Editorial Special Topic: Neuroethical Issues in Cognitive Enhancement

Andrea Lavazza¹ · Lorenza S. Colzato^{2,3,4}

Published online: 28 November 2018
© Springer Nature Switzerland AG 2018

Cognitive (neuro)enhancement is one of the most widely discussed topics in neuroethics. It is certainly hard to draw the line between various forms of personal empowerment, as this differentiation shifts based on technological progress. However, at the current state of knowledge, as regards ethical aspects, one can distinguish between cognitive enhancement and neurocognitive enhancement.

Cognitive enhancement refers to techniques or instruments (including electronic ones) that affect a person's "normal" skills, increasing or improving the various components of cognition (memory, attention, executive functions, creativity, etc) (Colzato 2017). The distinguishing feature of this technique is the conscious participation of the subject in the process. Neurocognitive enhancement, instead, refers to technologies and drugs that increase a person's "normal" skills directly in the brain, improving the subject's components of cognition as well as their mood. The distinguishing characteristic of this technique is its (at least partial) automaticity and the subject's unawareness of the process, which can imply passivity and dependence.

An example of cognitive enhancement in the sense described above is a recent experiment which has shown that ordinary people can improve their mnemonic performance only thanks to regular practice. Half an hour of practice every day for 40 days turned university students into Masters of memory, able to remember almost as many items as the best

performers in the field. Importantly, the mnemonic training induced patterns of activity in the new trainees' brains that closely resemble those of memory athletes (Dresler et al. 2017).

As for neurocognitive enhancement, it usually involves drugs for the treatment of psychiatric and neurological syndromes or diseases used off label to get non-therapeutic effects on healthy subjects. Non-invasive brain stimulation—and especially transcranial direct current stimulation (tDCS), based on the mechanisms of neuromodulation—can also improve some cognitive functions. Future developments of neuroenhancement might involve brain-machine interfaces, brain prostheses and implants, while genetic engineering via CRISPR-Cas9 could pave the way to significant and permanent changes in the cognitive abilities of treated subjects.

Cognitive enhancement as defined above does not raise major ethical problems, whereas neurocognitive enhancement, due to its (at least partial) automaticity and to the subject's unawareness of the process (including passivity and dependence), is the object of a heated debate ranging from proposals to legally ban it to proposals to make it compulsory for some professional fields (Lavazza 2018a).

We expect two ethical aspects to dominate future discussions. First, it has been pointed out that methods of (neuro)cognitive enhancement may disrespect human dignity and nature, augment inauthenticity, and cheating behavior, as well as encourage an uncontrolled striving for excellence and perfection. Once a number of individuals have shown that it is possible to improve one's cognitive abilities, there could be public pressure on other individuals to augment their abilities as well.

The second issue, instead, relies on the tension between two widely shared ethical principles underlying our society: individual freedom and equality. While effective (neuro)cognitive-enhancing programs can be seen as a way to express individual freedom, they may clash with the equality principle. Societies, and upward mobility in particular, increasingly rely on competition, which emphasizes individual performance and abilities. Neurocognitive enhancement is therefore likely to produce "positional benefits" by improving

✉ Andrea Lavazza
lavazza67@gmail.com

¹ Centro Universitario Internazionale, Via Garbasso, 42, 52100 Arezzo, Italy

² Cognitive Psychology Unit & Leiden Institute for Brain and Cognition, Leiden University, Leiden, The Netherlands

³ Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Bochum, Germany

⁴ Institute for Sports and Sport Science, University of Kassel, Kassel, Germany

one's social and economic status compared to others, based on the possibility of accessing new forms of personal empowerment. While this could be considered a fair individual choice, it may have significant consequences for society in terms of general public expectations and standards.

A possible scenario that is still to be seriously considered comes from the possible confluence of two fields of study, that of so-called cognitive capitalism and that of cognitive (neuro)enhancement explored here. As far as cognitive capitalism is concerned, a pioneering empirical study is that carried out by Rindermann and Thompson (2011). The authors, “using three large-scale assessments, calculated cognitive-competence sums for the mean and for upper - and lower - level groups for 90 countries and compared the influence of each group's intellectual ability on gross domestic product.”

Applying different statistical methods and measures to various country samples and historical periods, Rindermann and Thompson established “the decisive relevance of cognitive ability—particularly of an intellectual class with high cognitive ability and accomplishments in science, technology, engineering, and math—for national wealth.” Also, according to their data, “this group's cognitive ability predicts the quality of economic and political institutions, which further determines the economic affluence of the nation”. Based on these data, Rindermann and Thompson claim that “cognitive resources enable the evolution of capitalism and the rise of wealth”.

