BCIS: THE NEW ONTOLOGICAL DIMENSION OF CYBERSPACE

by

RAPHAEL LEPUSCHITZ*

Among other current fields of research for the „next" Internet, the Brain-Computer-Interfaces (BCIs) seem to be the one with the deepest ontological implications: If this technology is further developed, the perception of what we call „Cyberspace" or „Virtual Reality" will be fundamentally different to our actual understanding. Instead of solely addressing two of the five senses (ear and eye), with BCIs all five human senses could be reached, and this not via any external transmitters like monitors or speakers. Restricted to science fiction literature so far, however, several remarkable breakthroughs have been made with BCIs in the recent past. Within some years of advancement, this technology will easily be able to simulate our world or any other (compare „The Matrix" or „eXistenZ") just as good as a nowadays state of the art CGI-movie. For me, as a philosopher and professional web developer, the key questions related to this topic are as follows: How does a BCI work and what kind of neurological or psychological risks are to be expected? Who would and who should control these upcoming cyberspaces and its underlying technologies and standards (such as protocols, compatibility, etc.)? And last but not least: Are the transhumanist beliefs regarding an evolutionary/technological singularity due to the inter-connection of human minds (a very distant version of Hegels „Weltgeist") a blessing or a rather curse?

KEYWORDS

Brain-Computer-Interface, BCI, ontology, virtuality, Hegel, Weltgeist

1. INTRODUCTION

Ten years ago, when the movie „Matrix" was released, the idea of a fully simulated world was nothing new at all, but it was the first time, this topic was not only discussed by philosophers of mind and science fiction fans. Within this last decade several remarkable developments took place in the

* Raphael Lepuschitz, BA, MA, csad5854@uibk.ac.at

field of neuro-cybernetics. So this issue challenges our society now once again, but this time with a more actual attitude.

The development of so-called Brain-Computer-Interfaces (BCIs) has now reached prototype state and could be ready for a human assembly within some years as far as this didn't happen already. This progress will likely change the way we look at the difference between virtuality and reality and their ontological meaning as well as our understanding of the Internet. But it also contains enormous risks in varying fields of society and science: From a constant insecurity of technical errors, across hostile attacks or hacks into a logged-on user, to already known problems of Internet or game addiction – the range of possible issues is nearly unmanageable. Another interesting point may also be the philosophical implications of these developments: The definition of the „I" will merge more with virtual characters as their player/controller is no longer separated from its alter ego's body, but feels like being „inside" it. This change of the phenomenological perception of one's avatar could lead into a basically new form of a human's self-disclosure. As a second philosophical impact, the socializing and the pairing of our species could also change dramatically. When connected together via BCIs, the terms „teamwork" or „couple" could change its meaning insofar as the conjoined humans might experience themselves rather as „one" than as a group of different beings.

It seems clear that a technological evolution of mind-attached machines will reach us sooner or later. The important issues we face should therefore be discussed before this change of cyberspace and its ontology. In this paper I would like to give an overview of the forthcoming technology and its prototypes, the possible fields of problems based upon this developments and at last a comparison between Hegels idea of the „Weltgeist" and a potential „Internet of the minds".

2. NEURALS AND CHIPS: WHAT BCIS ARE AND HOW THEY WORK

The story of prosthetics is most likely as old as the history of the human race itself. Since ancient times, lost or damaged body parts have been fixed with different artificial replacements. A substantial change occurred in the 20th century, when auto mechanical attachments were used instead of just mechanical ones. These advancements culminated in the technology of cybernetics, for example with cochlear-implants for aurally handicapped, heart pacemakers or artificial bowels.

Although these implants automatically work for the body attached to and keep it alive or its parts working, in most cases they don't interact with

it – which means a control over this part by the body or mind or even a feedback signal back to it. These further steps of „prosthestation" have yet proceeded in the last years. Some almost creepy breakthroughs have been made, regarding the interaction of human nerves and cybernetic implants or animal neurals and controlled computers.

