

Podcast Episode 16: Brain-computer (brain machine) interface – Part 2

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Teaser

Hey everyone! Welcome to the new episode of the Life Extension Podcast – technology & magic, society & business. In this second part about brain-computer interfaces, or BCIs, I will discuss about personal identity, how it is formed, and how it could be impacted upon by BCIs. Continue listening, if you are interested in hearing how BCI users redefine what it means to be human, and about the science and business drivers of this technology. Last, this episode will familiarize you with the concept of mind control of consumer electronics.

This episode is the 2nd part of our discussion about brain-computer-interfaces.

4. Ethical concerns and personal identity

Obviously there are huge ethical concerns about brain-computer-interfaces. BCI implantation sometimes require drastic surgery, with irreversible effects. BCIs can be used to restore patients' lost abilities, but can also be used to manipulate users. Peoples' inner thoughts could be read. And what about the security of such personal data? Military applications involve questions of responsibility for a soldier's action, when artificial intelligence is connected to his brain. Ethical and legal concepts of war crime and human rights may become challenged (Afina 2019).

Opportunities of BCI applications are limitless, particularly if we assume and accept that personal identity is not and does not need to be fixed in time. An ethically concerned observer might be opposed to the technology, if it manipulates personal identity. But that view may also be too narrow, because personal identity is constructed anyway by processes mostly outside of an individual's control. Personal identity is regularly becoming deconstructed, by gradually progressing dementia, or by sudden trauma like an accident leading to paralysis. In turn, personal identity can also be reconstructed through learning, manipulation, or providing it with new opportunities of agency and social participation. After all, personal identity is highly malleable in a natural way! Ethical concerns about the impact of BCIs on the individual need to be complemented by cultural and social conventions according to regular practice, e.g. regarding to the degree of acceptable commercial and political manipulation of the individual. BCIs are just translation tools. The real issue is to what application is the brain being

connected through BCI. But human societies are already familiar with that sort of control. Should a consumer be allowed to purchase a military-style assault rifle or not? Is a person able to buy software which by triggering specific brain waves would put him into a state of never-ending bliss, eternally drugged, so to speak? What are the mechanisms of social distribution of desirable BCI applications: by principles of equality, of merit, or of inherited wealth? Are marketing companies allowed to send advertisements through a consumer's BCI? Are states allowed to supervise, shape, or correct behavior of their citizens?

Ramifications of BCIs on what it means to be human vs machine is another interesting philosophical question. For two decades BCIs are already used for deep brain stimulation to treat neurological disorders, dementia, and a variety of psychiatric conditions. It has been reported that people undergoing such procedures experience changes to their selfhood through an emerging symbiosis between mind and machine. In one case a BCI device has been implanted in a patient's brain to predict epileptic seizures and as a result to adjust the patient's behavior. Subsequently, when the implant had to be removed, the patient felt a deep loss (Kenneally 2021).

As BCIs for paralyzed people are mostly still in the experimental stage, not much user experience data is available so far. In one of the few studies, BCI users expressed very positive attitudes towards BCIs. All interviewed users reported improvements of their subjective experience as BCIs benefited their sense of agency and social participation. In addition, BCIs always engage users in processes of self-definition, which are acted out by each user in different ways, depending on personal character, and in particular on personal reference points, which could be a former self, an imagined future self, or other people. Perhaps the most interesting aspect of the study was, that the new connection between human and machine was not seen by users negatively in the sense of becoming a cyborg, but in the contrary as becoming again more human (Kögel et al. 2020).

5. Business and science as drivers

If I was given the opportunity to invest in any of Elon Musk's ventures, I would probably choose Neuralink. Neuralink is today focusing on the development of BCI medical devices to help patients with injuries or neurological disorders. But this is just the beginning. The company states as its long-term vision that they want to build BCIs for healthy people (Neuralink). What kind of applications could we imagine for such devices? Complex consumer and workplace applications in entertainment,

enhancement, and performance monitoring will make BCIs unstoppable from a business perspective. The same must not necessarily be true for an unexperienced car building company, with its only advantage being a first mover, or a space company largely dependent on state budgets and politics. Science and business will be the main drivers of further developments of BCI technologies. They will prevail over any possible political or ethical concerns. Companies building their business on BCI technologies may grow to become the largest in the world.

BCI products targeting consumers are already in the market. For a few hundred USD you can buy a pleasingly designed non-invasive head-set, which is sensing brain activity. Through bluetooth the user can activate several programmable areas on a computer screen by mentally focusing on them, in the same way as clicking on them with a mouse (Next Mind). Depending for which application the screen areas are programmed the user can therefore operate a TV screen, a computer game, or other simple applications just by concentration. Mental operation of those applications may not be as fast as mouse-operated ones yet, but they do work – and that’s the relevant point. At least as a gadget BCIs have already entered the consumer world. Operating computers, phones, and smart homes by mind control might become the next big thing in consumer electronics.

BCI companies have also started to offer neuromarketing products to market researchers, promising to generate valuable consumer insights by decoding emotions and non-conscious reactions to products, or experiences (Bitbrain). Market researchers are increasingly interested in that hidden layer of the consumer’s mind - things they would not say, or are unaware of themselves. This looks cool and professional. But we should not forget that the only thing that device is doing for neuromarketers is to inform about a change in brain signals. Meaning of such signals only comes through interpretation. There is no reasoning, and no narrative. So far, its no more than a crystal ball.

