Dimensions of Cognitive Enhancement: Hacking the Brain

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Received: 10-Jan-2022, Manuscript No. CEP-22-51903; **Editor assigned:** 12-Jan-2022, PreQC No. CEP-22- 51903(PQ); **Reviewed:** 18-Jan-2022, QC No. CEP-22-51903(Q); **Revised:** 20-Jan-2022, Manuscript No. CEP-22-51903(R); **Published:** 28-Jan-2022, DOI: 10.35248/ 2471-2701.22.8(1).293

Abstract

Demands for cognitive functioning are gradually increasing in an increasingly sophisticated information culture. Several ways to improve brain function have been developed in recent years. Evidence of their effectiveness (or lack thereof) and adverse effects has sparked debates concerning their ethical, societal, and medical consequences. In public discourse, cognitive improvement is frequently portrayed as a one-size-fits-all occurrence. However, upon closer examination, cognitive enhancement reveals itself to be a multidimensional concept: there is no single cognitive enhancer that improves brain function, but rather a wide range of interventions that can be grouped into biochemical, physical, and behavioral enhancement strategies. These cognitive enhancers differ in terms of mechanism of action, cognitive domains they target, time scales they work on, availability and side effects, and how they affect different groups of people. We unravel the aspects of cognitive improvement, evaluate important examples of cognitive enhancers that differ across these dimensions, and present a framework for both theoretical and empirical study in the process.

Keywords: Brain hacking • Neuro-ethics • Cognition • Memory • Working memory • Attention

Introduction

The demands on cognitive functions, which developed for a fundamentally different environment, are increasing in an increasingly complex world. In an information culture and a postindustrial economy, daily existence necessitates cognitive capabilities that must be gained through slow, laborious, and costly educational and training processes. Similarly, when the world develops at a faster pace, these talents may become obsolete or be lost due to natural ageing processes. People's mental talents also differ, allowing them to learn certain skills faster or slower, which can have a big impact on life outcomes. On both an individual and social level, strategies to increase the acquisition and maintenance of cognitive skills are becoming increasingly crucial. The research of techniques to improve the human brain has been fueled by the difficulties of our day. While humans have attempted to better their performance since the dawn of time, the current era is unusual in that not only are the difficulties developing faster, but so are the technologies that promise to fulfil them. An increasing number of people are experimenting with techniques to creatively surpass the natural constraints of human cognitive capacity, or to hack brain function, similar to the hacking culture in the field of computer software and hardware. This breakthrough has sparked both excitement and fear, since commentators hold widely divergent viewpoints on the feasibility, utility, hazards, and long-term influence of augmentation technologies on the planet. The lack of hard facts is one of the reasons for the sometimes polarized disputes. It is simple to defend any position without empirical evidence, as well as to dismiss opponents as having irrational beliefs. A tendency to perceive enhancement as a single phenomenon to be appraised as a whole, rather than as a broad group of procedures with significant distinctions and varying implications, is another prominent source of disagreement and theoretical ambiguity. Only by developing a clear understanding of how a specific enhancement technique might affect distinct cognitive functions in specific groups, as well as the expected side effects and costs, can a well-informed theoretical debate and promising empirical study designs to test the method emerge. Our Review's goal is to create a broad framework that will encourage both theoretical and empirical study.

Action structure

Enhancement is defined as interventions in humans that try to increase mental functioning beyond what is required to maintain or restore good health, according to a generally used definition. The efficacy of a number of non-pharmacological enhancers has been evaluated elsewhere [1,2]. We propose clustering enhancement solutions into three primary domains based on their basic mechanism of action, in order to rationalize the wide range of alternative approaches to cognitive enhancement. Although there are no hard and fast rules, most cognitive improvement techniques can be classified as pharmacological, physical, or behavioral therapies.

Biochemical approaches

Biochemical agents are the most common cognitive enhancers discussed in the public discourse. Biochemical interventions, on the other hand, are not limited to pharmaceutical "smart medications." Ordinary chemicals, such as oxygen, have also been found to boost memory processes and neuronal activation in memory-related brain regions [3-5]. Biochemical enhancers are ways for making use of specific nutritional components that have a long history in human history. The most commonly used substances are probably glucose and caffeine both of which have been shown to improve cognition in multiple studies [6-8]. Other beverages made from caffeine-bearing plants, such as guarana, have been demonstrated to improve cognition [9]. While non-caffeine components in caffeine-bearing plants may have independent benefits on cognition [10]. It's been questioned whether industrially produced drinks contain cognitive-enhancing ingredients other than caffeine, glucose, or guarana extract. Flavonoids, such as those found in cocoa, curry powder (because to the curcumin it contains) folic acid and omega-3 fatty acids are other nutritional components having some support for cognitive enhancement. Apart from specialized dietary supplements, fasting and overall calorie restriction may improve memory in elderly people, according to some data. Traditional natural remedies have also been explored as cognitive enhancers: in addition to herbs that grow in Western locations, such as salvia, traditional Chinese and Indian herbal medications, such as *Bacopa monnieri*, have been linked to cognitive enhancement. However, the most well-known examples of traditional Asian herbal medicines, ginseng and *Ginkgo biloba*, have yet to consistently show positive effects on cognitive abilities in healthy people. Another pharmacological intervention with a lengthy history is medications that are used recreationally and have shown the ability to improve some cognitive processes. Nicotine, for example, increases attention and memory, while alcohol, despite affecting many cognitive functions, may boost others, such as creative processes or memory, in retrospect. Pharmaceuticals are seen as prototypical cognitive enhancers by the general public: synthetic stimulants like amphetamine, methylphenidate, or modafinil, as well as antidementia therapies like acetylcholinesterase inhibitors and memantine, are at the centre of the public discussion on cognitive enhancement.

