t know what we are doing”. He further expressed concerns about the competence of politicians to construct regulations that would lead to proper precautions.

One participant argued that games affect human behavior. Most participants agreed that very realistic games, where players are hardly able to tell fiction from reality, are dangerous, since people learn what is right and wrong by mimicking other people’s behaviors. If the primary input is from a game where other moral practices are common, this will affect the player’s moral sensibilities, as one participant argued.

The participants moved on to discuss the areas where regulations would be most important. Some participants argued that the protection of privacy was crucial. Most agreed that intrusions into individual privacy should be directly outlawed. Safety measures should be taken to prevent people’s private information from being hijacked by hackers, as one participant argued. “What if people would voluntarily disclose information about themselves?” one participant asked. The participant explained that although individual choice must be respected, some restrictions must be placed on the kind of information that could be disclosed, considering the risks to that person. Another participant stated, “My thoughts are fundamentally private, and should not be shared, even by individual choice.” The participant argued that the difference between expressing one’s thoughts, for example on Facebook, and directly “uploading” them with a hypothetical BMI device was fundamental. Another member of the group was not completely convinced by this argument. She argued, “It is conceivable that you could devise a “filter” that would control which thoughts would
be uploaded.” The general conclusion seemed to be that there is “a lot we don’t understand about human thought,” as one participant summarized.

Another area where regulations should be strict was the potential use of BMIs in advertising. Participants argued that the advertising industry was already too powerful, and that this new technology would further increase their ability to manipulate people’s desires. All participants agreed that subconscious manipulation ought to be forbidden.

Opinions were more divided on whether BMIs and, in particular, some forms of brain or spinal cord stimulation should be allowed for recreational purposes. Some said that individual choice should be restricted. “Artificial pleasure is no different from real pleasure,” one participant retorted. However, most participants were reluctant to allow this practice. “In the modern world, few choices are genuine,” one participant stated, while the rest of the participants were concerned with potential brain injuries and long-term side-effects.

Many participants from seminar 2 handed in written commentaries about the seminar. Many believed that the scenarios were realistic. All wrote that they had learned a whole lot about this technology, and that they were likely to follow the debate on this issue more closely. However, some wrote that the seminar would have been better had more people attended. One participant would have liked a more detailed presentation of the technology.

4.3 Seminar 3:

This seminar took place in Warsaw in January of 2011, and included a total of 10 participants (7 men and 3 women). About half of the participants were medical professionals or doctoral students, the others were their friends.
4.3.1 Phase 1:

Group A participants argued at first that the issues in the scenario were not mainly ethical, but rather of a “practical nature.” One participant stated the impossibility of politically restricting BMI technology in this way, saying, “technology can’t be stopped.” The scenario was very “European,” as one participant said, arguing that politics in the EU are very conservative. “The EU is like a Zoo or a museum,” he added.

The general notion in this group was that technology was, in principle, impossible to stop, and that any political attempt to regulate it was doomed to fail. One participant also argued that society had no right to restrict access to any technology. It should be an individual choice, although this participant said he would not use BMI to enhance his own body. Another participant compared the technology to abortion, which is forbidden in Poland. She said, “You can always go abroad. Anything that is outlawed will go underground.”

Participants also worried about the EU falling behind technologically, and the effects that this could have on economic growth. “We want to have money and develop as a nation,” one member of the group said. Another member stressed that the long-term consequences of interfering with nature should not be underestimated.

Another participant suggested that technological development, in theory, could be stopped by a totalitarian world government, but as long as many countries and some freedom existed, this was practically impossible. She argued that the religious right in Poland would probably try to stop this type of development. She also worried that pious Muslims in the EU could tilt politics in a conservative route.
Most Group B participants agreed that the scenario was realistic. One participant thought the increased control and surveillance over workplaces was undesirable, while another suggested that workplace accidents could be avoided with increased surveillance and that this would benefit everyone. However, most of Group B agreed that it was wrong to “play with people’s brains” and that the legislation passed in scenario B was too liberal. One participant made a comparison with mood altering medicine that could also be used for the wrong purposes. Nevertheless, most felt that it would be wrong to ban it. Although BMI could affect people’s behavior, this was not something totally new.

Group C participants were initially worried about the fallibility of computers and the risks associated with making humans more dependent on them. “What if someone used a computer virus to corrupt brain implants?” one participant asked. “Or what if someone could hack into my brain?”

