Human Today, Cyborg Tomorrow?

Public Attitudes towards Brain Stimulation Devices (BSDs) and Brain-Computer Interfaces (BCIs)

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Scientists intensely discuss ethical, legal, and social issues of neurodevices such as brain stimulation devices (BSD) and brain-computer interfaces (BCI).

But what the public thinks about different use purposes and types has only been examined recently.

Therefore, we investigated how public judgments vary depending on 1. the neurodevice and 2. the order of assessment.

Introduction

Fig. 1. Pictorial illustration of non-invasive BSD (top) and invasive BSD (bottom) used in Experiments 1 and 2.
We conducted a web-based study (ENHANCE) with an offline-recruited random sample of the adult population in Germany.

Respondents were randomly allocated to one of four vignette experiments (N between 558 and 580), either about BSDs or BCIs.

Fig. 2. Pictorial illustration of non-invasive BCI used in Experiments 3 and 4.
Methods

• Within each of the four vignette experiments we used 2 x 2 between-subject designs, thereby each vignette varied randomly regarding two dimensions:

• 1st dimension = invasiveness: Whether the neurodevice is non-invasive or invasive was varied in textual descriptions of the neurodevice and pictorial illustrations (►Fig. 1., 2., and 3.)
Methods

• 2nd dimension = purpose of use: Respondents assessed the moral acceptability and the willingness to use the respective neurodevice either regarding treatment or enhancement.

Treatment:
• How would you evaluate the use of this technology for medical reasons (e.g. for the prevention, diagnosis or treatment of an illness)? Morally, I find it...
• Can you imagine using this technology for medical reasons (e.g. for prevention, diagnosis or treatment of an illness)?

Enhancement:
• How do you evaluate the use of this technology for non-medical reasons in order to improve one’s mental performance (e.g. in one’s spare time or profession)? Morally, I find it...
• Can you imagine using this technology without medical necessity for the improvement of your mental performance (e.g. in your spare time or profession)?

• In experiments 1 and 3, the use willingness was assessed prior to the moral acceptability and in experiments 2 and 4, the moral acceptability was assessed prior to the use willingness.
Results

Moral acceptability of using a neurodevice

Willingness to use a neurodevice

Fig. 4. Frequency of responses for moral acceptability (top) and use willingness (bottom) for Experiments 1-4.
Results

Fig. 5. Predicted values (with standard errors) of moral acceptability and use willingness for experiments 1-4. All models show significant differences for purpose of use, * show significant differences for invasiveness. Color labels on the lower left of each side apply to all plots.
Results

• Linear regression models show a statistically significant lower acceptability and use willingness for invasive as compared to non-invasive devices (in 7 out of 8 models) and for enhancement as compared to treatment (all models).

• Investigating sociodemographic variables, we found that men and younger people are more willing to use a neurodevice than women and older people.
Discussion

• Our results suggest that the demand on neurodevices with the purpose of enhancing key human features seems limited compared to treatment purposes. Thus, the idea of widely artificially augmented humans currently remains more science-fiction than reality.

• Our findings also show a stronger hesitancy towards invasive as compared to non-invasive neurodevices. This could be due to fears concerning an operation or cyborgization of humans.

• While the development and application of such neurodevices is still in its infancy, our results offer interesting insights into related public attitudes.