CHAPTER 3

Mental Enhancement

Countries must learn how to capitalize on their citizens' cognitive resources if they are to prosper, both economically and socially. Early interventions will be key. To prosper and flourish in a rapidly changing world, we must make the most of all our resources—both mental and material. Globalization and its associated demands for competitiveness are increasing the pressures in our working lives.
—John R. Beddington, *then chief scientific adviser of the UK government, and colleagues (Beddington et al., 2008, p. 1057)*

Abstract This chapter explains how people's nonmedical substance use, particularly that of prescription stimulants, was understood as "enhancement" or "brain doping" since the early 2000s. In both the academic debate and popular media, it was frequently claimed that ever more people, in particular students, were using such drugs to increase their cognitive performance. This chapter illustrates that this was not a new phenomenon and that even "moral enhancement", the idea to use substances, and neuroscientific technology to improve people's moral behavior already existed in the 1960s and 1970s. The actual present prevalence of brain doping is then discussed in detail, with an emphasis on other motives to use drugs besides cognitive enhancement. Indeed, much of the use turns out to be rather emotionally motivated and to cope with stress, particularly in competitive environments, or to be even self-medication of psychological problems. This shows how difficultly the distinction between

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medical and nonmedical use can be drawn. Finally, nonpharmacological alternatives to improve one's mental health are presented. The chapter concludes that the academic debate on cognitive enhancement was not very informative and that a general theoretical framework for people's instrumental substance use should be preferred, which is introduced in Chap. 4.

Keywords Cognitive enhancement • Neuroenhancement • Moral enhancement • Coping • Stress • Science communication • Mental health

This quote is from the introduction to the article "The mental wealth of nations", which summarized the "Mental Capital and Wellbeing: Making the most of ourselves in the 21st century" research project, funded by the Government Office for Science of the UK and using a huge image of a brain on the cover of its report. The title obviously alludes to Adam Smith's (1723–1790) famous work, *The Wealth of Nations*, in which the Scottish economist and philosopher wrote about the generation of wealth through industrialization and free markets. The article's first author, John R. Beddington, is emeritus professor of biology and was the UK government's chief scientific adviser from 2008 until 2013. This emphasizes the significance of a project on "mental capital", which should also be seen in the context of deindustrialization in many developed countries, often poor in raw materials and thus reliant on intellectual work and property.

The quote is also a lesson in framing: Processes such as competition and globalization are described as inevitable facts, almost like a natural law, and the only way to "prosper and flourish" seems to be adaptation by maximizing performance. While it is difficult to measure psychological stress and whether it is increasing because we must essentially rely on subjective evaluations, we have here a group of leading experts testifying to "increasing pressures" in our lives. And, as we will see below, this report was carried out and completed during a time in which the enhancement debate gathered momentum in academia as well as in the media. The cultural background to the discussion that follows in this chapter is thus that of a competitive performance society. Although it is difficult to prove such complex interactions, we will actually find many links between

performance pressure on the one hand and enhancement on the other. This is important insofar as it provides an alternative narrative: One of adapting to external pressure and coping with stress, compared to an intrinsic wish to improve oneself in a certain domain.

Here, we will not discuss in detail whether the situation is really as inevitable as the report stated. However, it is interesting to note that two years after the coronavirus pandemic, processes of deglobalization are also increasing in speed, as COVID-19 and the measures to prevent it exposed the dependence and vulnerability of a globalized economy in an unprecedented way. Related questions about the values underlying adaptive behavior will be addressed thoroughly at the end of Chap. 4 and in the final conclusion (Chap. 5). But in the context of the plea to improve people by the scientists and officials behind "Making the most of ourselves in the 21st century", one critical remark is helpful here: Imagine that you agreed with their conclusion that performance enhancement should be mandatory and there were relatively safe means—more on that later—to raise your IQ from 100 to 110. After "improving" yourself accordingly, the question whether this higher level of intelligence was sufficient or whether performance should be increased further would arise again. Also imagine the competitive pressure due to others, nationally as well as globally, making use of similar means.

