

Oral presentation:

## Naturalness and Neural Implants – Changes in the Perception of Human Beings

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With our presentation we would like to contribute to the overall discussion on the general subject of the relation of nature and culture and in especially the relation of man and machine and his concept and perception as human being.

Basis of our investigation is the analysis of the discourse on NT. This analysis is accompanied by an investigation of the technical possibilities and developments on the specific field of neural implants.

### **1. Technical optimism**

While investigating NT we realize that in the field of NT a **technological optimism is strongly dominating**, which does not reflect the actual state-of-the-art of technological debates.

In NT more than in other technological fields **technologically driven approaches** in order to solve general problems of human health and increasing living standard are pursued and expressed.

**With the background and the knowledge of the complexity of new technological innovations this optimism of solving such problems technically is remarkable.**

*(experience with **environmental problems** and the **complexity ecological and social systems**)*

The reason for the dominance of technical optimism, which is based on a linear thinking is an interesting field of investigation. Here I can only speculate that it may be characteristic for emerging technologies as NT is one and may be related to the scientific system and the striving for funding.

*(In addition it would be interesting to investigate, why there is so less public resistance against this dominance).*

However, these approaches compete with other scientific approaches and other methods of solving grave problems human is confronted with.

A document these technical oriented approaches are most clearly presented is the report on the workshop with the title “Converging technologies for improving human performance”.

**The overall idea of the whole document is that not only social problems but also human “defects” like wealth problems or even ageing should be solved technically.**

With this document the public **discourse on the relationship of human beings and technologies got new momentum**. As mentioned above this document and its focus on technical solutions even for social and psychological issues. Its approach to address problems had remarkable influence on the ongoing debate on NT and CT not only on the USA but also on the European discussion.

*(HLEG 2004,*

*Spanish NBIC-initiative (<http://nbic.org.es>),*

*Workshop Budapest: “Converging Technologies – Promises and Challenges”, Budapest 2005 (see Coenen 2006),*

*STOA-Project on Converging Technology 2005*

*EU-Project on CT: “ConTecs”.*

*And I am sure that these are only a few of them.)*

Nevertheless, it could be argued that there are only a few prominent people who represent the normative idea of the improvement of human performance. But there are some considerations which **indicate that this idea and especially the technical optimism has greater importance for research processes:**

- **official paper of the NSF and therefore of the US-government.**

- Along with the ongoing process of the political and financial support of NT, **engineering thinking has gained influence**. There are intentions to apply **concepts of engineers to biological systems (NIH – Roadmap)**. Cells and compartments of cells like mitochondria are perceived as **chemo-mechanical machines (Jones 2004)**.
- **A lot of funding is allocated to** research on NT and on CT.
- Founding of the *Future of Humanity Institute* in the UK, Director N. Bostrom

!!!! We do not want to overestimate the relevance and impact of this document. **Here it should serve as an articulation of an attitude which is predominant in the field of NT.**  
!!!!

Important for our contribution is that this document express explicit the **technologically driven approaches to solve general problems** and especially **the objective to conquer the natural limits of human being**. That means, **human nature is perceived as incomplete and insufficient**.

*(These ideas could be traced back to the concept of A. Gehlen, who perceived human beings as deficient by nature.)*

## 2. Neural implants – Scientific facts and developments

While it is useful to analyse **documents on research policy** to understand the **dynamic of the discourse on NT** it **doesn't** help to **assess if the promised developments are realistic**. For the analysis and assessment of social and ethical impact of a technology it is necessary to differentiate. Therefore **we chose one specific field** of technological developments and have a closer look on the scientific literature on that field.

One crucial subject for the development of the ideas presented in the NBIC-report is the development of neural implants (neuronics).