Despite these worries, other participants also appreciated some positive aspects of scenario C. The medical benefits and the treatment prospects were appealing and so was the possibility of this technology having a positive impact on the economy. One participant was very skeptical about the military applications of BMI technology. “The prospect of the ‘ideal soldier’ is quite terrible,” she said. “Would it be OK to erase memories from a war?” one participant wondered. Another participant suggested that, just like drugs, technology would be relegated to the black market if forbidden. She added that since this research could help a lot of people, we should not ban or restrict it. One participant suggested that a license of some kind would perhaps be helpful. Another pointed out that even a license would not prevent bad people from using this technology in a bad way. The group consensus was that a strict prohibition was impossible, and that the best approach was to legalize and regulate the technology.

4.3.2 Phase 2:
In this phase, the groups were reshuffled and three new groups formed. The first group seemed to agree that this kind of ethical debate was important. They also thought that scenario A was the worst one. It was impossible to stop this development, as one participant emphasized. Some argued that allowing BMI for commercial purposes did not exclude the possibility of its regulation, but regulation should be specific for different cases. One participant suggested that a body of experts could give advice on how to minimize risks. A list of regulations would not be sufficiently dynamic to keep track of rapidly changing technologies. Instead, a government agency should keep track of the development and update its assessments frequently.

This group also agreed on the military use of BMI technology, such as brain implants that could be used to improve the interaction between soldier and technology, or implants that could reduce stress from battle. However, one member argued that brain implants should never be required by firms or workplaces. In agreement with this, another member added, “People without BMI should not be subject to discrimination.”

Another concern raised by this group was inequality, and what it means to be a person, or a human. “Would we be different people if we had implants?” one participant asked. “Would we remember things in the implants, and how would we know that someone has true emotions?” It was generally agreed that tampering with people’s emotions was unacceptable. In particular, the participants were worried that advertisers could use BMI devices to manipulate desires and emotions.

The second group’s discussion was more centered on issues of privacy. One participant said, “I don’t like the idea that employers could snoop.” Another participant believed that although privacy infringements at the workplace facilitated by BMI technology could enhance worker productivity in the short term, it would have very bad long-term consequences.
The general attitude was that scenario B was the worst one. One participant explained that even if outright coercion was banned, there would be informal coercion to use implants. On the other hand, one participant was worried about the risks of an unregulated black market. “If medical implants are allowed, there will be a black market for them,” he argued.

The attitude of the third group to the scenarios was more cautious. The group generally agreed that only therapeutic uses of BMI technology should be allowed. However, they believed that the EU would not be able to enforce this type of regulation on its own. “This decision has to be made on a global level,” one participant suggested.

One participant argued that a complete “blocking” of the technology was not an option, but neither was being too liberal. “Respect for individual autonomy was crucial for this regulation,” he said. In his view, scenario B was “moderate.” All participants in this group were skeptical of human enhancement. “It’s OK to treat psychological diseases, but not to change people’s characters,” one participant suggested. When asked if not all therapies alter the personality, the participant answered, “Therapy only works if you agree to it. Implants may be imposed on you.” A general concern was raised in this group that people with brain implants would not be “themselves.” “If I had a partner with implants, I would not know him,” one participant claimed, and the group agreed. In particular, great concern was shown regarding employers demanding certain character traits.

4.3.3 Phase 3:

When all of the groups came together, all 10 participants reflected on the seminar experience. They thought that it was stimulating, and generally enjoyable. One participant said, “I realized I had a lot of thoughts about these questions.” Another stated, “We don’t take time for these discussions.” Yet
another participant explained, “I didn’t know anything about these things [brain implants]—that they were so advanced.”

The group thought that the scenarios were “quite OK” and “not unrealistic.” “A lot can happen in 20 years,” one participant suggested. Another asked for more ethical questions, since the scenarios were “too simplistic.”

Two participants voted for scenario A, seven were in favor of B, and only one was in favor of C. He explained that he thought that liberal regulations should be combined with education about the risks. This participant made a comparison with the war on drugs, which was “a failure.” However, he thought it would be wrong to “switch off minds,” as in the army case. Proponents of scenario A claimed that only medical use could justify the risks, but medical technology also had to be regulated. One proponent of scenario A said, “I don’t believe in this kind of total individualistic ‘freedom’.” They also agreed on the need to introduce strict controls to ensure that implants were safe.