So, once we take that road, it quickly becomes a slippery slope. Whether we aim for an IQ of 120, 130, 140, or even higher, the demand for further improvement would always arise again. (We acknowledge here that "higher IQ" does not always translate into better functioning. It is just meant as a simple illustration.) Also imagine that making use of these means comes at a cost, financially as well as the time and effort spent, and with the risk of side effects. It is thus very likely that performance enhancement in an already-competitive and stressful environment will, at least in the long run, only lead to reiterations of these aspects at continuously higher levels, both of benefits and of costs.

A visual illustration of this critical conclusion is presented in the report's own summary, although this was probably unintended by the authors. "The mental wealth of nations" includes a figure showing positive and negative influences on people's "mental capital". Enhancement already begins before birth ("fetal programming") and then continues throughout life. The notion that people get older and retire from work is literally called a "waste of mental capital" (Beddington et al., 2008, p. 1059).

Drugs and alcohol, relevant to our topic, are mentioned as a negative influence, alongside childhood trauma and social isolation. The most prominent negative factor is stress. While this may already sound complex, it is actually only the simple picture as published in *Nature*. To see the scientists' original figure, one has to download a more complicated version.[1] This combines so many factors that parents, as well as people of all ages, must consider that the endeavor to "boost brain power in young and old" and prevent negative influences could be quite exhausting. In fact, such intensive efforts to increase a nation's "mental capital" might themselves stress people out—which would have negative effects according to the proposal itself and thus run counter to the whole project.

The above should suffice to exemplify the complexity of mental or cognitive enhancement, both on the individual and on the global level, at the outset of this chapter. In what follows, we will summarize the scholarly debate and its representation in the media, answer the question about prevalence, and discuss nonpharmacological forms of enhancement. As mentioned, the substances used will be addressed in more detail in Chap. 4.

3.1 The Debate

As the "Decade of the Brain" approached its end in 2000, scholars from different disciplines, such as neuroscience, law, and philosophy, increasingly identified ethical issues related to brain research. Some found it necessary to address them in new disciplines such as "neuroethics" or "neurolaw" (Schleim, 2020a). How meaningful this nomenclature is will not concern us here any further, but the proliferation of ever more "neuro" terms has provoked critique by some (De Vries, 2007; Vidal & Piperberg, 2017; Wilfond & Ravitsky, 2005). As a matter of fact, ethical issues about the brain, neurology, and psychiatry were being discussed long before some researchers coined the new terminology. Examples in medical ethics or bioethics are legion and can already be found in the context of brain stimulation and psychosurgery in the 1950s through to the 1970s (Schleim, 2021; Valenstein, 1974).

In particular, one of the topics that has received increasing attention since the early 2000s is cognitive or neuroenhancement (Fig. 3.1). The

[1] "The mental wealth of nations", online at: https://www.nature.com/articles/4551057a

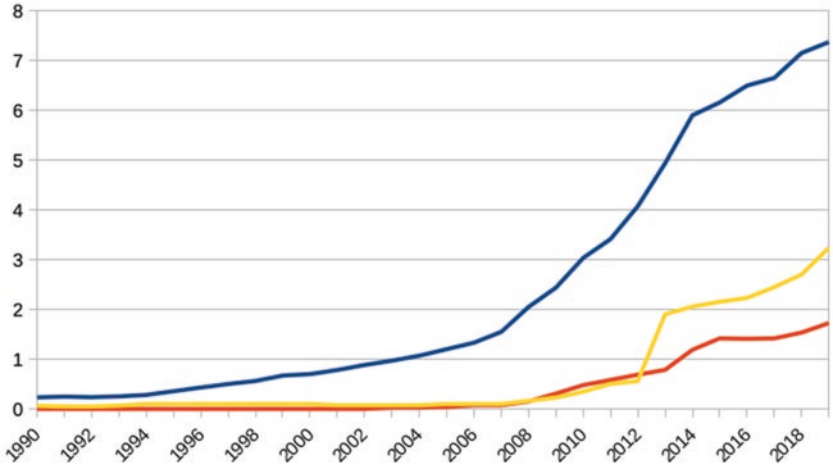

Fig. 3.1 Increasing Attention to Cognitive Enhancement. Cognitive enhancement is increasingly addressed in English-language books from the 1990s (blue line). Neuroenhancement is a less common term, although its use has also been increasing in recent years (red line). Moral enhancement (yellow line) has gained increasing attention since a seminal publication in 2008. (Source: Google Ngram (lines smoothed; ×10^8))

same pattern can also be found in academic journals (Schleim & Quednow, 2017). Furthermore, O'Connor and colleagues have shown that the topic of enhancing and optimizing the brain even dominated media coverage of neuroscience, with 43.4% of the articles addressing the subject (O'Connor et al., 2012). There is thus ample evidence from different sources that the topic of this chapter played and still plays a major role in discourses about the brain and applications of neuroscience.