The mode of operation of an invasive BCI is as simple to understand as it is complex in his design and implementation: A chip smaller than a coin is surgically implanted to the motor cortex, connecting at least a dozen, but mostly about 100 or more silicon electrodes to neurons. After the output signals are adjusted to the user, a computer program evaluates them and transmits the compiled orders to any external computer program (e.g. a desktop or email program), or to a virtual keyboard for typing letters or to a robotic hand.[1]

As examples may be mentioned the works of John Donoghue and his team, who published their paper about Neuromotor prostheses (NMPs) in nature back in 2006.[2] Their research – basically focused on to humans with paralysis – also included mind-controlled computer programs as well as „operated devices such as a television, even while conversing."[3] Based upon this study the Pittsburgh University published results this year concerning a monkey controlling a robotic arm via an implanted chip.[4] Related researches have also been reported in nature in 2006.[5]

It is obvious, that this technology could be used to help paralyzed people more than with any other prosthesis ever since. Past, present and future researches also focus on other „interface regions" of the brain, for example to restore blind peoples eyesight or to help patients suffering from the „locked-in syndrome" to interact with the outside world. The first patient, who was able to communicate again via a BCI was Johnny Ray back in 1998.[6]

Another more recent example of nerve-computer interaction is the sensitive robotic hand developed by researchers at Lund University in Sweden and Scuola Superiore Sant'Anna in Italy: Robin af Ekenstam, whose right hand had to be amputated due to cancer was given a new robotic hand this

---

1 John Donoghue. et al. 2002, 'Connecting cortex to machines: recent advances in brain interfacses', Nature neuroscience supplement, vol. 5, pp. 1085-1088.

2 Hochberg, Leigh R. et al. 2006, 'Neuronal ensemble control of prosthetic devices by a human with tetraplegia', Nature, vol. 442, pp. 164-171.

3 Ibid.

4 Schwartz, Andrew B. et al. 2008, 'Cortical control of a prosthetic arm for self-feeding', Nature, vol. 453, pp. 1098-1101.

5 Santhanam, Gopal et al. 2006, 'A high-performance brain–computer interface', Nature, vol.442, pp. 195-198.

6 Kennedy, P.R. et al. 1998, 'Restoration of neural output from a paralyzed patient by a direct brain connection', Neuroreport, vol. 9, pp. 1707-11.

year, which not only can be fully controlled by him, but also sends feedback-signals to his nerves.[7] Unlike other common limb-prosthetics, the implant of the „Smart Hand Project" recovers also Ekenstams sense of touch, not just his ability to grasp.

3. BCIS FOR THE MASSES?

The Smart Hand Project took about 10 years of development and has now finally reached prototype level. As the improvements of Nerve-Computer- and Brain-Computer-Interfaces seem to become faster every year, the question occurs if this technology would expand into the mass market of gaming and virtualization (e.g. as a next type of cinema after the 3D-movie hype nowadays).

An argument pro are the developments of personal computers and mobile phones from the eighties to the nineties: Back in the 1980s, computers were mostly used by scientists and mobile phones mainly by top-level-managers, but this changed within ten years as we all know to a broad usage of this technologies and its deep implications for human society.

On the other hand, there's a big difference between the BCI's and mobile phones. The latter are not implanted in a human's body, but only attached to it externally. Computers, to bring a more distant example, are mostly operated in front of the user, not via direct implants, but using monitor and speakers, keyboard and mouse, camera and microphone. So an implant represents a greater extend of cyborgification than these other devices do and this on various levels, such as follow:

- First of all, an implant has to be built into a human's body, and therefore a surgery is necessary. This leads to a classical problem in the treatment vs. enhancement-debate, which can be summarized in the principle of „primum nil nocere": As an operation is always closely connected to various risks, then why should a doctor agree to „harm" a patient (even on the patients demand)?
- Also, an implant cannot be detached from or changed by its carrier as easily as a mobile phone. Every hardware-upgrade would cause another surgical intervention and every operation – especially on the brain – involves the risks again and again.
- The BCI would not just be its owners add-on, e.g. like a mp3 player, but a part of himself, just as a pacemaker and therefore change the definition of a „human body" into a more computerized way.

[7] Cipriani, C. et al. 2008, 'On the shared control of an EMG controlled prosthetic hand: analysis of user-prosthesis interaction', IEEE Transactions on Robotics, vol. 24, pp. 170-184.