4.4 Seminar 4:

This seminar took place in Lepe, a small village close to Seville, in April of 2011, and included 9 participants (4 men and 5 women). About half of the participants were teachers in the local school; the others were their friends and visitors to a local pub.

4.4.1 Phase 1:

Many participants in Group A were quite happy with strict regulations, but thought that they could gradually be liberalized if the technology proved to be safe. This, they argued, was “a golden mean.” As with the other groups, they expressed concerns about military applications of BMI. Health seemed to be an uncontroversial purpose. One participant suggested that instead of limiting what
kind of technology should be used, limits should be placed on who could use it, in order to avoid risks. The general opinion was that although the applications of this technology should remain restricted, research should be allowed to the full extent. One participant suggested that robots might be used instead of BMI enhanced humans.

Group B participants were also quite skeptical of permissive legislation. They argued that the benefits were not sufficient to legitimize the medical risks. They argued that the uncertainty about the long-term effects of brain implants was great, as the brain is a complex and delicate system. One participant suggested that if BMIs could be used to gather and manage information, then this could be very advantageous. However, this was a minority opinion in the group.

Group C participants were very skeptical of the scenario. They saw nothing positive in C. They argued that interpersonal relationships are very important, and the development illustrated in the scenario seemed to undermine the norms and traditions that reinforce these relationships. In addition, they argued that these developments undermine privacy, further damaging friendships and relationships. A majority in this group agreed on strict regulations. BMIs were acceptable if used for medical purposes and perhaps also for trivial videogames, but not for surveillance. The group agreed that it would be unacceptable to use BMI technology for military purposes.

4.4.2 Phase 2:

The first group discussed the potential risks of not developing military technology. One participant said that he was worried that if the EU did not invest in military technology, that the EU values and way of life might be threatened. Another participant replied that war was pointless and that European values were doomed regardless. One participant said, “We’ll all speak Chinese in a generation.”
The discussion then turned to the issue of technological innovation. Some participants argued that change was too fast, and that this would threaten the continued existence of mankind. One participant argued that “natural selection has stopped, and the weak survive today” and that this would ultimately spell the end of our species. Most participants disagreed, although none pointed out the factual error in the claim. Instead, their disagreement was on moral grounds. However, most participants agreed that mankind would not survive the collapse of civilization, due to its presumed maladaptation to “the state of nature.” One participant made the claim that “evolution does not go in reverse.”

The second group of participants was mostly concerned with the problem of exacerbated inequality that could be a potential side effect of human enhancement. Some argued that inequality would remain high, while others said it would become even worse. Another topic raised by this group was the comparison of electrical stimuli with the use of recreational drugs. Here, participants, who were mostly liberal with regard to drugs, thought that liberal thinking should be applied to this kind of recreational stimulation for the same reasons.

The third group was also concerned with potential catastrophes. One participant in this group asked for more research, and said that moral guidelines should follow the discussions in biotechnology. In that area, not all that we can do is allowed, and this would also be a useful way of thinking about brain implants. The fact that a plausible compromise has been reached in biotechnology suggested that a similar one might be possible in this area, as the participant argued.

4.4.3 Phase 3:

Some argued that it was not necessarily a bad thing to remove “natural” aspects of life, such as cancer, while other claimed that diseases kept the species strong. One participant said that he wanted
to live as long as possible, and didn’t care about evolution. Another participant suggested that the sum of diseases seems to be constant, since new diseases will appear as soon as we cure old ones.

“Effectively, this means that selection pressures will remain,” the participant argued.

Another participant worried that since this new technology will be expensive, the evolutionary advantage will be in favor of rich people, who will procreate more and have better health. Someone argued that the new epidemic was depression, due to high unemployment.

One participant defended scenario C, since it was perceived to be the least restrictive one. “At least we won’t be overrun by the Chinese,” he stated. Others thought this scenario was too permissive.

One participant was skeptical about the possibility of informing people about how to use technology in a safe way. “Regulation is the only way,” she suggested. “Should we really punish people who use this technology?” one participant asked rhetorically. “Isn’t the fear of this technology similar to fears about photo cameras capturing the soul a century ago?”