We have already discussed the common definition of "enhancement" in the introduction, even reflected in the title *Beyond Therapy* chosen by the US President's Council on Bioethics (President's Council on Bioethics, 2003). In spite of the definition's tentative and pragmatic character already being acknowledged 20 years ago, it is still guiding research on the topic. For example, in a recent review of open questions in the debate, Racine and colleagues characterized cognitive enhancement as "the use of medications or other brain treatments for improving normal healthy cognition" (Racine et al., 2021, p. 2, quoting Farah, 2015). In the introduction

to a new special issue on the topic, Hope and colleagues similarly referred to the understanding of enhancement common among ethicists, as "interventions that are used to improve human form or functioning beyond what is necessary to restore or sustain health" (Hope et al., 2021, p.1, quoting Juengst & Moseley, 2019). Racine and colleagues' definition is more narrow in that it only refers to "cognition" and limits the means to "medications or brain treatments", while Juengst and Mosley's broadly speaks of "interventions"—and actually also includes body image. However, both definitions share the "beyond therapy" idea: Enhancement means *improvement beyond healthy or normal functioning*. Cognitive or moral neuroenhancement—what does that precisely mean? We have not yet addressed these concepts in detail. Let us begin with a brief reflection on the latter.

Moral Enhancement

After what has now become a seminal and highly cited paper by moral philosopher Thomas Douglas from the University of Oxford, who argued that this kind of improvement is ethically permissible, ever more neuroscientists, psychologists, and philosophers have taken up the idea. Douglas presented a rather pessimistic view of people when he wrote:

> There is clearly scope for most people to morally enhance themselves. According to every plausible moral theory, people often have bad or suboptimally good motives. And according to many plausible theories, some of the world's most important problems—such as developing world poverty, climate change and war—can be attributed to these moral deficits. (Douglas, 2008, p. 230)

The philosopher presupposed that "biomedical moral enhancement technologies will become technically feasible in the medium term future" (ibid., p. 242). According to his view, people's moral behavior could be improved by changing their emotions in such a way that they give rise to better motives, which then lead to better actions. In the subsequent debate, this was often understood as pharmacologically instigating prosocial or altruistic emotions (see also Langlitz et al., 2021; Schleim, 2011; 2022a). Note how weak Douglas's original point actually was, arguing only for the permissibility of moral enhancement if people choose this for themselves. However, if people, in general, really have such bad motives,

as he assumed, why should they themselves make the choice in the first place? And would not other means be available to improve their actions, such as moral education? Changing their emotion, by contrast, without their informed consent, would be a serious violation of their autonomy and resemble a totalitarian doctrine.

In addition to this ethical problem, moral enhancement obviously raises questions about the feasibility of such a project. While the debate has not only been ongoing but actually growing for many years (Fig. 3.1), there is still no clarity about how moral enhancement should be applied in practice. Douglas's hope for a solution to be available "in the medium term future" is relativized when one realizes what has been overlooked in neuroethics thus far—that moral enhancement was already proposed in the 1960s and 1970s. For example, brain researcher José M. R. Delgado (1915–2011) wanted to "psychocivilize" the entire population by implanting remote-controlled brain reading and stimulating devices, which he called "stimoceivers" (Delgado, 1971; Schleim, 2021). The device was developed in animals and later tested in some humans as well, particularly psychiatric patients.