It is well known that cognitive abilities are the best predictors of job performance, and that the intelligence of a nation is the best predictor of national performance. In this vein, as Rindermann (2018) states, cognitive capitalism refers to the idea that the cognitive ability of society as a whole, and of its cognitive elite in particular, is the prerequisite for the development of technological progress and for the wealth-furthering norms and institutions that form the core of the capitalist system. Cognitive abilities are therefore one of the key factors for the overall wellbeing of society.

The processes of scientific and technological innovation on a global scale, along with phenomena of social complexification, are undergoing continuous acceleration, which will require greater cognitive skills to manage this complexity and its associated problems (for example, those related to climate change and the decrease in natural resources). However, according to Rindermann (2018), cognitive abilities in the Western world could decrease due to demographic trends. In fact, European and Japanese societies in particular are becoming older, with fewer births and a longer life expectancy, which results in a decline in fluid intelligence and, therefore, in a reduced capacity for innovation. Furthermore, the most educated and cognitively most capable people usually have fewer children.

In this framework, the classic suggestion is to increase the educational programs that allow for the enhancement of cognitive abilities constituting human capital. In particular, reference is made to cognitive training programs such as the reasoning training proposed by Klauer (Klauer and Phye 2008). But if neurocognitive enhancement proves to be safe and effective, it promises to be quicker and easier to administer to a greater percentage of the population compared to traditional methods, since it does not require the conscious and prolonged effort of the subject. In the case of a significant decline in the cognitive abilities of a society as a whole, neurocognitive enhancement would be one of the most viable options. But this option comes with a number of ethical questions, and possibly entails pressure for this form of enhancement to be promoted and spread even to those who would not resort to it by their own initiative.

This special issue of the *Journal of Cognitive Enhancement* on neuroethical enhancement gathers a series of relevant contributions addressing different forms of enhancement from a wide range of domains (philosophy, neuroscience, cognitive, developmental, and life-span psychology). Together, these papers shed more light, from various angles, on the complex (neuro)ethical issues that surround the topic of (neuro)cognitive enhancement.

In their paper “Neuroethical Issues in Cognitive Enhancement: The Undergraduates' Point of View,”, Cancer et al. (2018) present the results of a survey carried out on university students to test the naïve conceptions of the ethical implications of different forms of enhancement. What they found is that passive ways of enhancing human performance are seen as infringing moral rules.

In her paper “Responsible Cognitive Enhancement: Neuroethical Considerations”, Colzato (2018) presents examples of cognitive enhancement from the field of food supplements, pharmacology, and brain stimulation. She proposes the idea of a responsible cognitive enhancement supported by clear mechanisms of action, which takes into account individual differences and evaluates the far-reaching, sweeping claims coming from the media and the business world.

In their paper “How Brain stimulation techniques can affect moral and social behavior”, Di Nuzzo et al. (2018) present a mini review about how brain stimulation techniques such as tDCS, transcranial magnetic stimulation (TMS) and deep brain stimulation (DBS) are used to affect moral and social behavior. Given that morality has been debated over centuries as the social behavior regulator in our society, ethical considerations are risen about the effects and usability of brain stimulation techniques on this matter.

In their paper “Enhanced Cognition, Enhanced Self? On Neuroenhancement and Subjectivity”, Ferretti and Ienca (2018) investigate the implications of neuroenhancement from a first-person and phenomenological perspective that focuses

on the role of the human brain and body as mediators of subjective experience. This analysis is conducted both on historical-philosophical and on empirical grounds.

In their paper “Neuroethical Implications of Neurocognitive Enhancement in Managerial Professional Contexts”, Fronda et al. (2018) address criticalities and benefits of the use of neurocognitive enhancement techniques on individuals and society, highlighting particularly the use of neurocognitive enhancement within professional contexts in the improvement of organizations effectiveness, coordination, and productivity.

In their paper “Cognitive Enhancement with Brain Implants: The Burden of Abnormality”, Gilbert and Tubig (2018) argue that even if brain implants could augment one’s cognitive capacities, they would not guarantee a net benefit for the implanted individual. The authors state that individuals augmenting their capacities will likely experience a sort of abnormality: it is indeed documented that patients who suddenly cease experiencing symptoms suffer for the newly found normality.

In her paper “The Cognitive Basis of Commonsense Morality”, Gligorov (2018) draws a parallel between commonsense psychology and commonsense morality, and proposes that the right way to characterize commonsense morality is as an empirically evaluable theory, similar to a scientific theory. She therefore argues that in order to change our psychological dispositions we must change the background theory that produces them.