At this point, one of the more skeptical participants claimed that human freedom was at stake, and that the others were missing the point. “We don’t want to be slaves to the machines,” he said. Other participants retorted that serfdom to machines could be worth it if it meant getting rid of cancer and other diseases. This claim led to a general agreement that pretty much any technology was OK as long as it was for medical purposes. The group also agreed that we are not empathetic enough, and that individualism is a problem.

4.5 Seminar 5:

This seminar took place in Stockholm in June of 2011, and included 10 participants (7 men and 3 women). All of the participants were philosophy students at Stockholm University.
4.5.1 Phase 1:

The participants in Group A were very negative to scenario A. “Brain implants sound frightening, and may be used by companies to manipulate and exploit us. This is really unpleasant; I’ve never thought about these things,” one participant said. “This seems pretty realistic, considering that we’ve had pacemakers for 50 years,” another participant argued. They all agreed that regulations were necessary to avoid disastrous consequences. They suggested that rules should be simple, stringent, and transparent, rather than complex.

Group B participants were mainly worried about the level of social control and surveillance. In particular, they were concerned with the possibility of implicit coercion and the implantation of devices that might be risky or very intrusive. Regulations were needed to avoid this. One participant suggested that surveillance was already possible by other means, but this technology made it more important to have comprehensive regulations to protect employees. One participant said that rules could be negotiated by labor unions at the workplace level, to allow for local needs. Although participants were negative to the use of BMIs for military purposes, they argued that similar things could be possible with drugs. If legislation could protect workers from intrusion, their use could be acceptable.

Group C participants saw many risks. One suggested that it would be like “plastic surgery for your mind.” The group was also very concerned by the many accidents that probing into the brain could cause. Without any regulations, misuse and quacks performing sham surgery would be certainties. One participant called the scenario “very disturbing.” Another said that the only positive thing with this scenario was a possible increase in productivity if employees could interact with computers more intuitively. However, this positive aspect was outweighed by the probable negative consequences.
4.5.2 Phase 2:

In the first group, participants were very hostile to all scenarios, but most upset by scenario C. “I thought scenario A was horrible, but it turned out to be the best one in comparison,” said one participant from Group A. Even though the intentions were good, the participants argued that the consequences of scenario C were awful, and the consequences mattered more. Scenario B was strange, as one participant suggested, because it lacked most good things and bad things. Another participant replied that scenario B would lead to massive surveillance, and this would be bad for organized labor. Some advantages were seen in being able to manipulate computers with one’s mind, although these would be “convenient, but hardly worth it,” according to one participant. This group concluded that scenarios B and C would impose unacceptable infringements on individual freedom since, in practice, getting the implants would be mandatory.

The second group was mostly concerned about the risks of “brain hacking” in scenarios B and C, although they also worried about what employers might do with this technology. They found the notion of removing a soldier’s empathy appalling. One participant said, “This reminds me of 1984,” referring to George Orwell’s novel. “I’m not hostile to technology,” one participant added, “but to certain uses of technology.” She continued, “If people with Parkinson’s can get better, that’s great, but where do you draw the line between ‘ill’ and ‘different’? Who decides what a good life consists of?”

The third group discussed the problems of the superpower dynamics implicit in the scenarios. If China and the US race ahead with BMI technologies, the EU must follow, as one participant argued. Another suggested that the rivalry between the US and China may work to the EU’s advantage, since it could profit from exporting to them if they were to engage in a trade war. One participant suggested that brain implants were, in a sense, similar to handguns. “Guns don’t kill people,” the
participant argued, “but there are good reasons to restrict their availability.” The group agreed that scenario A was the least bad one. Concerns were raised about the simulated world mentioned in scenario C. For example, would some people rape simulated children? Some acts were considered bad, even though they did not necessarily have bad consequences. Being able to live out any fantasy or preference would undermine virtue, as one participant stated. Scenario B was also found problematic for other reasons. The legislation would allow shady medical practitioners to install unsafe devices, perhaps analogous to some cases of failed breast implants.

4.5.3 Phase 3:

All participants agreed that the scenarios were interesting, and it was fun to talk about these issues. “I would never have imagined these things,” one participant added. “The things happening in the scenarios were quite odd, but also quite realistic,” one participant mentioned. “It was a good idea to have pretty similar scenarios, so that comparisons were possible,” another suggested. Yet another participant said, “It was great to discuss your own scenario first before reading the other scenarios, so that you could really get a perspective on it.”