For Delgado, its application would be mandatory to prevent humankind from destroying itself, which can be understood better in the context of the Cold War (1945–1990). As the brain researcher was convinced that his method would first be developed and applied to treat patients with mental disorders, thus having the opportunity to refine it and improve its safety, he perceived the realization of his vision merely as a question of time and found the ethical issues manageable. However, several years later, he relativized his views on the potential of neurotechnology and promoted its use in combination with the improvement of social structures and education to help people better control themselves (Delgado, 1983; Fins & Vernaglia, 2022). This change of mind occurred after he lost funding for his neuroscientific vision, as he failed to convince other scientists and important decision-makers that his brain stimulation devices could indeed be used to control animals' or people's emotions (see Snyder, 2009).

The idea of improving people scientifically was widespread during this period, even if scholars were not yet calling it "moral enhancement" (see also Somit, 1976). Behaviorist Burrhus F. Skinner (1904–1990), for example, wanted to change the reward structure of the environment such that people would behave better (Skinner, 1971). He called his method "cultural design" and was widely criticized for promoting a totalitarian idea. In the same year, *TIME Magazine* published a report entitled "A Pill

for Peace?" and quoted from a speech of Kenneth Clark (1914–2005), then president of the American Psychological Association (APA), at an APA meeting in Washington, DC. According to the report, the psychologist stated that "[t]he world's leaders […] should be required to take 'psychotechnological medication'—pills or other treatments to curb their aggressive behavior and induce them to govern more humanely."[2] The journalist writing about Clark's speech found this "an extraordinarily dramatic extension" of Skinner's approach and view "that man must be controlled to survive." The report also addressed the dilemma, mentioned above, concerning informed consent, which has thus not been resolved more than 50 years later:

> How possibly could the drug dispensers differentiate between the power drive that constitutes leadership and that which leads to aggressive violence? And who would dispense the drugs? If they were voluntary, those most in need of them would be precisely those who would not take them. If they could somehow be made obligatory, then the dispensers would become the dominators. Who polices the police?[3]

So much for moral enhancement, which was already promoted by scientists decades before the "Decade of the Brain" and the advent of neuroethics. This example vividly illustrates not only the complexity of tinkering with the brain, but also the obliviousness of present ethical debates to the historical dimension. As we will see shortly, this is unfortunately not the only example in this respect. Let us now have a closer look at cognitive or neuroenhancement, which has received the most attention in science and the media to date.

Cognitive or Neuroenhancement

"Cognition" is in itself a broad term, encompassing perception, thought processes, and decision-making. It is often used as the counterpart to "emotion", but sometimes also in a broader sense to denote psychological processes as a whole, as in "cognitive science" (Greene et al., 2004). We will use it here in the former, more narrow, sense. To understand a little

[2] "A Pill for Peace?", *TIME Magazine* of September 20, 1971, Vol. 98, Issue 12, p.10.
[3] Ibid.

better what cognitive enhancement is about, we will look at a few experimental studies investigating the effects of certain drugs on healthy people.

One particularly illustrative example is an investigation of the effects of methylphenidate—better known under the brand name Ritalin—on cognitive ability and decision-making by Agay et al. (2010). Although their primary interest was the drug's effect on subjects with an ADHD diagnosis, they also had a healthy control group, as well as a placebo condition for both groups. Interestingly enough, the three different psychological tasks they used yielded three different outcomes: For the first test, the "digit-span task", participants were shown increasingly longer sequences of digits for a short period of time, which they then had to reproduce either forwards or backwards. The healthy subjects receiving methylphenidate correctly remembered about 65% of the digits, compared to roughly 60% in the placebo group (Agay et al., 2010).[4]

The second task was about decision-making to maximize financial rewards and minimize losses. In the "Iowa Gambling Task", subjects draw cards from four decks with different reward/loss structures. The challenge is to find out which of them, in the long run, yield the highest benefits. This was originally developed by neurologists in Iowa to investigate functional deficits in patients with a particular kind of frontal lobe brain damage. However, methylphenidate did not affect the outcomes between the groups for this part of the experiment (nor for the subjects with an ADHD diagnosis).

For the third condition, the researchers developed an alternative version of the previous task which they called "Foregone Payoff Gambling Task". In addition to the card decks having a different reward/loss structure, for each card chosen the participants also saw what the results would have been for the other decks, thus what their "foregone payoffs" were. This made the task cognitively more demanding. Surprisingly, the subjects without an ADHD diagnosis who were given the drug made more disadvantageous choices than those in the placebo group—slightly above 30% compared to slightly below 25%—and thus had a worse outcome (Agay et al., 2010).