Neuronal implants are artificial devices which are implanted into the human body and which have contacts to nerves or neural tissues. **These devices interact with the body by electrical stimulation. Neuronal implants are also termed neuroprosthetics. In this sense a**

**pacemaker is an example of a neuronal implant even though there is no direct connection to a nerve. The electrodes just touch the inner cardiac wall at a specific location and send out electrical pulses.**

Together with the rise of NT the idea of a direct access to the human brain has gained new attraction. The research on this topic was intensified in the last years:

- 1990 US-President proclaims *The Decade of the Brain*.
- 2000-2010 German Brain Research Foundation proclaims the *Decade of the Human Brain*
- BMBF[3] funding of Computational Neuroscience.
- Imaging methods in brain (neuroimaging) and recognition research have accelerated the development in this field and have redirected attention to that field (Hüsing 2006).
- European research priorities includes similar objectives.
- Statements and public promises that solutions to several problems are now mature: Technical developments and research on that topic will have increasing progress (Knoll 2004, p.9, Eckmiller 2005).

## **Relation from NT and neuronics**

There are **two central reasons for the high expectations that NT could contribute essentially to further developments of the brain/machine interface (BMI).**

### **1. Further miniaturisation is a crucial requirement for realizing a brain/machine interface.**

This interface should be able not only to stimulate a brain area or other areas of nerve containing tissues like the muscles of the heart by electrical pulses (peace maker, suppressing the shaking of Parkinson patients), but to **connect with individual nerves and exchange signals.**

This is especially the case for retina implants and could lead to a significant improvement of cochlea implants.

Another reason for the need of miniaturisation is linked with the **complex stimulation patterns neural networks are communicating** with each other. These patterns must

be interpreted or/and generated by the artificial implant. Therefore **considerable computing power must be provided** by the implanted device.

2. The second reason why NT is to be considered as a crucial technology for the further development of the brain/machine interface is related to the fact that **brain/machine interfaces can only be realised by an interdisciplinary approach**. This goes together with the consideration that NT is the new key technology which is as important for the future as microelectronics was for the past. The argument is that on the level of nm biology, chemistry and physics will merge. (*This consideration is also represented by research policy*)

From a discourse analytical perspective **NT** can be considered as an important step in the field of the **brain/machine interfaces**, in so far as it **has given that field new momentum**.

Although, applications of NT in the field are still at the very beginning and it seems very open, what type of technical concepts will be realised in the nearest future.

### **Examples of neural implants**

In the paper accompanied this talk we present several examples of neural implants which should give an impression of the variety of the different approaches within this research field. It illustrates the possibilities as well as the limits of these technical applications. Many of the scientific approaches and technical applications have already been in use for a long time while some of them are still in work by progress.

**Examples are cardiac pacemaker, bladder control for patients with spinal cord injuries, cochlea implants, retina implants and deep brain stimulation for Alzheimer patients.**

*(For more details see extended abstract.)*

On **one example** which is even not typical in respect to the existing praxis but it is crucial for the perception of this field and the public discussion about neural implants I would like to present in more detail:

### **Control a machine by thoughts:**

The idea of controlling a machine just by thought is very old and there are several attempts to realise it. A practical background is to enable lock-in patients (ALS for example) to communicate. There exist several attempts to control a cursor on a computer screen and therefore to compose sentences. Usually characteristic patterns of the EEG[2] are used for this purpose (Thomas 1999). But the bad signal to noise relation constrains this method. Therefore some experiments have been performed to implant electrodes in the head. The most popular experiment was performed 2001 by Nicolelis and his team (Nicolelis 2002). He implanted an array of electrodes on the surface of the brain of a monkey. He read out the signals the monkey produced while it was steering a robot arm. After training the monkey could move the robot arm in a controlled manner directly by his thought.

Conclusion of the analysis of the field of neural implants

**The analysis shows that the development of neuronal implants has been performed continuously. Generally it has not been possible to observe a deep qualitative incision** creating a new generation of technology in the last years.

**In addition these developments do not legitimate the promises and expectations which are expressed in the discussion on NT. Especially in respect to the objective to conquer the natural limits of human being.**

### **Summarise**

The high expectations, that NT could contribute essentially to further developments of the brain/machine interface.

