

Trends in Augmentation of Human Performance 1

Elisabeth Hildt
Andreas G. Franke
Editors

Cognitive Enhancement

An Interdisciplinary Perspective



Springer

Cognitive Enhancement

Trends in Augmentation of Human Performance

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Cognitive Enhancement

An Interdisciplinary Perspective

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Preface

This book is a collection of contributions to the conference “Cognitive Enhancement,” which was held from 21 February until 1 March 2011 at the University of Mainz, Germany. During this interdisciplinary conference, young scholars from Europe, Canada and Australia met to present their work and to discuss issues related to cognitive enhancement with renowned international experts. The scholars stem from various disciplines such as medicine, psychiatry, neuroscience, neurotechnology, philosophy, medical ethics, neuroethics, sports science, social sciences and law.

Several persons rendered the realization of this book possible. First, we would like to thank the following individuals for their continuous support, for chairing the conference sessions and for stimulating discussions: Prof. Dr. Ruth Zimmerling, Political Science, University of Mainz; Prof. Dr. Klaus Lieb, Department of Psychiatry and Psychotherapy, Mainz University Medical Center; Prof. Dr. Thomas Metzinger, Department of Philosophy, University of Mainz; and Prof. Dr. Perikles Simon, Department of Sports Medicine, Mainz University Medical Center.

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Mainz, Germany
October 2012

Elisabeth Hildt
Andreas G. Franke

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Chapter 1

Cognitive Enhancement – A Critical Look at the Recent Debate

Elisabeth Hildt

Abstract Cognitive enhancement, which can be characterized as the attempt to increase cognitive functions such as attention or memory in healthy individuals, has received considerable attention during the last decade, both in the general public and in academic discourse. In spite of a very active interdisciplinary debate which has provided helpful reflections, categorizations and clarifications, the numerous questions and problems related to cognitive enhancement are far from having been exhaustively discussed or even solved. Without any doubt, there are several aspects within this field that require more reflection and further clarifications. In this chapter, which serves as an introduction to the following book, I'll discuss three of them. The first aspect concerns conceptual issues. Specifically, it concerns the question of what we are talking about when we use the term cognitive enhancement. The second aspect regards the question of how issues in cognitive enhancement should adequately be discussed within society. And the third aspect regards the interplay between individual autonomy and society. The last section of this chapter includes an overview of the contributions to the present book.

Keywords Cognitive enhancement • Neuroenhancement • Cognition • Autonomy • Society • Ethics

Cognitive enhancement (CE) has received considerable attention during the last decade, both in the general public and in academic discourse. Cognitive enhancement can be characterized as the attempt to increase cognitive functions such as attention or memory in healthy individuals. There are various strategies that aim at enhancing cognitive functions. Pharmacological cognitive enhancement is in the

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current focus of attention (de Jongh et al. 2008; Repantis et al. 2010b; Morein-Zamir and Sahakian 2011). It encompasses the use of caffeine, prescription stimulants (e.g. methylphenidate, modafinil) or illicit drugs (such as illicit amphetamines) (de Jongh et al. 2008; Repantis et al. 2010b; Morein-Zamir and Sahakian 2011). Non-pharmacological strategies for cognitive enhancement include non-technological forms, such as physical exercise, meditation, and mnemonics as well as technological ones, such as transcranial magnetic stimulation (TMS) or transcranial direct current stimulation (tDCS) (Hamilton et al. 2011; Dresler et al. 2013).

Over the past decade, there has been a very active interdisciplinary debate on the various strategies for cognitive enhancement and the individual, social and ethical implications of cognitive enhancement; this debate has provided helpful reflections, categorizations and clarifications. Issues analyzed and discussed include safety, efficacy, risk-benefit-ratio, autonomy, cognitive liberty, identity, authenticity, pressure to perform, fairness, justice, human nature and medicalization of human life (cf. President's Council on Bioethics 2003; Farah et al. 2004; Sahakian and Morein-Zamir 2007; Gordijn and Chadwick 2008; Greely et al. 2008; Bublitz and Merkel 2009; Savulescu and Bostrom 2009; Nagel 2010; Metzinger and Hildt 2011; Metzinger 2012; Outram 2012).

However, the numerous questions and problems related to cognitive enhancement are far from having been exhaustively discussed or even solved. Without any doubt, there are several areas that need more reflection and further clarifications. In this chapter, which serves as an introduction to this book, I will discuss three of these areas. The first regards conceptual issues. It concerns the question of what we talk about when we talk about cognitive enhancement. The second concerns the question of how issues in cognitive enhancement should adequately be discussed within society. And the third deals with the interplay between individual autonomy and society.