[4] This study is discussed here to illustrate the complexity of investigating cognitive enhancement. To avoid making the description overly complex, I only refer here to descriptive statistics and omit the discussion of statistical significance. As is common in this kind of research, the sample size—16 per condition in the non-ADHD group and 13 per condition in the ADHD group—is too small to allow conclusions about the general population.

We can draw three important conclusions from this brief summary of the study. Firstly, researchers often use laboratory tests designed to measure performance differences in clinical populations. It is unclear what the results from such tasks—remembering digits or drawing cards—mean for people's everyday lives. We must thus be aware of what I have previously called a "translational fallacy" (Schleim, 2014a), consisting in the premature translation of clinical tests into real life. Secondly, we should not expect too much of the substances used. This single study is obviously too limited to draw general conclusions, but the effects of substance use that we have seen here are rather modest and probably practically irrelevant, even *if* the tasks could easily be translated into people's everyday lives. Thirdly, the results are also inconsistent, because they suggest an improvement in some domains, no performance difference in others, and even an impairment in yet other conditions. Pharmacologists have previously emphasized that the cognitive effects of drugs can be quite complex, with a gain in one domain potentially accompanied by an impairment in another. There is, in particular, no "more is better" guarantee, but rather an optimal level of functioning, above which an improvement can become an impairment (see Quednow, 2010).

Is there, then, no more conclusive evidence? Considering the caveats discussed above, one exceptional study examined 39 healthy male chess players with an average age of 37.3 years (Franke et al., 2017). They were asked to play several games against a chess computer adapted to their level of performance to keep the difficulty similar for all participants. The substances administered were, again, methylphenidate, or modafinil (Provigil), a drug primarily prescribed for particular sleeping disorders, as well as caffeine, or a placebo. To obtain as much meaningful data as possible from a still relatively small group of subjects, all players participated over four days. At each visit, they received a different substance, without of course knowing which. The playing time per game was limited to 15 minutes.

On average, the chess players scored 6.3% (methylphenidate) to 8.2% (modafinil) more points per game compared to the placebo. However, these increases were too small to reach the statistical significance threshold. The performance differences between the caffeine and methylphenidate consumption groups were negligible. Compared to the freely available caffeine, the chess players scored an average of 1.7% more points under the influence of the prescription drug modafinil, but this difference was also not statistically significant. Surprisingly, chess players took more time per game after administration of any of the two medical drugs and therefore

lost more often because they ran out of time. The researchers speculated that the participants would have performed better under the influence of the active substances if there had been no time limit (Franke et al., 2017).

This study is remarkable in that it was carried out under relatively realistic conditions—at least for chess players. In this sense, the first of the three caveats—addressing the "translational fallacy"—is met. It would still require further research, though, to generalize this to other applied contexts. The second caveat, that the effects in such studies are usually small, was confirmed by the chess players' data. Without going into the details of the meaning of "statistical significance" and its relation to practical relevance, it should be obvious that such substances will not make a chess master out of a beginner. However, they could still be useful: In very competitive situations, such as professional sports, where the performance of all participants is similar due to preselection, even a small difference of 1.7% *can* mean a lot. Modafinil is actually considered a doping substance in sports and its use in combination with medical problems has repeatedly sparked debate (see Kaufman, 2005). The substance is thus also banned from certain chess tournaments, unless a participant has a valid exemption. However, the third caveat, emphasizing possible trade-offs of substance use, was also reaffirmed by the chess study, with the players, on average, making better decisions, but at the cost of time.

In contrast to the popular but also vague notion of "smart drugs", we have now gained a preliminary understanding of what cognitive enhancement means in research and how it is investigated. In more psychological terms, we might keep in mind that such experimental tasks investigate processes such as attention, working memory, planning, and decision-making. We will draw a firmer conclusion on the effects of these substances in healthy people in the chapter on substances. Also note that the focus of that chapter will be on stimulant drugs, as they are the most frequently used substances in the context of neuroenhancement. For the aims of this section, we will now summarize the central arguments in the debate before discussing the prevalence question in the subsequent section.