- Speaking of BCIs, not only the body, but also the mind of the cyborg would be different to „usual" human minds: If the BCIs software would be able to give its carrier supernatural skills he usually does not have, like a photographic memory or the ability to compute numbers much quicker than any „normal" human, these skills would surely retroact to the cyborgs mind and change also its psyche.

Nevertheless, some of these arguments can also be disproved easily: Surgical interventions to make the body „better" are widely accepted in several cultures, from plastic surgeries in western and Asian societies to piercings and tattoos in so called „primitive" cultures or postmodern subcultures. So it is imaginable that a BCI operation one day becomes as usual as breast augmentations or nipple piercings today.

4. POSSIBLE RISKS AND OPPORTUNITIES

Besides the pro and contra arguments about the implantation of BCIs in general, many mischiefs and risks appear not until then. These possible problems can be mainly summarized the following issues:

- The behaviour of the user could be changed without his agreement. He or she could become an unconscious slave for hackers, companies or security agencies.
- The border between reality and virtuality would fade even more than for today's Internet and gaming addicted. An important point here is again the likely change of the ontology of the virtuality: With every advancement and every additional grade of perfection the simulation would be more difficult to identify as such. Strongly addicted computer game players yet often tend to confuse reality and virtuality, if a BCI user would really feel his avatars body in a simulation, the risk of a total loss of self consciousness would be much higher than today.
- In a further developed state neuro-implants could be used to switch a human mind from one body to another or even out of the bodily existence into a solely virtual one. Juristic implications for this kind of „mind shift" are unpredictable so far, as the personal identity of a human being would not be given, as we know it anymore.
- Hackers or government agencies could try to gather and misuse personal thoughts, memories or other information. Today we are aware about computer viruses, Trojans, phishing- and spam emails

or hacked websites and databases. In a BCI society not our credit card or bank account numbers could be the desired items of hostile subjects, but information far beyond today's range of data mining.

- Neuro-implants could be damaged through a hostile attack or virus, a denial-of-service attack or an overload of the users mind could lead to neurological defects or even death.
- The brain of a BCI user could be damaged not only while its implantation, but also during „runtime", e.g. during a server malfunction or server breakdown.
- BCIs for mass-produce would be developed by bioinformatical companies who most likely also would control the servers or know the vulnerabilities of protocols etc. A protection against this kind of threat is open standards and a worldwide organization for all technical and medical specifications, such as the World Wide Web Consortium (W3C) today.
- As a special philosophical issue, the autonomy of the subject [Autonomie des Subjekts – annotation] by Kant must here be instanced. As it is one of the basic principles of modern definition of a humans political and individual rights it could lose it's imperative character – given to anyone by birth or at least by full intellectual up growth. If a human being could not be looked up upon as autonomous/self-governed, the definition of the subject would have to be rethought of.

Furthermore to all these risks also great opportunities are possible with these technological advancements (possibilities for the computer and entertainment industries not included):

- The working process within teams would most likely change to a real teamwork, not just the combined single works of several people. This could lead to a next „intelligence explosion" far beyond the one our society experiences since the beginning of the Internet age.
- As mentioned before also much closer relations between couples, friends or families could occur: Being connected via BCIs these humans could lose a big part of their individuality and mind-collectives could act as one. This point is intensively to discuss whether it's a pro or a contra argument.
- Police, the judicial system and terror defense would have a technology to read the victims or the suspect's minds. The advantage to nowadays court procedures is obvious at first, but as noted before, also this kind of mind-evidences could be manipulated.

- Within this issue, also the „right to silence" also has to be mentioned: This principle of jurisdiction (nemo tenetur se ipsum accusare) is amongst others also part in the „European Convention on Human Rights" and stands as legal right to everyone who is accused in any trial. If a court is trying to avoid this right by the usage of BCIs, this would be a massive violation of human rights and also of legal practice so far.

To assure the safety of Brain-Computer-Interfaces, ethical standards established years ago have to remain valid:

The Belmont Report enunciates three basic ethical standards for the conduct of human research. The first, respect for persons, incorporates the idea that individuals are autonomous agents and should be free to make their own choice regarding participation after being given a full understanding of the risks and benefits. The second, beneficence, obligates the investigator to act in a way that will maximize benefit to the individual volunteer and/or the greater society while simultaneously minimizing the risk of harm. The third standard, justice, obligates the investigator to design studies so that the benefits and burdens of research are shared in a just way. An ethicist should be involved in the earliest phases of any human research developing or testing invasive BCI methods.[8]

5. OUTLOOK: *WELTGEIST 2.0* – AN INTERNET OF MINDS?

Virtuality has emerged in the last years more and more, especially through the so called „Web 2.0" appearance. A lot of people working in intellectual, creative or office jobs are connected to the whole world via websites as facebook or twitter or by programs like skype all day long, certainly also per „classical" communication technologies such as telephone, sms or email.