1.1 What Do We Mean by the Term Cognitive Enhancement?

According to a widespread definition, enhancement is a term used to “characterize interventions designed to improve human form or functioning beyond what is necessary to sustain or restore good health” (Juengst 1998, 29). There are various fields of enhancement, such as those that aim at improvements in bodily appearance (cosmetic surgery), athletic performance (doping in sports), genetic make-up (genetic enhancement) or brain functions (neuroenhancement) (Gordijn and Chadwick 2008; Savulescu and Bostrom 2009).

Usually, however, the term “enhancement” does not serve to specify a certain method or technology but to specify the context of its use, for whether a certain method or technology is used as a treatment or as an enhancement depends on the concrete situation. A typical example of such diverging contexts is the use of methylphenidate (Ritalin®) in the treatment of attention deficit hyperactivity disorder (ADHD), as opposed to the enhancement use of methylphenidate by healthy individuals who attempt to increase mental performance.

Unlike medical treatments, enhancements aim at some kind of betterment in healthy individuals. Eric T. Juengst (1998) described the concept of enhancement to be a “moral boundary concept”. Whereas on the descriptive level, enhancement serves to characterize a certain measurement to lead to some form of improvement, on the normative level, enhancement could be described as dwelling outside the field of medicine and beyond medical obligation, a measurement not legitimized by medical needs. In this distinction between treatment and enhancement, the concepts of health, disease and normality and the aims of medicine are crucial.

This distinction between treatment and enhancement is broadly accepted for pragmatic reasons, in spite of having several drawbacks. When it comes to concrete applications, it is often problematic to draw a clear line between medical uses of a certain technology and non-medical ones, for, in many contexts, there is a grey zone that renders the distinction very problematic. In addition, the normative implications of the treatment-enhancement distinction are far from being clear. For what does it imply to consider a certain practice to be outside the field of medicine – beyond the claim that the health care system will not pay for it?

The above sketched view on enhancement clearly focuses on technological forms of enhancement and on the question of how far new technologies should be used in order to improve human capacities or traits in healthy individuals (cf. Juengst 1998; Parens 1998). In contrast, another view on enhancements starts from a totally different point in that it stresses that all attempts of humans to strive for betterment can be considered to be enhancements (Caplan 2002; Greely et al. 2008; Bostrom and Sandberg 2009). A typical example of this strategy can be found in a commentary by Greely et al. (2008, 702):

Human ingenuity has given us means of enhancing our brains through inventions such as written language, printing and the Internet. Most authors of this Commentary are teachers and strive to enhance the minds of their students, both by adding substantive information and by showing them new and better ways to process that information. And we are all aware of the abilities to enhance our brains with adequate exercise, nutrition and sleep. The drugs just reviewed, along with newer technologies such as brain stimulation and prosthetic brain chips, should be viewed in the same general category as education, good health habits, and information technology – ways that our uniquely innovative species tries to improve itself.

In this second approach, the term “enhancement” is used in a much broader way. What at first sight seems to be nothing but a question of definition, to be simply a disagreement about what we talk about when we talk about enhancements, in fact has much wider implications. For depending on how the term is used, reasoning with regard to cognitive enhancement differs considerably. Whereas the first approach aims to contextualize technological enhancements in that it compares them to current technology use in medicine, the second approach tends to trivialize technological forms of enhancement.

Undoubtedly, there is nothing wrong with saying that people have always striven to improve themselves in various ways. There is nothing new with this idea of improvement, either. Anthropological thinking over the past centuries has been dominated by the idea that it is characteristic for humans to strive for the better. What definitely is new, however, is the use of current technologies to strive for this end.

Compared to traditional strategies, biotechnologies undoubtedly provide different means to improve human capacities. This does not mean that enhancements via biotechnologies differ categorically from enhancements via non-technological strategies such as sleep, training or nutrition. But means undoubtedly do matter: Different strategies may differ with regard to the mechanisms involved, with regard to efficacy, benefits, risks and numerous other aspects.

In the following, I will not go into a detailed argument that means matter (cf. Cole-Turner 1998; Parens 1998). My point merely is that means matter factually. What makes technological enhancements factually different is that they rely on highly specific additional factors – medical or technical support, drugs or technical devices. Some of them need the assistance of a physician or some other medical professional. Others do not need any medical assistance but depend on the provision of or the access to technical devices or psychoactive drugs. All of these highly specific components are to be seen in the context of an established medical or social practice in which access and practical procedure underlie general regulations.