B was the worst scenario, some opined. Others disagreed and thought that C was worse, since it was more permissive. One participant emphasized the influence of the superpowers in scenario A. According to this participant, war would be a likely outcome, with much worse consequences than for either B or C.

Another participant said that a combination of A and B would be best. This would allow for individual choice without thought control. “I would like an on/off button on my implant,” the participant added.
One participant objected to this argument, stating that no choice would in fact be possible. “The notion of people installing devices to optimize their work productivity makes us more specialized, and in a sense more like ants,” another participant added. “Part of our humanity is about being a generalist. A civilization of specialists is somehow less human.”

The participants also argued that it was important to ask who has the power. The powerful will control technological developments to further their own ends. In that respect, a few participants thought that scenario C was the likely development. They viewed technological progress as something that cannot be stopped, and once the technology is available to improve computer games, this will be very popular.

“Imagine World of Warcraft [an online computer game] superimposed on everyday reality; wouldn’t that undermine values and detach people from real life?” one participant asked. “I don’t think so,” another replied. “Most normal people can differentiate between fiction and reality.”

“What if the game is extremely realistic,” the first participant asked, “and you kill someone in the game? How can you be so certain that it would not affect normal people?” After some discussion, most participants agreed that violent simulated computer games might have a detrimental effect, if realistic enough. However, if these games were to promote appropriate social behavior, the effects could be positive. Another aspect of the simulated game is that it is a more climate friendly way of experiencing things (instead of travelling). One participant said that it is easy to get carried away in the “anti-technology camp.” “We tend to get used to most things that seemed strange when they were new.”
Another positive aspect of scenarios B and C was the possibility of treating psychiatric disorders. In contrast, participants were generally appalled by the idea of “shutting down” empathy in soldiers. “Creating psychopath-soldiers really sucks,” one participant concluded.

4. Conclusions

The wide differences among the participants in terms of geographic, demographic, and professional characteristics did not prevent the expression of some similar views and support at all five of the convergence seminars. For example, a general consensus emerged that research priorities in BMI should be those which meet crucial societal needs. Many participants claimed that socially useful applications that would benefit human health should be prioritized over novel consumer products and military applications. Further public participation on social and ethical issues of BMI was unanimously encouraged. A broader public influence over the technological development was supported in its own right, but it was also advocated as a necessary step in avoiding (additional) public alienation or backlashes, and in enabling BMI to benefit different members of society.

Views were more divided regarding the extent of regulation needed to curb unwanted developments. Some participants believed that a strong regulatory scheme was necessary, as it would deter unwanted applications. Others argued that regulation (and bureaucracy) was important since it would at least create some inertia in the development, thereby allowing for more insight into long-term impacts and side effects. In contrast, some participants said that over-regulation and excessive precaution were a problem because these implied a loss of potential benefits and would generate (economic) imbalances if certain countries went ahead with less regulation. Another finding was that
many important ethical issues were not necessarily ones that arose in the mid- to long-term stages of the BMI development.

Due to the limited scope of this study, the participants’ viewpoints should obviously not be interpreted as representative of the general public of the respective regions. What we have done is to collect qualitative data of attitudes and viewpoints in different sectors of the European population, in an attempt to cover some of its geographic and social divergence. The large degree of agreement on some topics that we found between the participants in the five different seminars indicates that these views may be widespread, but of course does not exclude the likelihood that other views may also be widespread. Additional studies are needed to obtain a more complete picture of opinions on BMI in the European population.

This was the first use of convergence seminars on this topic. The method functioned well, both logistically and more importantly, by giving rise to the type of discussions that we aimed for, namely discussions on how today’s decisions might be influenced by different possible future developments. As expected, the methodology was well suited for discussions on the future of BMI, with its many uncertainties. The responses provided by the participants in discussions and questionnaires indicated that their advice regarding what decisions should be made about the BMI development was influenced both by different possible future developments and by the points of view of their co-participants.