Gadgets and crystal balls are fine for the consumer market, as long as they look good. Other markets are more demanding. BCIs as medical devices mostly require implantation to capture the right signal from the right space. Signal acquisition in the brain is highly challenging, and the current status of BCIs is far away from commercial applications. The other barrier is regulatory approval when brain implants in human subjects are involved for research. On the other hand, it is not clear yet, if non-invasive BCIs based on EEG technologies will ever be able to read brain activity clearly enough to be useful in complex medical applications like the smooth movement of an arm in real time or the restoration of speech (Smalley 2019).

Brain-computer interface based products will certainly become big business in the future, but we will still be more fantasizing about them than actually using them for quite some time.

6. Conclusions for longevity

What should we take from all this with regards to life extension as the topic of this podcast? The development of BCIs may not have an immediately obvious impact on longevity in the same way as gene or stem cell therapies. As a medical intervention BCIs act to restore lost capabilities of narrowly defined patient groups, but not to extend life spans of the general population. The impact of BCI technologies will be mainly cultural at first, as they will permeate everyday life comparable to today's smartphones. A possible impact on life extension might materialize at that time, however. Once human cultures have integrated the idea of brains connecting to artificial devices as an everyday practice for information, work, entertainment, and enhancement, transhumanist ideas of the superhuman immortal may appear less outlandish than today. Cultural and psychological barriers to transcend biological limitations of the human will become much smaller at that time. The stage of a consumer market for cyborg technologies is being prepared already.

Bibliography

Afina, Jasmin (2019): Human control is essential to the responsible use of military neurotechnology. In *Chatham House*. Available online at https://www.chathamhouse.org/2019/08/human-control-essential-responsible-use-military-neurotechnology?gclid=CjwKCAjww-CGBhALEiwAQzWxOr13BLvin5SIWjrVr4In3RAAtqBT6Ozn1u8QfmqMoV2INdSZ35hxDdxoCGkkQAvD_BwE, checked on 3.7.21.

Babiloni, Fabio (2016): Brain computer interfaces for the industrial application of cognitive neuroscience. *Frontiers*. Available online at https://www.frontiersin.org/10.3389/conf.fnhum.2016.220.00101/event_abstract.

Bitbrain. Available online at <https://www.bitbrain.com/applications/neuromarketing>, checked on 10.7.21.

Bitbrain (2020): Modern BCI-based Neurofeedback or EEG Biofeedback for Cognitive Enhancement. Bitbrain. Available online at <https://www.bitbrain.com/blog/neurofeedback>, updated on 21.5.20.

Bonci, Andrea et al. (2021): An Introductory Tutorial on Brain-Computer Interfaces and Their Applications. In *Electronics* 10 (560). Available online at <https://doi.org/10.3390/electronics10050560>, checked on 4.7.21.

DeMarse, Thomas B., Dockendorf, Karl (Ed.) (2004): Adaptive Flight Control With Living Neuronal Networks on Microelectrode Arrays. IEEE International Joint Conference on Neural Networks, 2005. Available online at <https://philosophy.as.uky.edu/sites/default/files/Adaptive%20Flight%20Control%20With%20Living%20Neuronal%20Networks%20on%20Microelectrode%20Trays%20-%20De%20Marse%2C%20Dockendorf.pdf>, checked on 6.7.21.

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Gonfalonieri, Alexandre (2020): What Brain-Computer Interfaces Could Mean for the Future of Work. In *Harvard Business Review*, checked on 6.7.21.

Kansaku, Kenji (2021): Neuroprosthetics in systems neuroscience and medicine. In *Scientific Reports* 11 (5404). Available online at <https://www.nature.com/articles/s41598-021-85134-4>, checked on 3.7.21.

Kapalschinski, Christoph (20221): Blackrock Neurotech - Deutscher Tech-Finanzier Angermayer und Facebook-Investor Thiel steigen bei Hirnchip-Entwickler ein. Die prominenten Investoren unterstützen ein US-Unternehmen, das Hirn-Computer-Schnittstellen entwickelt. Es soll sogar weiter sein als Elon Musks Neuralink. In *Handelsblatt*, checked on 7.7.21.

Kenneally, Christine (2021): Do brain implants change your identity? In *The New Yorker*. Available online at <https://www.newyorker.com/magazine/2021/04/26/do-brain-implants-change-your-identity>, checked on 3.7.21.

Neuralink. Available online at <https://neuralink.com/applications/>.

Next Mind. Available online at www.next-mind.com, checked on 10.7.21.

O'Leary, Karen: Handwriting with a brain implant. A brain implant in a paralyzed person can decode neuronal activity into accurate text communication. In *Nature Medicine*, checked on 3.7.21.

Open BCI. Available online at <https://openbci.com/>.

Smalley, Eric (2019): The business of brain-computer interfaces. In *Nature Biotechnology* 37, pp. 978–987. Available online at <https://www.nature.com/articles/s41587-019-0231-y.pdf>, checked on 10.7.21.