In contrast, non-technological strategies, such as sleep or meditation, are primarily employed in the private domain in so far as they usually do not depend on any specific external factor that has to be provided by a third party. Furthermore, the risks going along with the non-technological strategies are rather low, in general, and, therefore, do not legitimize any external influence.

That's why the general conditions of the various technological and non-technological forms of enhancement will differ considerably. When talking about how to handle cognitive enhancement in society, the concrete context of the enhancement strategy in question should always be taken into account. For without any contextualization, there is nothing that can be said except the rather general statement that people have always attempted to improve themselves – a statement that sounds liberal but is rather trivial and tells us absolutely nothing about how to use a particular technology.

Whereas the above reflections pertain to all kinds of enhancements, there are conceptual questions that pertain specifically to the field of cognitive enhancement, the most central one being: What is *cognitive* enhancement? A plausible direct answer is: Cognitive enhancement aims at increasing cognitive functions. Cognitive functions are information-processing functions such as learning, planning, concept formation, perception, attention, memory, reasoning and problem solving.

If you take a closer look at the interdisciplinary debate, it is far from clear, however, what is meant when people talk about cognitive enhancement. Whereas some authors consider the aim of cognitive enhancement to “improve the performance of the healthy” (Greely et al. 2008, 702) or to “augment the minds of the healthy” (Cakic 2009, 611), according to a definition by Nick Bostrom and Anders Sandberg (Bostrom and Sandberg 2009, 311), cognitive enhancement is “the amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems [...]”. Another characterization of the term “cognitive enhancement” is that it “encompasses a number of theoretical and empirical observable phenomena broadly inclusive of enhancements

or improvements (observed or theoretical) in memory, cognitive performance, and intelligence” (Outram and Racine 2011, 324).

The vagueness of these characterizations may at least partly be due to the fact that there is a considerable lack of knowledge concerning the question of in how far current technologies actually succeed to enhance *cognitive* functions.

In view of these difficulties, several authors prefer to use the term “neuroenhancement” instead of “cognitive enhancement”. Neuroenhancement is a broader term to characterize all kinds of interventions intended to improve brain functions in healthy individuals. It encompasses different types of enhancement, such as cognitive enhancement, mood enhancement, moral enhancement or memory blunting. Mood enhancement has been characterized as aiming at feeling “better than well.” It is the attempt to promote subjective well-being in otherwise healthy individuals who suffer from poor self-esteem or who feel down, alienated or socially isolated (Kramer 1993; Elliott 2000; DeGrazia 2000; Stein 2012; Synofzik et al. 2012). In the past, pharmacological forms of mood enhancement, in particular antidepressants such as selective serotonin reuptake inhibitors (for example Prozac®), have been the focus of attention. In contrast to this, reflections on moral enhancement, i.e. on interventions “that may reasonably be expected to result in [a person] having morally better future motives, taken in sum, than she would otherwise have had” (Douglas 2008, 229), are currently fictitious for the most part (Douglas 2008; Harris 2011). In addition, there are attempts to selectively blunt emotionally-laden extremely negative or traumatic memories (de Jongh et al. 2008; Parens 2010).

These distinctions between different types of neuroenhancement may seem to be a little bit artificial. Apart from the consideration of how far positive effects on these functions can actually be achieved in healthy individuals, there is the question of how far it is possible to *selectively* modify mood, cognition or motives since interventions that improve mood may imply an increase in motivation, which, in turn, may result in positive effects on cognitive functions. Also, cognitive enhancement may imply some sort of feeling better brought about by an increase in alertness. And – one could speculate – moral enhancements will probably imply modifications in cognitive and emotional functions.

Nevertheless, in spite of these difficulties to draw a clear line, in my opinion, it is helpful to distinguish between these different forms of enhancements. The reason is that the context in which they are sought, the aims they are heading at, and the consequences going along with them differ considerably. Extremely simplified, mood enhancement aims at making people happier and moral enhancement aims at making people better from a moral point of view; whereas, cognitive enhancement aims at making people capable of higher mental performance.

The term cognitive enhancement serves to characterize strategies that are expected to improve cognitive performance and thereby to confer an advantage in certain situations. Notwithstanding the fact that an increase in cognitive functions may also be considered beneficial in order to enjoy music or to have fun, the social reality in which cognitive enhancement is most often sought is to have an advantage in competitive situations or to perform better in situations where there is pressure to perform.