However, the evidence supporting their effectiveness in enhancing brain function and cognition in healthy persons is frequently far less than predicted in theoretical debates. Importantly, the lack of an objective effect on cognition can be accompanied by a significant placebo effect: for example, users who thought they were given mixed-amphetamine salts subjectively rated themselves as performing better and even showed minor objective performance increases, regardless of their actual medication state. While most pharmacological enhancers are meant to influence or imitate specific neurotransmitters, brain signaling molecules like adrenaline, GABA, glucocorticoids, ovarian hormones, and other neuropeptides have also been proposed as cognitive enhancers.

Genetic changes, which have been shown to improve numerous learning and memory functions in animal models, are another pharmacological technique for cognitive enhancement.

Despite advancements in explaining the genetic basis of cognitive qualities in humans, genetic changes in humans must still be viewed as future techniques rather than currently available enhancing alternatives.

Physical techniques

A number of brain stimulation devices are currently the most commonly discussed physical treatments for cognitive enhancement. While invasive methods such as deep brain stimulation are restricted to subjects with pathological conditions, several types of allegedly noninvasive stimulation strategies, such as electrical stimulation methods such as Transcranial Direct Current Stimulation (tDCS55), Transcranial Alternating Current Stimulation (tACS56), Transcranial Random Noise Stimulation (tRNS57), and Transcranial Pulsing Stimulation (tPS57), are increasingly used on healthy subjects (MNS61). The following specifics of the stimulation protocols appear to be critical: Commercial do-it-yourself electrical brain stimulators may harm rather than enhance cognition, and systematic evaluations have cast doubt on whether electrical brain stimulation has an obvious and straightforward enhancing effect on multiple cognitive domains, even under controlled laboratory conditions. Recent research has questioned whether some of the most regularly utilized electrical brain stimulation configurations have any neuro-physiologically relevant effects. In light of this, the development of noninvasive deep brain stimulation based on temporally interfering electric fields could provide a more systematic and focused mechanism than existing methods.

Domain of consciousness

The human mind is made up of a wide range of cognitive operations rather than being a single entity. As one might expect, no single cognitive enhancer improves every cognitive function. Rather, most cognitive enhancers have diverse efficacy profiles for different cognitive domains. Mnemonic strategies, for example, improve memory but not meditation; meditation training, on the other hand, improves attention but not mnemonic strategy training.

Conclusion

Enhancing one's cognitive abilities is clearly a multifaceted endeavor. For every theoretical or empirical study subject, however, not every dimension is relevant. Many empirical cognitive enhancement researchers, for example, are primarily concerned in studying the neurobiological and psychological factors that underpin cognitive functions. The characteristics of availability and social approval are mainly unimportant for this goal. Many theorists, on the other hand, are concerned in the social and ethical implications of cognitive improvement, as these aspects may be particularly important. Side effects and temporal aspects may be of secondary value to empirical researchers interested in the neural mechanics of specific cognitive processes, but they are critical for users considering which cognitive enhancement approach to utilize for a specific goal. Direct comparisons between cognitive enhancement strategies with radically different modes of action have been rare up to now, and more comprehensive comparisons across dimensions may be difficult: practical issues of information availability from different dimensions aside, interventions typically differ on different dimensions, making global comparisons difficult. Furthermore, there are various interactions between different enhancers, further complicating the situation. Interactions between glucose and coffee, food and exercise, exercise and working memory training, video games and sleep, video games and brain stimulation, exercise and brain stimulation, and brain stimulation and sleep have all been observed.

References

1. Dresler, M., et al. "Non-pharmacological cognitive enhancement." *Neuropharmacology* 64 (2013): 529-543.
2. Knafo, S., & César, V. "Cognitive enhancement pharmacologic, environmental and genetic factors." *Elsevier* 47 (2014).
3. Moss, C., & Andrew B.S. "Oxygen administration enhances memory formation in healthy young adults." *Psychopharmacology* 124.3 (1996): 255-260.
4. Scholey, A.B., et al. "Cognitive performance, hyperoxia, and heart rate following oxygen administration in healthy young adults." *Physiol Behav* 67.5 (1999): 783-789.
5. Yu, R., et al. "Cognitive enhancement of healthy young adults with hyperbaric oxygen: A preliminary resting-state fMRI study." *Clin Neurophysiol* 126.11 (2015): 2058-2067.
6. Smith, M.A., et al. "Glucose enhancement of human memory: a comprehensive research review of the glucose memory facilitation effect." *Neurosci Biobehav* Rev 35.3 (2011): 770-783.
7. Glade, M.J. "Caffeine-not just a stimulant." *Nutrition* 26.10 (2010): 932-938.
8. Nehlig, A. "Is caffeine a cognitive enhancer?." *J Alzheimer's Dis* 20.s1 (2010): S85-S94.
9. Haskell, C.F., et al. "A double-blind, placebo-controlled, multi-dose evaluation of the acute behavioural effects of guaraná in humans." *J Psychopharmacol* 21.1 (2007): 65-70.
10. Haskell, C.F., et al. "Behavioural effects of compounds co-consumed in dietary forms of caffeinated plants." *Nutr Res Rev* 26.1 (2013): 49-70.

Cite this article: Jones C. Dimensions of Cognitive Enhancement: Hacking the Brain . Clin Exp Psychol, 2022, 8(1), 003-004.