
Preface

“The mind is the limit. As long as the mind can envision the fact that you can do something, you can do it, as long as you really believe 100%”—this is a quote that I like to repeat myself before every challenging (physical or mental) situations in order to get the best performance out of me. In research, teaching or sport, my ultimate goal is not to outperform others but to always get better for my own sake. This is for me the essence of cognitive enhancement: the use of any (legitimate) means (e.g., video game, brain stimulation, neurofeedback, physical exercise or food supplements) to reach one’s personal best.

Why having a book about cognitive enhancement now? Why has this topic become so relevant in the past few years?

Economically, the interest in cognitive enhancement is mainly driven by the increasing costs of the welfare system, especially with regard to the increasing age of citizens in Western societies. For instance, cognitive enhancement can help to delay cognitive decline in the elderly, which would extend the time people can live autonomously and, thus, reduce the welfare costs for the time thereafter. Along the same lines, training children could speed up the education of healthy individuals and reduce the risk of behavioral deviance and pathology, again with considerable savings for welfare and education systems. But there is also a more ideological reason for the increased interest in cognitive enhancement. Both Eastern and Western societies are continuously driven towards more individualism, which emphasizes the existence and often also the importance of individual differences over commonalities and collectivistic values. These tendencies go hand-in-hand with ideological developments in public opinion and within political parties, which in many countries have gravitated towards more neoliberal, individualism-heavy positions over the last 15 years or so. Among other things, this has involved a rather systematic deconstruction of the welfare system and established the view of the individual as an architect of his or her own life. Research on cognitive enhancement has benefited from both aspects of this trend. The economic problems of the welfare system have boosted the interest in procedures and activities that make welfare societally more affordable, and the ideological turn towards individualism provides a natural breeding ground for the public interest in procedures and activities that help to express and to further develop individual needs and interests.

The widespread use of smart phones has led to a real explosion of “apps” to enhance cognitive functioning, ranging from simple alerts reminding the elderly to take her/his pill to theoretically guided programs to systematically enhance specific cognitive functions. Industry and funding agencies have taken notice of the many opportunities these techniques can open, and the current European Research Area (ERA in Horizon 2020) has various calls to promote gamification. Along the same line, President Obama declared already in 2011 the importance of investing money in educational technology and realized the enhancing potential of gaming. Indeed, as quoted from the White House initiative “Games that Can Change the World”: “Games for impact are designed to be at once entertaining and engaging, and also something more: educational, enlightening, and perhaps even designed to motivate action.” Clearly, this is likely to strengthen this trend further in the near future, but I think that the full potential of gamification is not always sufficiently appreciated. Turning psychological experiments and training procedures into apps is certainly handy for both researchers and users, especially as it allows integrating cognitive enhancing programs better with real-life circumstances. Another example to demonstrate how ERA is focusing on cognitive enhancement is the Joint Programming Initiative “A healthy diet for a healthy life” which is funding research on how nutrients can prevent (social) cognitive decline in normal aging. This initiative is particularly emblematic in showing how economic problems of the welfare system have boosted the interest in procedures and activities that make welfare societally more affordable.

Need for Theory

Kurt Lewin’s claim that “nothing is as practical as a good theory” is the *leitmotif* of this book about cognitive enhancement. While in the past the field of cognitive enhancement used mainly effect-driven approaches (that seek to demonstrate that an enhancing intervention can have an effect without explaining how it modulates the targeted function and why some people benefit more than others), this book proposes a mechanistically oriented, theory-driven approach that tries to understand and explain individual differences to a degree that allows a comprehensive understanding of how a particular intervention modulates cognition.

Structure of the Book

The present book aims to present different means to enhance cognition and to get a better understanding of the underlying mechanism of *how* those means modulate our behavior. According to the similarities of the mechanism of action, the book is divided into six parts.

The first and second part are devoted to food supplements and/or drugs that acting on increasing the level of a particular neurotransmitters are able to enhance those cognitive functions modulated by them. The focus of the third part is on noninvasive brain stimulation methods which are used to stimulate regions of the brain related to cognitive functions targeted by the enhancing intervention. The fourth part is dedicated to neuronal entrainment methods by means of which, in order to optimize performance, the brain “takes over” or synchronizes its activity based on external or internal stimulation. The fifth part addresses far transfer interventions which underlying idea suggests that individuals are getting better not only in skills related to their practice of preference, but also in entirely unrelated skills. The fifth part aims to explore environmental factors which, under particular circumstances, are known to promote cognitive performance. The sixth part is about environmental factors able to promote cognitive performance. The seventh part considers “real-life” examples in which the concept of cognitive enhancement has been successfully applied. Finally, the last part is dedicated to the costs and benefits associated with cognitive enhancement.

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