When people talk about cognitive enhancement, the focus of interest is not so much on the question of which particular kinds of brain functions are being improved. Rather, the focus is more on the question of why enhancement is sought, whether it is profitable and what the implications are. For the debate on cognitive enhancement is not so much about an increase in cognitive functions *per se* but about an increase in cognitive functions that aims at an increase in mental performance in competitive situations. The term cognitive enhancement is used to emphasize this social context; whereas, the broader term neuroenhancement is much less specific in that it refers to all kinds of interventions involving improvements of brain functions.

1.2 An Empirically-Based Broad Societal Debate Is Needed

After having discussed some conceptual issues relating to cognitive enhancement, let me now say a few words on the current debate on cognitive enhancement. In spite of considerable enthusiasm with regard to cognitive enhancement and in spite of various reports suggesting that prescription drugs are currently being widely used in order to improve cognitive functioning in healthy individuals (Forlini and Racine 2009; Partridge et al. 2011), there is a remarkable lack of knowledge concerning safety and efficacy of the purported cognitive enhancers and concerning the distribution among society.

A central question is: To what extent do the biomedical approaches considered to provide cognitive enhancement actually improve cognitive functions in healthy individuals? With regard to psychoactive drugs, current evidence suggests that cognition-enhancing effects of the putative cognitive enhancers in healthy individuals are at best very modest (Franke and Lieb 2010; Repantis et al. 2010a, b; Husain and Mehta 2011). In addition, further consideration is required regarding the questions of negative side effects and long-term effects, in particular, whether there is a risk of addiction that is linked to the use of stimulants for cognitive enhancement in healthy individuals.

Furthermore, prevalence rates are far from clear at the moment. In the literature, prevalence rates concerning non-medical use of prescription stimulants – which includes all forms of purposes, among them cognitive enhancement, but also partying, recreation etc. – vary widely. For example, in students, past-year prevalence rates between 5 and 35 % were reported in a meta-analysis published in 2008 (Wilens et al. 2008). Up to now, there are only a few studies that selectively assess the use of stimulants (prescription stimulants and illicit drugs) for cognitive enhancement (Franke et al. 2011).

Besides, with regard to cognitive enhancement use, societal and cultural differences may play a role, so that there may be considerable differences between countries. Data stemming from the USA cannot be directly transferred to other countries with different cultural traditions and social contexts and with different regulations pertaining to psychoactive substances.

In a situation like this, it is important to avoid favoring a rather unfounded cognitive enhancement euphoria by carelessly reporting about putative high benefits

and putative high prevalence rates of cognitive enhancement. Researchers and journalists alike have to be very careful when they interpret and discuss study results in order to avoid an overoptimistic picture. Otherwise, people may be led to believe that part of the peer group might profit from cognitive enhancement – which may draw them towards using cognition-enhancing drugs.

However, as with assuming high putative benefits, it is equally problematic to understate the effects that may go along with putative cognitive enhancers. For even if the only desired effect of some drug were wake-promotion, this effect could lead to an increase in performance—an effect that could be considered beneficial in particular in situations dominated by time pressure or sleep deprivation. In addition, it might be expected that future substances might be more effective enhancers. So, to stress that current drugs do not seem to efficiently enhance cognition is important in that it shows that their usefulness for enhancement purposes is limited at the moment. In a substantial sense, however, it does not render reflections on cognitive enhancement obsolete.

In sum, more detailed empirical data is absolutely needed on the safety and efficacy of purported cognitive enhancers in healthy individuals, on the risk of addiction, on their distribution in society, on the life context in which the substances are used and on the social implications. All of this is necessary in order to enable a realistic, empirically-based discussion of the medical, social and ethical issues in cognitive enhancement, which, in turn, is an important precondition for any kind of attempt to regulate the use of cognition-enhancing technologies in society.