With BCIs and appropriate software, another boost of virtualization is imminent. A direct connection to another human mind or even several other minds as well is likely going to change the way we communicate strongly. Thoughts have to be transformed into spoken or written language since the first days of mankind. Language and its abstraction, reception and translation has therefore become one of our species main characteristics ever since. This would change dramatically, if the technology of BCIs could transmit our thoughts and feelings directy. It is possible, that even pure information of all kinds, knowledge, skills could be shared from one human to another within no time – just as simple as we share mp3s, movies or software today.

[8] Wolpaw, Jonathan R. et al. 2000, 'Brain–Computer Interface Technology: A Review of the First International Meeting', IEEE Transactions On Rehabilitation Engineering, vol. 8, no. 2, p. 169.

In Hegels magnum opus „The Phenomenology of Mind" he elaborates the idea of the Weltgeist (world-spirit), a metaphysical construction for the idealistic explanation of all being. The mind itself starts – following Hegel – at the point of consciousness, right before self-consciousness. From reason to spirit, herein defined as ethics, morals and culture, Hegel completes his system with religion, which itself is totally different from common definitions and could rather be referred to as „all-over-spirituality".

In the last chapter „Absolute Knowledge" Hegel works out the idea of a final self-consciousness of the Weltgeist through a more and more growing knowledge since the age of Enlightenment. He describes the way from consciousness to (what he understands by) religion for the concept of knowledge itself again, as the synthesis and dialectical endpoint of history of the spirit. Hegel quotes:

> *Diese letzte Gestalt des Geistes, der Geist, der seinem vollständigen und wahren Inhalte zugleich die Form des Selbsts gibt, und dadurch seinen Begriff ebenso realisiert, als er in dieser Realisierung in seinem Begriffe bleibt, ist das absolute Wissen;*[9]

(This last embodiment of Spirit – Spirit which at once gives its complete and true content the form of self, and thereby realizes its notion, and in doing so remains within its own notion – this is Absolute Knowledge.)[10]

In Hegels definition of the Weltgeist, that cannot fulfill the hermeneutic circle as well as the Geist of one individual does: The reason why is because the Weltgeist is not able to self-consciousness, which is the beginning of Hegel hermenteutics. Its „process of knowledge" is „the transforming of that inherent nature [An sich, annotation] into explicitness [Für sich, annotation], of Substance into Subject".[11] As Hegels world-spirit is not a target-orientated one – in opposite to Schopenhauers Weltwille – it cannot become aware of itself at the end of the hermeneutic circle. This also implicates for the spirit, that this cannot complete itself unless it is thought together with the Weltgeist. Hegel points it out as follows:

> *Eh daher der Geist nicht an sich, nicht als Weltgeist sich vollendet, kann er nicht als selbstbewußter Geist seine Vollendung erreichen. Der Inhalt der Religion spricht darum früher in der Zeit, als die Wissenschaft, es aus, was der Geist ist, aber diese ist allein sein wahres Wissen von ihm selbst.*[12]

---

[9] Hegel, G.W.F. [1807] 2003, Phänomenologie des Geistes, Reclam, Stuttgart, p. 558.
[10] Hegel, G.W.F. 1998, Phenomenology Of Spirit, Motilal Banarsidass, India, p. 485.
[11] Ibid.
[12] Hegel, G.W.F. [1807] 2003, Phänomenologie des Geistes, Reclam, Stuttgart, p. 561.

(Consequently, until Spirit completed itself in itself, until it has completed itself as a world-Spirit, it cannot reach its consummation as self-conscious Spirit. Therefore, the content of religion proclaims earlier in time than does Science what Spirit is, but only Science is its true knowledge of itself.)[13]

Finally, following Hegels completion, a scientific society leads directly to what he calls the Aboslute Knowledge. Thinking of this as the last state of the Weltgeists journey as a self-unaware being by the use of its self-aware beings (the human minds/spirits) today we could speak of the „Weltgeist 2.0", which emerges among our technological horizon through BCI prototypes.

