

# Neuro- enhancement: old dreams, sober reality

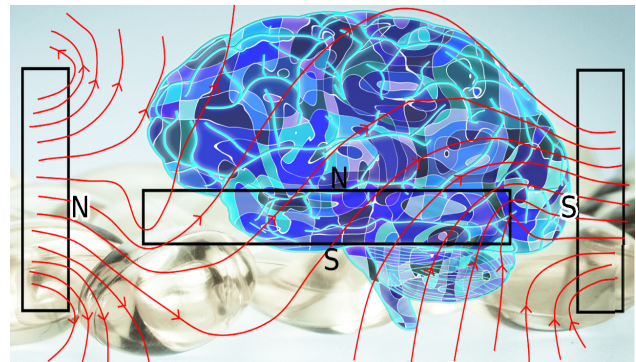
## In brief

- Boosting the performance of the brain is an old dream still unfulfilled.
- Approaches to enhance its capabilities range from drugs to brain stimulation or brain-computer interfaces.
- Besides therapeutic success with long-known drugs in ill people, almost no effects have been proven.
- Options for action include establishing a governance framework, adapting medical regulation and following fundamental rights.

## What is it about?

Boosting the performance of the brain – neuroenhancement (NE) – is an ancient dream recently promoted in popular culture. Visions of radically improving the capabilities of the human brain and thereby transcending natural boundaries have informed science fiction stories as well as academic debates. At the same time, ever more elderly people suffer from mental decline, which raises the demand for new restorative drugs. National governments and the European Commission see brain research as strategic and have devoted substantial funding in the hope of finding cures for neurodegenerative conditions and for gaining competitive advantage.

There is no consistent definition of NE. It is not a distinct, well-circumscribed technology, in contrast to other controversial life science developments such as gene editing or in-vitro-fertilization. Instead, it is best described as the aim and practice to reach enhanced brain functions through a wide range of technologies: psychopharmacology, invasive and non-invasive brain stimulation, brain-computer interfaces and – maybe in the future – genetic engineering. However, the aim is ambiguous as the understanding of what 'brain performance' is, and what it means to enhance it, remains unclear. Targets include a variety of cognitive, affective and physiological functions, including memory, wakefulness, learning, executive functions, decision-making, affect and sensory capacities as well as motor abilities.



Research on neuro-enhancement is difficult and little rewarding

All technologies used with the aim of NE are also applied for therapeutic purposes. In fact, knowledge about NE is mostly a by-product of research on therapeutics. Since it would not address a disease, a product aimed at NE could not be approved. No pharmaceutical or medical device producing company currently funds trials on NE. Existing scientific evidence is based on individual, small studies with healthy people, often using inconsistent definitions and uneven methodological standards. Meta-analyses of studies on existing prescription drug use reveal only little significant enhancement of cognitive capacities. Likewise, evidence for an NE effect of electric or magnetic transcranial stimulation is patchy. There are few promising new approaches because we know too little about how the brain works. This all suggests that NE (as depicted in popular culture) hardly exists today. Industry currently does not engage much in neuropharmacology, but this could change. Eventually, NE may become an issue.

## Basic data

<b>Project title:</b>	Neuro-Enhancement and Responsible Research and Innovation NERRI
<b>Project team:</b>	A. Bauer, A. Bogner, D. Fuchs, K. Kastenhofer, H. Torgersen (in an international consortium)
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<b>Funded by:</b>	DG Research, FP 7
<b>Website:</b>	<a href="http://nerri.eu">nerri.eu</a>

## Too much hype

In the absence of scientific evidence, the media may be guiding the public understanding of NE. Also scientists sometimes 'learn' about NE from media sources. Upon having heard of it, people approach scientists working on a particular method and ask whether it could be used for NE. However, current practices of NE are still limited to the clandestine consumption of prescription drugs or the potentially risky application of transcranial stimulation devices. Media reports often grossly exaggerate these practices with respect to effectiveness and the number of people engaging in them. Regarding future enhancement technologies, popular predictions are often inspired by transhumanist speculation or sci-fi visions.



The distinction between restoration and enhancement is blurred

From both the scientific and philosophical perspectives the distinction between medical restoration and enhancement is problematic because it builds on an (often tacit) assumption of what is or is not 'normal' or 'healthy'. For the public, the distinction is self-evident: restoration concerns therapy for those who are ill, approved by physicians. As medicine transgresses into lifestyle domains and diagnostic criteria move away from a binary classification of diseases, the difficult distinction between treatment and enhancement becomes subject to professional guidelines and codes of conduct. An ongoing discourse between stakeholders and the public should seek to ensure that these guidelines also align with public attitudes.

Interviews and focus groups in Austria showed little awareness and considerable scepticism. Doping in sports was a frequent analogy. Few had problems distinguishing therapy for the sick from enhancement of the healthy. Some considered it appropriate to 'artificially' improve cognitive functions, many more feared health risks and societal consequences like increased competition. Taking drugs appeared to be an absurd reaction to the stress from an ever more demanding life. Especially people who felt under pressure thought that ubiquitous NE would come anyway. They had little hope that regulation would prevent negative effects, and they did not trust pharmaceutical companies and regulators. Some young people considered using NE to be part of their bodily liberty. Others feared risks and/or considered NE to be 'unnatural' – some would rather take 'natural' enhancers made from plants.

## What to do

**Uncertainties about risks tend to trigger concerns about a lack of governance. Options for action may include:**

**Establish a governance framework** to address both safety concerns and societal consequences. Although many experts consider regulatory measures to be premature, unfeasible or inappropriate, others think regulation is necessary, at least for items such as electrical stimulation devices available over the Internet. A regulatory approach needs to determine whether the respective NE technology falls under the auspices of medical, consumer or other legal frameworks.

**Adapt medical regulation:** therapeutic benefit is currently the benchmark for assessing risks and benefits. However, criteria for assessing a putative enhancement are absent. Medical regulation departs from individual rights, e.g. self-determination. For NE this may be insufficient because many perceive the very idea of NE to affect fundamental societal principles, non-discrimination and fairness. Present frameworks can hardly fill the regulatory gaps.

**Follow a fundamental rights approach** in defining the need for state action. Finding a balance between diverging fundamental rights requires a broad set of considerations over values and morality. Among the human rights, the right to health and the governments' obligation to protect and fulfil this right might stand out. Human health understood as a state of physical, social and mental wellbeing may open up for considering non-therapeutic applications. It would allow addressing individual choice as well as long-term social, ethical and economic issues.

### Further reading

[pewinternet.org/2016/07/26/human-enhancement-the-scientific-and-ethical-dimensions-of-striving-for-perfection/](http://pewinternet.org/2016/07/26/human-enhancement-the-scientific-and-ethical-dimensions-of-striving-for-perfection/)

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