There is another aspect that is important for a fruitful societal debate on the medical, social and ethical issues in cognitive enhancement. According to an investigation by Cynthia Forlini and Eric Racine, in the discussion of the non-medical use of prescription stimulants, three different discourses can be distinguished, each of these discourses being dominated by a different paradigm (Forlini and Racine 2009; Racine and Forlini 2010): A bioethics discourse, a public health discourse, and a (print) media discourse. According to this analysis, the public health discourse is characterized by a “prescription drug abuse” framework which clearly distinguishes between the use of freely-available substances such as caffeine and the non-medical abuse of prescription stimulants, the latter being a practice that is highly criticized. In contrast, the (print) media discourse is dominated by a “lifestyle choice” framework. Here, the focus is on individual lifestyle and individual choice. Characteristic of the third discourse, the bioethics discourse, is a “cognitive enhancement” framework, which “focuses on the ethical issues arising from presumed benefits of non-medical use of neuropharmaceuticals by healthy individuals” (Forlini and Racine 2009).

This clearly is an interesting analysis which reflects the different perspectives in society with regard to the non-pharmacological use of prescription stimulants and its pros and cons. There is an important fourth point of view, however, which has not been taken adequately into account up to now: The perspective of those availing themselves of psychoactive substances for cognitive enhancement – a perspective that might be called “user discourse”: In a recent interview study 18 university students experienced with the use of prescription or illicit stimulants for

cognitive enhancement were asked about their views concerning the differences between using caffeine and illicit/prescription stimulants for cognitive enhancement (Franke et al. 2012). In short, their perspective can be characterized as dominated by a “function-oriented” framework. In this, the users stress the usefulness and the potential benefits and harms for themselves that result from substance use.

In my view, it is extremely important not to consider these various discourses within society to be separate discourses but to mix them up. For as long as they are separate discourses, they each mainly represent one particular perspective in the complex field of cognitive enhancement. Instead, an approach that integrates the various discourses would help to adequately consider various views held by society. A broad, empirically-based rational debate encompassing the various institutions, groups and opinions in society is a suitable basis for policy recommendations concerning cognitive enhancement technologies.

1.3 Individual Autonomy, Cognitive Liberty and Society

One of the central and most controversial issues in the debate on cognitive enhancement concerns the relationship between individuals and society. With regard to this question, the concept of cognitive liberty is crucial. Wrye Sentientia characterizes cognitive liberty to be “every person’s fundamental right to think independently, to use the full spectrum of his or her mind, and to have autonomy over his or her own brain chemistry” (Sentientia 2004, 223). She then goes on to describe two fundamental principles of cognitive liberty (Sentientia 2004, 227):

1. As long as their behavior doesn’t endanger others, individuals should not be compelled against their will to use technologies that directly interact with the brain or be forced to take certain psychoactive drugs.
2. As long as they do not subsequently engage in behavior that harms others, individuals should not be prohibited from, or criminalized for, using new mind-enhancing drugs and technologies.

The concept of cognitive liberty stresses individual decision-making and the individual’s right to decide for him- or herself, in particular to decide on whether or not to use technologies that modulate brain functions. This can be considered as analogous to the concept of informed consent, according to which, in medical contexts, it is up to the patient to decide on the medical treatment to be applied. A valid informed consent presupposes a competent person to decide voluntarily after having been supplied with the information necessary for autonomous decision-making. Central to the concept is the thorough understanding of the relevant circumstances and the absence of external or internal constraints limiting free decision-making (Faden and Beauchamp 1986).

Without any doubt, cognitive liberty is central to the use of any cognition-enhancing technology: It is up to the individual to decide whether or not to take substances that influence his or her brain. Nobody should be allowed to tamper with another person’s brain. With regard to pharmacological cognitive enhancement,

however, there are several aspects that may limit cognitive liberty – for it requires that a person have thorough information on the substances used and to freely decide, without any constraints. Both of these presuppositions can be questioned since currently there is not much knowledge available concerning the effects of so-called cognition-enhancing drugs, nor can it always be assumed that there are no constraints. Constraints may include subtle and indirect social pressure to perform, but also direct instructions at the workplace, for example in the armed forces. Particularly in minors, given the influence of third persons, the voluntariness of taking cognition-enhancing drugs is questionable.

Cognitive liberty does not imply that there is a societal obligation to provide technological options that allow individuals to modify their brain activity. In particular, it does not imply that society is bound to ensure free access to existing technologies since the general context in which technologies are used within a society has to be taken into consideration. It is not realistic, for example, to claim free access to certain psychoactive substances for cognitive enhancement when, in therapeutic contexts or with regard to drug consumption, access to these substances is strictly limited by formal regulations or medical law. In order to reflect on an adequate use of cognition-enhancing technologies within the existing societal framework, it will be important to characterize the relevant analogies and disanalogies with current existing practice. Concerning pharmacological cognitive enhancement, these are the analogies and disanalogies between drug use for enhancement purposes, for medical purposes and for illicit consumption.