Central Arguments

The annual number of papers on cognitive or neuroenhancement on the *Web of Science*, a common database for scientific publications, already exceeded 100 in 2013 (Schleim & Quednow, 2017). It is now approaching

200 and that database alone presently lists 2086 entries on the topic. However, the *Web of Science* does not cover all scientific journals, and, in particular, it does not list books or book chapters, in which academics also disseminate and discuss their research. These figures should make it clear that we cannot summarize the whole debate here, but we also need not do so. In the following paragraphs, we will address a couple of very influential or very recent publications.

A highly cited and influential review coauthored by, among others, Nobel laureate and neurologist Eric Kandel, as well as the influential British neuropsychologist Barbara Sahakian, professor at the University of Cambridge and one of the authors of "The mental wealth of nations" (Beddington et al., 2008), was published in 2004 in *Nature Reviews Neuroscience* (Farah et al., 2004). These authors claimed that "[o]ur growing ability to alter brain function can be used to enhance the mental processes of normal individuals" (ibid., p. 421). They pointed out that in some school districts in the US prescription stimulants (such as methylphenidate or amphetamine) were consumed at a rate that could not solely be understood on the basis of ADHD diagnoses, for which these drugs are commonly prescribed. There was, furthermore, evidence that on some campuses as many as 16% of students might take these substances. Nutritional supplements promising improved memory were also gaining in popularity. The authors concluded from this that "pharmacological enhancement has already begun" (ibid., p. 421). They later wrote about "the advent of widespread neurocognitive enhancement" (ibid., p. 422) and then briefly addressed the ethical issues of safety, coercion, distributive justice, and personhood, before stating that "[n]eurocognitive enhancement is already a fact of life for many people" (ibid., p. 424). They also called for an interdisciplinary discussion involving neuroscientists as well as ethicists, and then concluded:

> With many of our college students already using stimulants to enhance executive function and the pharmaceutical industry soon to be offering an array of new memory-enhancing drugs, the time to begin this discussion is now. (ibid., p. 424)

A few years later, some of the coauthors of that article published another highly cited article, this time in *Nature*, with Henry Greely, professor of law at Stanford University, as first author (Greely et al., 2008). "Towards responsible use of cognitive-enhancing drugs by the healthy", the title of that article, can be understood as an academic manifesto in favor of the

practice. It started out with the claim that "[s]ociety must respond to the growing demand for cognitive enhancement" (ibid., p. 702), followed by the statement that students are using substances such as amphetamine or methylphenidate "not to get high, but to get higher grades, to provide an edge over their fellow students" (ibid.). The authors then referred to research suggesting that "almost 7% of students in US universities have used prescription stimulants in this way, and that on some campuses, up to 25% of students had used them in the past year" (ibid.). They also addressed issues of safety, coercion, and fairness. Responsible use of the drugs for them consisted in maximizing benefits while minimizing harm, expressed in seven demands (Box 3.1). Greely and colleagues eventually concluded:

> We should welcome new methods of improving our brain function. In a world in which human work-spans and lifespans are increasing, cognitive enhancement tools—including the pharmacological—will be increasingly useful for improved quality of life and extended work productivity […]. (Greely et al., 2008, p. 705)

Box 3.1 Seven Demands for Cognitive Enhancement

In the manifesto, "Towards responsible use", Greely and colleagues called for

- a presumption that mentally competent adults should be able to engage in cognitive enhancement by using drugs;
- an evidence-based approach to the evaluation of the risks and benefits of cognitive enhancement;
- enforceable policies concerning the use of cognitive-enhancing drugs to support fairness, protect individuals from coercion, and minimize enhancement-related socioeconomic disparities;
- a program of research into the use and impacts of cognitive-enhancing drugs by healthy individuals;
- physicians, educators, regulators, and others to collaborate in developing policies that address the use of cognitive-enhancing drugs by healthy individuals;
- information to be broadly disseminated concerning the risks, benefits, and alternatives to pharmaceutical enhancement; and
- careful and limited legislative action to channel cognitive enhancement technologies into useful paths.