Appendix 1: The three scenarios

Scenario A

The year is 2032. Fifteen years ago, in 2017, European politicians introduced the world’s strictest
regulation on Brain Machine Interfaces (BMI). Only therapeutic brain implants, such as Deep-Brain Stimulation (DBS) and cochlear implants, were allowed. All commercial applications of BMI were banned, and the use of brain implants to alleviate psychological diseases was heavily restricted. DBS became the leading therapy for Parkinson’s disease, dystonia, and other severe neurodegenerative diseases, but contrary to other parts of the world, it was rarely used to treat psychiatric conditions such as major depression, obsessive-compulsive disorder, and anorexia nervosa. Complex regulations and limited prospects for commercial use hampered investment in Research and Development for BMI, and European research lagged behind that of American and Asian competitors. Asian manufacturers now lead the field in BMI devices. Technology originally developed for patients with paraplegia has been further developed by Chinese manufacturers, and is now sold to consumers who want to improve their computer use, not least in gaming. Private imports of such devices have now gone out of control. Many experts regret that Europe, with its strong tradition in emphasizing product safety and individual privacy, did not take part in the development of this new technology. On the battleground, Chinese and American Special Forces operating together in Somalia vastly outperformed their European counterparts due to their ability to interface with advanced technology. Military pundits fretted that Europe’s army would not be able to hold ground in a modern cyborg war.

1. What do you think of this scenario? Which are the positive and negative aspects?

2. What can we learn from the scenario?

3. Should different decisions have been made in 2017? Why?

Scenario B

The year is 2032. Fifteen years ago, in 2017, European politicians introduced permissive regulation
policies on Brain Machine Interfaces (BMI). Any kind of non-harmful brain implant was allowed. This led to the rapid proliferation of therapeutic and commercial BMI-devices that improved the individual's ability to interact intuitively with computers, for instance in gaming. When non-invasive BMI devices became available, industry began to use them to improve employees' interaction with machines. In some cases, this technology was also used as a new means of surveillance of employees. Whistle blowing became virtually impossible. Although increased surveillance improved productivity, many unions complained of increasing alienation. In some companies, only people willing to accept surveillance with BMI technology were hired. In the last few years, the widespread and poorly controlled use of BMI devices has led to problems in the form of medical malpractice, leading to cases of serious brain damage. Although BMI has been beneficial to many patients, it turned out that the new therapies were introduced too rapidly, and long-term side effects turned out to be quite severe in many cases. While European soldiers could compete with the world elite, ethical concerns were raised about new methods to stunt empathy in front-line military personnel. Although returning soldiers are now less likely to suffer from post traumatic stress syndrome, many have difficulties in maintaining close relationships, and are often involved in acts of random violence and drug abuse.

1. What do you think of the scenario? Which are the positive and negative aspects?
2. What can we learn from the scenario?
3. Should different decisions have been made in 2017? Why?

Scenario C

The year is 2032. Fifteen years ago, in 2017, European politicians introduced very permissive regulation policies on Brain Machine Interfaces (BMI). Any kind of brain implant and trial
procedure was allowed, no matter how invasive. This led to the rapid proliferation of therapeutic and commercial BMI-devices that improved the individual's ability to interact directly with vehicles, home appliances, and computers. The most controversial success of commercial BMI came in the form of a new type of BMI gaming control. Social psychologists warned about the long-term consequences of a whole generation being immersed in an eerily realistic simulated world, detached from contemporary values and social conventions. One result of this was social fragmentation, as the generational divide grew wider. While older generations found it increasingly difficult to adapt to the torrent of innovations in the IT-sector, many young adults seemed to disdain conventional social mores and civic duties. A whole subculture of "neurohackers" emerged; bent on experimenting with neural implants in a similar way to how previous generations had experimented with "mind expanding" drugs. When non-invasive BMI devices became available, industry started to use brain implants to improve employees' interaction with machines. The prospect of "engineered personalities" has led to severe political conflicts between proponents of the technology and opponents, who rally on the streets almost daily. While European soldiers are able to compete with the world elite, concerns are being raised about new methods to stunt empathy and to remote control front-line military personnel. Although returning soldiers are now less likely to suffer from post traumatic stress syndrome, many have difficulties in maintaining close relationships, and are often involved in acts of random violence and drug abuse.

1. What do you think of the scenario? Which are the positive and negative aspects?
2. What can we learn from the scenario?
3. Should different decisions have been made in 2017? Why?
Acknowledgement: This project was performed as part of ETHENTECH a, 7th Framework Program (Science & Society Co-ordination Action) funded by the European Commission in 2010.