In addition, when discussing cognitive liberty, the limits of cognitive liberty should be taken into consideration. In accordance with the Millian tradition (cf. Mill 1859/2006), Sententia writes that individuals should not be prohibited from using mind-enhancing drugs and technologies “as long as they do not subsequently engage in behavior that harms others” (Sententia 2004, 227). This is a crucial point for it can be expected that within society, when people use effective cognitive enhancers, there will almost certainly be direct or indirect effects on other individuals. Whether these will be positive or negative remains to be established in detail. The first presumption is that often the implications on other individuals will be negative because, in the majority of cases, people who avail themselves of cognitive enhancers aim at increasing performance in some competitive situation – which implies that others will be disadvantaged in some way or another. However, there may also be positive effects on others. For example, it has been argued that cognitive enhancement may increase a society’s overall productivity and achievements.

Possible harm to others, in particular negative implications concerning fairness and justice, may limit cognitive liberty and legitimize some sort of formal regulations or policymaking. In order to find a balance between the individual user’s point of view and broader implications for society, detailed reflection and research is needed that is not restricted to the individual but that considers the overall situation in society including: common practices in the health care system, analogies and disanalogies with other forms of technology uses, the existing legal framework, social conventions and general assumptions. Such reflections and research are required since the central issues in cognitive enhancement concern the individual’s room to maneuver in a modern society.

1.4 Book Outline

The following book is an interdisciplinary approach to cognitive enhancement. The intention of the book is to provide empirical information concerning the various fields of cognitive enhancement and to reflect on its individual, social, ethical and legal implications. The book is a collection of contributions by researchers stemming from different disciplines such as medicine, psychiatry, neuroscience, neurotechnology, philosophy, medical ethics, neuroethics, social sciences and law. The various researchers have very different perspectives with regard to cognitive enhancement, the various strategies, and its implications. What unites these contributions is the ambition to foster a rational and empirically-based debate on cognitive enhancement that serves further development.

The book is divided into three parts. The first part deals with medical and psychosocial aspects of cognitive enhancement. The first four contributions in this part deal with pharmacological strategies for enhancement. Andreas G. Franke and Klaus Lieb give an overview of the various substances for pharmacological neuroenhancement. They distinguish between over-the-counter substances, prescription drugs and illicit drugs. In their chapter, the focus is on “brain doping,” a term that refers to the illicit use of a subcategory of these prescription and illicit drugs for neuroenhancement. They draw a very critical picture of the use of these substances for enhancement purposes in that they stress their very limited positive effects, the safety risks and possible side effects. Dimitris Repantis then presents the results of a systematic review of the literature on the available evidence of the risks and benefits of antidepressants, anti-dementia drugs and psychostimulants currently used for pharmacological cognitive enhancement. He concludes that with regard to the use of prescription drugs for enhancement purposes in healthy individuals, there is a considerable lack of evidence both for the effectiveness and for the long-term safety. In the subsequent chapter Brad Partridge critically analyzes currently available data on prevalence rates of non-medical stimulant use by students for cognitive enhancement. In particular, he identifies several examples in the literature in which the prevalence of cognitive enhancement has been uncritically presented and discusses possible implications that may result from such presentation. In order to contribute to a better understanding of the underlying mechanisms by which cognitive neuroenhancers such as modafinil modulate brain functioning, Carlos Trenado and Daniel J. Strauss developed a neural computational model. In their chapter, they present a biologically-inspired, large-scale computational model for studying modafinil effects on electroencephalographic neural correlates of attention.

In the next three chapters, various non-pharmacological strategies for neuroenhancement are presented. Martin Dresler first gives a review of recent research on the various behavioral techniques for the enhancement of cognition in the domains of attention, intelligence, creativity, and memory. His chapter underlines the potential and relevance of these non-technological approaches. Following this, Pavel Dietz summarizes recent research on different kinds of sports and exercise and their potential to enhance cognitive task performance. He then discusses some

of the limitations of these studies, particularly focusing on their heterogeneous study design. Subsequently, Colleen Dockery gives an overview of the state of the art of transcranial direct current brain stimulation for neuroenhancement purposes. Her summary of brain stimulation experiments is imbedded in a critical perspective towards neuroenhancement and the current societal context of a growing reliance on high-level cognitive functions for economic competition.