The next two sources were published between what I called the "manifesto" and the present. In 2013, the specialized journal, *Neuropharmacology*, hosted a debate on cognitive enhancement between three renowned scientists. This journal primarily addresses a certain branch of science, unlike the much broader *Nature* journals mentioned above. The three participants were Steve E. Hyman, who at that time held a professorship at Harvard University and had previously been Thomas Insel's predecessor at the US National Institute of Mental Health; Nora D. Volkow, director of the US National Institute on Drug Abuse; and David Nutt, professor of neuropsychopharmacology at Imperial College London (Hyman et al., 2013).

Nutt took a very positive stance on enhancement, referring to stimulant use in the military and describing it as a logical follow-up to biological evolution. Hyman took a moderately positive position, but also highlighted the problems of fairness and coercion, particularly in competitive settings. Volkow pointed out that, in the US, 8% of 12th graders had used amphetamine nonmedically in the previous year and that the stimulant is known for its addictive potential. She also called it a "fairy tale" that there will be a "magic bullet" or "a medication that will improve all of a sudden our cognitive abilities" (ibid., p. 10). Volkow, furthermore, voiced doubts that unless healthy people are sleep deprived, stimulant drugs actually improve their cognition.

With similar critical thoughts, Martha Farah, a cognitive neuroscientist, professor at the University of Pennsylvania, and active in neuroethics since its very inception, published the essay "The unknowns of cognitive enhancement" in *Science* (Farah, 2015). This is particularly remarkable, as she also coauthored the two enthusiastic articles in the *Nature* journals mentioned above. In comparison to the "manifesto", her thoughtful piece received much less attention—not even 8% of the citations on *Google Scholar*, for example. This may be only circumstantial evidence that the present communication culture pays much more attention to optimistic rather than neutral or even critical content, but is corroborated by more systematic analyses (see Partridge et al., 2011; Racine et al., 2010).

Farah referred to new research questioning the enhancing effects of stimulant drugs in healthy subjects, raised the problem of dependence, and then illustrated an aspect of the experiments already familiar to us: "As with amphetamine, studies have produced conflicting results. A recent literature review of the cognitive effects of modafinil found a range of outcomes: enhancement, null effects, and occasionally impairment" (Farah,

2015, p. 380, referring to Battleday & Brem, 2015). To be fair to the evidence, most studies reported positive (i.e., enhancing) results—but this must be seen in the context of the now widely known publication bias, that is, the fact that most scientific journals reject null findings. Farah concludes: "Given that enhancements would likely be used for years, long-term effectiveness and safety are essential concerns but are particularly difficult and costly to determine" (ibid., p. 380). Barbara Sahakian and a collaborator had pointed out the importance of understanding long-term effects in a similar fashion almost ten years earlier:

> Despite the difficulties inherent in monitoring the effects of drug usage over several years, a full exploration of the long-term implications of new treatments is vital, especially those that might routinely be used by the healthy population. (Turner & Sahakian, 2006, p. 82)

The final two reviews I want to address here have in common that they try to summarize and systematize almost 20 years of the neuroenhancement debate. They were both published in specialized journals and by authors from a younger generation of researchers. In "Hacking the Brain: Dimensions of Cognitive Enhancement", Martin Dresler and colleagues distinguish seven dimensions and three strategies of cognitive enhancement (Dresler et al., 2019). The strategies are the means, namely behavioral (e.g., sleep, meditation, and computer training), biochemical (e.g., nutrition and pharmaceuticals), and physical (e.g., gadgets, implants, and electrical stimulation). The dimensions are the perspectives from which one can look at the strategies, such as the cognitive domain to be improved (e.g., memory, creativity, and attention), personal factors interacting with the means (e.g., intelligence, age, and genes), and side effects. The authors conclude that "[c]ognitive enhancement clearly is a multidimensional endeavor" calling for "a more differentiated approach" (ibid., pp. 1142–1143). Put differently, all the means and dimensions potentially matter and have to be considered in further research. We will come back to this in the chapter's conclusion.

Most recently, Racine and colleagues identified and discussed "Unanswered Questions About Human Psychology and Social Behavior" regarding cognitive enhancement (Racine et al., 2021), identifying important "gaps" in the ethical discussion to date, thus over roughly 20 years of scholarly activity. They formulate three major questions that should be addressed in further research. Firstly, which psychological and social

outcomes should be enhanced? Secondly, what are the similarities and differences between the various methods (i.e., what the previous group of authors called "strategies") of enhancement? And thirdly, what are the motivations of people to engage in cognitive enhancement?