The age of an interconnection of human minds awaits us with a lot of questions and dreams. The transhumanistic denomination of the so-called „Singularists" beliefs in a technological singularity – a point where a lot of years of advancement are made within one second. Their belief mostly refers to an artificial intelligence to reach this point, but it seems logical that this could also be reached by a huge amount of human minds connected together. For example a group of scientists works together on one problem. Today they would gather their information or run their tests, share them, compare them, discusses them and finally after some days, weeks or months have at best some results. Although the gathered information usually were thoughts, it had to be transformed into language or data, spread around, retransformed into thoughts again, compared, reretransformed into language and so on. If omitting the information-transformation could shorten up the process of data sharing and –interpolation, the achievements could be made in no time, compared to now.

Nevertheless, these transhumanistic dreams are rather speculative: Today, no one knows how it would be to live in a world of interconnected minds, nor can seariously be spoken about a „singularistic age", if computers or Brain-Computer-Interfaces aren't that far developed yet.

6. CONCLUSION

In this paper I tried to give a short overview of the main philosophical issues concerning Brain-Computer-Interfaces. It could be shown that this technology is now in a state of high functionality, although it is still not common in usage. We already know some problems that could occur when this technology reaches mass-production state, like medical or technical errors, hostile attacks or hacks or even a change of consciousness through technical abuse. Some other fields of problems we might face can hardly be

[13] Hegel, G.W.F. 1998, Phenomenology Of Spirit, Motilal Banarsidass, India, p. 488.

discussed today, before this next fundamental change in human communication has finally been accomplished.

However, it seems clear to me that the progression of BCI technology will not be stopped and that we all will have to change (learn?) the way we communicate once more. As these changes will emerge rather slowly than quickly, we all should participate in the forthcoming discussions about where this technology should lead us and how its underlying technologies and standards should be constructed.

Finally, some following questions remain to be asked: How would our understanding of the cyberspace change in the future, if we used BCIs instead of PCs to communicate? Is a violation of our basic rights such as the right to silence acceptable for the prevention of terroristic attacks or for crime detection? And does a human have the duty to stay within his body and his given mind to avoid legal problems such as the shift of the personal identity?

REFERENCES

[1] Cipriani, C. et al. 2008, "On the shared control of an EMG controlled prosthetic hand: analysis of user-prosthesis interaction", IEEE Transactions on Robotics, vol. 24, pp. 170-184.

[2] Donoghue, John et al. 2002, "Connecting cortex to machines: recent advances in brain interfacses", Nature neuroscience supplement, vol. 5, pp. 1085-1088. [3] Hegel, G.W.F. [1807] 2003, Phänomenologie des Geistes, Reclam, Stuttgart, p. 558.

[4] Hegel, G.W.F. [1807] 2003, Phänomenologie des Geistes, Reclam, Stuttgart, p. 561.

[5] Hegel, G.W.F. 1998, Phenomenology Of Spirit, Motilal Banarsidass, Delhi, p. 485.

[6] Hegel, G.W.F. 1998, Phenomenology Of Spirit, Motilal Banarsidass, Delhi, p. 488.

[7] Hochberg, Leigh R. et al. 2006, "Neuronal ensemble control of prosthetic devices by a human with tetraplegia", Nature, vol. 442, pp. 164-171.

[8] Kennedy, P.R. et al. 1998, "Restoration of neural output from a paralyzed patient by a direct brain connection", Neuroreport, vol. 9, pp. 1707-11.

[9] Santhanam, Gopal et al. 2006, "A high-performance brain–computer interface", Nature, vol. 442, pp. 195-198.

[10] Schwartz, Andrew B. et al. 2008, "Cortical control of a prosthetic arm for self-feeding", Nature, vol. 453, pp. 1098-1101.

[11] Wolpaw, Jonathan R. et al. 2000, "Brain–Computer Interface Technology: A Review of the First International Meeting", IEEE Transactions On Rehabilitation Engineering, vol. 8, no. 2, p. 169.