In the second part of this book, philosophical and ethical aspects of cognitive enhancement are discussed. From the point of view of medical ethics, Kirsten Brukamp gives an overview of the ethical issues involved in neuroenhancement. Her focus is on medical risks, the lack of evidence-based medicine, and financial challenges to health care systems, human nature, virtue ethics, liberty, justice and the social value of the purposes behind neuroenhancement. Then, Michael Hauskeller calls into question the purported aim of human enhancement, the making of better human beings. He stresses that what is considered to be a betterment is highly context-dependent for whether some neuroenhancement is desirable for people depends on what they are getting better at, what end the improvement serves, and who benefits from it. In the following contribution, Frederic Gilbert examines the emerging ethical challenges raised by implementation of nanotechnology in brain devices for enhancement purposes in healthy subjects. His particular focus is on the ethics of an adequate informed-consent procedure for invasive nano-bionic brain interventions for neuroenhancement. In the chapter that follows, Emma Peng Chien discusses the mechanism of cognitive enhancement from a philosophical point of view. She argues in favor of mechanistic differences between cognitive-enhancing drugs and behavioral training. In addition, she suggests possible mechanisms for cognitive-enhancing drugs and behavior training and accounts for the characteristic differences of these two strategies. Roland Kipke then examines the question as to whether the ethical problems of cognitive and non-cognitive enhancement are significantly different and, therefore, whether the concentration on cognitive enhancement within the bioethical debate is justified. He concludes that the ethical questions raised by the different forms of pharmacological cognitive and non-cognitive enhancement are in most respects equal or similar, and that the concentration on cognitive enhancement is largely not justified. Following this, Lisa Forsberg discusses three objections to the use of cognitive enhancement based on potential effects that the use of cognitive enhancement is thought to have for the value of achievement. After a detailed examination of a number of counter-arguments against each of these three objections, she concludes that none of the three objections succeeds as an *in principle* objection to the use of cognitive enhancement. Based on an examination of published literature of the perspectives of stakeholders towards cognitive enhancement, Cynthia Forlini and Eric Racine identify three points of contention between the stakeholder perspectives and the ethics debate on cognitive enhancement in academia, which suggest that two separate debates are taking place on parallel tracks. In view of this, they propose that the discipline of bioethics needs to reaffirm its role as a meeting place for the traditional academic ethics debate on cognitive enhancement and the more experientially-based approach of stakeholders to enrich future deliberation.

The third part of the book reflects on social, political and legal aspects of cognition-enhancement. First, Peter Reiner analyzes the current debate on cognitive enhancement and argues that the normative claims at the extremes – by the Transhumanists on the one side and the Bioconservatives on the other side – are driven to a considerable extent by biopolitical intuitions. In order to overcome polemics and to move forward in the discussion on cognitive enhancement, he suggests the adoption of a middle ground position he calls “The view from reasonableness.” He also advocates taking empirical data on public attitudes towards cognitive enhancement into consideration. Then, Armin Grunwald’s chapter focuses on the question: Are we witnessing a historical change from a performance society to an enhancement society with an inherent and infinite spiral of enhancement including increased self-exploitation and self-instrumentalization? Armin Grunwald’s hypothesis is that we can learn from the ongoing debate on human enhancement about our society and contemporary perceptions of ourselves. In the proceeding chapter, Greta Wagner discusses fairness arguments in the cognitive enhancement debate, which focus on the question of whether potential cognitive enhancements would decrease or increase fairness in society. She characterizes both positions as being based on a notion of society as competitive, in which fairness is the purpose of a certain degree of institutional intervention. Within the framework of Michel Foucault’s terminology, she argues that the bioethical debate on fairness forms part of a neoliberal governmentality. Jan-Christoph Bublitz then explores some of the legal issues raised by neuroenhancement interventions. He argues that the law will have to recognize a basic human right, namely, cognitive liberty or mental self-determination, which guarantees an individual’s sovereignty over her mind and entails the permission to both use and refuse neuroenhancements. The focus of the chapter by Elizabeth Shaw is on a particular group of offenders who appear to have an impaired capacity to appreciate the moral significance of their acts and a limited ability to engage in effective practical reasoning. She discusses whether it could ever be morally permissible to employ certain types of cognitive enhancements to enhance offenders’ capacities for practical reasoning and moral communication as part of their rehabilitation. John Danaher then discusses legal issues from a totally different perspective in that he asks whether agents should be held criminally responsible for the consequences of failing to make use of enhancement technologies. He argues that they should, provided such technologies would have allowed them to avoid the risks associated with the state of abnormal agency.