In their paper “Would the Use of Safe, Cost-Effective tDCS Tackle Rather than Cause Unfairness in Sports?,” Imperatori et al. (2018) address how neuromodulation technologies like tDCS might enable professional and amateur athletes to reach their respective levels of physical excellence in a safe, cost-effective, and fair manner. The authors argue that tDCS use can be considered ethical and permissible according to WADA requirements if meets requirements of safety, hard work from the athlete, and accessibility.

In his paper “Cognitive enhancement through genetic editing: a new frontier to explore (and to regulate)?,” Lavazza (2018b) discusses the new generation of genetic editing techniques—in particular CRISPR-Cas9, which makes the possibility of cognitive enhancement through genetic engineering near and real. The article considers the safety of the practice and addresses ethical issues suggesting extreme caution before embarking on the path of genetic editing, especially regarding parents’ will to give their children better cognitive skills.

In his paper “The dual application of neurofeedback technique and the blurred lines between the mental, the social, and the moral,” Tachibana (2018) focuses on neuroethical considerations about combining neurofeedback training with the use of functional magnetic resonance imaging given that this

enables the regulation of an individual’s cognitive, emotion-related, and behavioral states through a real-time representation of her brain activities.

Finally, in his paper “Cognitive Enhancement and the Threat of Inequality,” Veit (2018) evaluates the widespread concern that human enhancement will inevitably accentuate existing inequality and analyzes whether prohibition is the optimal public policy to avoid this outcome. He argues that, for three reasons, the inequality objection does not sufficiently support the conclusion that cognitive enhancement should be prohibited.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

- Cancer, A., Schulz, P. J., Castaldi, S., & Antonietti, A. (2018). Neuroethical issues in cognitive enhancement: the undergraduates’ point of view. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0110-3>.
- Colzato, L. S. (2017). *Theory-driven approaches to cognitive enhancement*. New York: Springer.
- Colzato, L. S. (2018). Responsible cognitive enhancement: neuroethical considerations. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0090-3>.
- Di Nuzzo, C., Ferrucci, R., Gianoli, E., Reitano, M., Tedino, D., Ruggiero, F., & Priori, A. (2018). How brain stimulation techniques can affect moral and social behavior. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0116-x>.
- Dresler, M., Shirer, W. R., Konrad, B. N., Müller, N. C., Wagner, I. C., Fernández, G., Czisch, M., & Greicius, M. D. (2017). Mnemonic training reshapes brain networks to support superior memory. *Neuron*, 93(5), 1227–1235.
- Ferretti, A., & Ienca, M. (2018). Enhanced cognition, enhanced self? On neuroenhancement and subjectivity. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0109-9>.
- Fronda, G., Balconi, M., & Crivelli, D. (2018). Neuroethical implications of neurocognitive enhancement in managerial professional contexts. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0100-5>.
- Gilbert, F., & Tubig, P. (2018). Cognitive enhancement with brain implants: the burden of abnormality. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0105-0>.
- Gligorov, N. (2018). The cognitive basis of commonsense morality. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0098-8>.
- Imperatori, L. S., Milbourn, L., & Garasic, M. D. (2018). Would the use of safe, cost-effective tDCS tackle rather than cause unfairness in sports? *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0113-0>.
- Klauer, K. J., & Phye, G. D. (2008). Inductive reasoning: a training approach. *Review of Educational Research*, 78, 85–123.
- Lavazza, A. (2018a). Transcranial electrical stimulation for human enhancement and the risk of inequality: prohibition or compensation? *Bioethics*. <https://doi.org/10.1111/bioe.12504>.
- Lavazza, A. (2018b). Cognitive enhancement through genetic editing: a new frontier to explore (and to regulate)? *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0104-1>.
- Rindermann, H. (2018). *Cognitive capitalism: human capital and the wellbeing of nations*. Cambridge: Cambridge University Press.

- Rindermann, H., & Thompson, J. (2011). Cognitive capitalism: the effect of cognitive ability on wealth, as mediated through scientific achievement and economic freedom. *Psychological Science*, 22, 754–763.
- Tachibana, K. (2018). The dual application of neurofeedback technique and the blurred lines between the mental, the social, and the moral. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0112-1>.
- Veit, W. (2018). Cognitive enhancement and the threat of inequality. *Journal of Cognitive Enhancement*, 2(8). <https://doi.org/10.1007/s41465-018-0108-x>.