NT has given the field of NI new momentum. The perception of an acceleration of the progress on that field can not deduce from the scientific point of view.

The discussions in both fields (NT and NI) could be characterized as driven by visions.

NT ↔ NI ↔ Visions ↔ rhetoric and dynamic of the debate

In order to maintain these visions and their pursuit important subjects and perspectives are ignored.

### 3. Critic on the existing ethical debate

In the last years a broad debate about NT, NBIC and its implications has arisen. The majority of the articles discuss the possible social and ethical consequences of NT and CT. But these contributions mainly do not reflect the feasibility of the expected innovations but take them as given (Chen 2002, Moor 2003, Grunwald 2006b, Dunkley 2004, Mnyusiwalla 2003).

It should be mentioned that there are several investigations on the rhetoric and dynamic of the debate on NT where the futuristic character is explicitly addressed (e.g. Fiedeler 2005, Coenen 2004, Schummer 2004, Grunwald 2006a). (*Discourse analysis on the involved actors etc....*)

Although these contributions have opened the field for new questions and doubts and put them into a wider theoretical context, to our knowledge the principal idea of perfecting the human body wasn't put into question explicitly.

Therefore we would like to promote the critical debate, where the **further penetration of technology into societal and cultural processes and vice versa is considered as a deep transformation process.**

This process opens a new stage for technology with a **new quality of boundaries between human beings and technology as well as the perception of technology in everybody's life.** Especially the **Feminist Theory** as well as the continuing discourse **in the tradition of Critical Theory** focus on the **transformation of the body-technology interfaces, the economic implications of new technologies as well as the domination of technology as solution for social and political problems** (Scheich 1996, Knapp, G.-A., Wetterer, A. 2001, Böhme, Manzei 2003).

**Here we would explicitly mention that this new quality is not related to the development of neural implants or NT alone but to the developments of several techniques together.**

Genetic engineering, stem cell research, possibility of cloning, possibility of creating chimeras (with consciousness (?) by implanting human stem cells into the brain of monkeys, enhancing mental capabilities by pharmaceuticals...

*(Cosmetically surgery, body shaping, body building, tattoos...*

*it is a broad variety with a lot of shades.*

At this point we would like to distinguish between scientific and technical developments on the one hand side and social and cognitive development on the other side. While we do not perceive a disruption in the technical development, we realise an

Increasingly, fundamental concepts are questioned by the technical possibilities (concept of life, concept of a person, what is health, what is care...) while the cognitive concepts to deal with these developments could not follow this technical developments.

With a more critical perspective the public discourse in favour of NT and CT should be considered as the continuation of a single-edged understanding of technology, which can be characterised by the following aspects:

1. The concept of **technology as the central instrument for solving societal problems**.  
With this perspective **other possibilities of resolving problems are widely excluded**.  
The technical process therefore continues with a further devaluation of social, emotional as well as communitarian needs of human beings. (technology or care?)
2. The concept of NT and especially Converging Technologies imply new interfaces between body and technology. Blurring boundaries between the corporal constitution of human beings and technological implications have been already discussed intensively (especially in the field of biotechnologies).

On the one hand **these interfaces create legal and social insecurity and risks (Habermas 2001)**. On the other hand there is an extension of disembodiment of human beings as well as the further mechanisation of the world (Becker-Schmidt 1999, Krings 2002).



There is a new social constellation between technology and the perception of the natural world. Obviously this process can be observed over the whole technological process. However it seems important to focus on the changing concept of responsibility and ethical values.

For example the technical achievements are celebrated in the media (transplantation medicine, deep brain stimulator...) while the problems the individual patient is confronted with are not reflected (Helmut Dubiel: Tief im Hirn).

3. NT, as any new technology, is always is embedded into a national and political context, which has to be considered seriously. It has to be analysed who has which interest in the development of this technology. Especially the economic interests have to be analysed. That these often does not harmonise with that one of the consumers shows for example the GMO-debate.