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Part I
Medical and Psychosocial Aspects
of Cognitive Enhancement

Chapter 2

Pharmacological Neuroenhancement: Substances and Epidemiology

Andreas G. Franke and Klaus Lieb

Abstract Pharmacological neuroenhancement (PN) refers to the general use of psychoactive substances with the purpose of cognitive enhancement (e.g. enhancement of vigilance, concentration, memory or mood) by healthy subjects. Substances for PN include Over-the-Counter- (OTC-) substances such as coffee, caffeinated drinks/energy drinks, caffeine tablets and Ginkgo biloba as well as prescription drugs and illicit drugs (e.g. (psycho-) stimulants). “Brain doping” refers to the illicit use of a subcategory of these substances. On the one hand, this subcategory includes prescription drugs for the treatment of attention deficit/hyperactivity disorder (ADHD), sleep disorders, Alzheimer’s disease and depression. This group consists of (psycho-) stimulants (e.g. amphetamines, methylphenidate), modafinil, antidementives (acetylcholinesterase inhibitors, memantine) and antidepressants (e.g. selective serotonin reuptake inhibitors). On the other hand, this subcategory includes stimulating illicit drugs (e.g. illicit amphetamines, cocaine, ecstasy).

OTC-drugs as well as prescription and illicit drugs have very limited positive effects on cognition and mood. Furthermore, their use leads to safety risks and can cause severe side effects. Therefore, a general use by healthy persons cannot be justified. Claims for liberalization should be critically questioned.

Keywords Brain doping • Cognition • Neuroenhancement • Enhancement • Psychostimulants

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2.1 Introduction

Enhancement has been an eternal pursuit of humankind. For millennia, humankind tried to improve performance with regard to physical skills by the use of divergent training methods and substances (Baron et al. 2007; Lieb 2010). In the past, physical skills were more important than mental skills. Later, mental skills became increasingly important. For example, famous writers and philosophers (e.g. Balzac, Voltaire) wrote their manuscripts using potential mental performance enhancing substances. For centuries, caffeine was the most important substance for enhancing one's own cognitive abilities. Later, the development of stimulants seemed to be an important step towards academic performance enhancement for wake promoting effects, enhancement of attentiveness, concentration, memory and mood.

Pharmacological neuroenhancement (PN) refers to the use of various substances with the aim of cognitive enhancement via enhancing effects on sub-domains of cognition (e.g. attentiveness, concentration, endurance, memory, mood). Divergent substances belong to the group of pharmacological neuroenhancers. The most famous and widely spread substances are over-the-counter- (OTC-) drugs, which can be bought in supermarkets. Caffeinated beverages (coffee, caffeinated drinks/energy drinks) and caffeine tablets as well as phytopharmaceuticals are pharmacological neuroenhancers. The term "Brain doping" is used infrequently and means the misuse of a subcategory of substances for PN. It refers to the use of prescription and illicit substances by healthy people aiming at academic performance enhancement, mood enhancement and enhancement of pro-social behavior (de Jongh et al. 2008; Franke and Lieb 2010; Lieb 2010). Brain doping is used much like the term of "doping" in sports, which refers to an illicit use of "prohibited substances" for physical performance enhancement. This subcategory of substances consists of prescription substances used without medical indication and illicit drugs. Methylphenidate (MPH), amphetamines (AMPH) and modified amphetamine substances (e.g. amphetamine salts), modafinil, antidementives (acetylcholinesterase inhibitors, memantine) and antidepressants (selective serotonin reuptake inhibitors, SSRIs) for the treatment of attention deficit/hyperactivity disorder (ADHD), sleep disorders, Alzheimer's disease (AD) and depression as well as illicit amphetamines and derivatives (3,4-Methylenedioxy-N-methylamphetamin, MDMA, ecstasy) and cocaine belong to this subcategory. The use of prescription drugs without medical indication as well as the use of illicit drugs for cognitive enhancing purposes is prohibited and can have serious legal consequences, depending on users' sociocultural background.

Nevertheless, there seems to be a high demand in Western societies for the illicit misuse of brain doping substances. In a non-representative online poll of the journal *Nature*, 80 % of participating graduates who were familiar with *Nature* and read the journal's announcement of the online-poll answered that adults should be allowed to use such substances. Out of these subjects another 20 % answered that they have already used stimulants, modafinil or beta blockers at least once (Maher 2008).