The first question is remarkable in that it raises the fundamental concern of the whole debate. We have seen above that "cognition" is a very broad term and that researchers use a variety of experimental designs to measure it. What I find so remarkable is that one might expect more clarity on so basic a question after two decades of debate. However, the review discussed above also took the pragmatic approach of listing more or less everything that could be included in the "cognitive domain" (Dresler et al., 2019).

With their second major question, Racine and colleagues stress how important it is to carry out research in real-life settings, which we also addressed as a caveat above. The authors discuss much more complexity and finally conclude:

> The growth of biotechnology and neuroscience yields numerous possibilities for the development of cognitive enhancement. […] Extensive research into these aspects is imperative if we are to assess the ethics of the (non-)use of cognitive enhancers in an evidence-based and integrative manner and inform future policy making as well as technology development. (Racine et al., 2021, pp. 18–19)

This sounds as if the research were just about to begin—but as we have seen above, there are already more than 2000 related publications listed on the *Web of Science* alone. If the debate has been unable to yield any more clarity in 20 years, can we be sure of substantial improvement after another 20 years? We will also keep this conclusion in mind for the end of the chapter. However, before getting there, we will actually question two other foundational aspects of the neuroenhancement debate that have not yet been addressed: What is it that people change when they take the common substances? And how prevalent is that behavior?

Is it Really About Cognition?

Attentive readers might find some of the messages communicated thus far paradoxical, if not contradictory: On the one hand, many scholars have stated or at least suggested that cognitive enhancement is common and increasing. Yet, on the other hand, experimental studies of what the

drugs—in particular, prescription stimulants—are actually doing to their users have yielded ambiguous results. Meanwhile, there have been many such attempts, sometimes in the context of clinical research involving healthy control groups, as with the first study we discussed above (Agay et al., 2010), and sometimes specifically with healthy people, to directly investigate the potential of cognitive enhancement in that group, as with the chess players (Franke et al., 2017).

To put the paradox in a provocative way: Why would so many normally functioning people pay for and use the drugs, risking and in some cases actually suffering from side effects, if the substances are doing nothing? *Why are the users using, if that's of no use?* Or could it be that the experimental researchers are not investigating the effects correctly? Does cognition need to be measured differently or do the drugs affect something else instead? So, who is wrong here, the scientists or the users? A plausible answer is inspired by another researcher.

In an article published in 2013, the sociologist Scott Vrecko of King's College in London did something nobody else in the field of neuroethics had done before: He actually interviewed users of so-called cognitive enhancers to learn more about their motives (Vrecko, 2013). While quantitative research employs strict standardization in large samples of people to generalize findings to the whole population (and, in reality, many researchers only investigate their medical or psychology students out of convenience), Vrecko took a qualitative approach: He used semi-structured interviews—basically a number of prepared questions defining the focus of interest, while allowing the interviewees to answer freely—to talk to 24 students "attending an elite university on the East Coast of the United States" (ibid., p. 5). His results thus cannot be generalized to all users at all locations, but this is also not necessary to inform the debate. What the students told him was both remarkably consistent and remarkably different from the way the phenomenon had thus far been described in the scholarly debate.

According to the recruitment procedure, the interviewees needed to have experience with prescription stimulants as a study aid but did not consider themselves to have ADHD or a similar diagnosis. None of them apparently wanted to become the "next little Einstein". Instead, they described their stimulant use in ways that led Vrecko to identify the following four motives: (1) feeling up, (2) drivenness, (3) interestedness, and (4) enjoyment. The first reflects an increased level of energy and well-being, and the second a strong desire to do something. To illustrate the

latter, one student said that under the influence of the drug (containing amphetamine) she would "just sit down and do whatever it is I have to do and won't feel okay until I finish it" (ibid., p. 8). The third category concerned students finding their academic work more interesting and the fourth that they enjoyed it more. The answer to the question Vrecko formulated as, "Just How Cognitive Is 'Cognitive Enhancement'?", also his article's title, thus seems to be: What academics have commonly described as cognitive enhancement, instead appears to be about *emotion and motivation*.

When I present these findings in my lectures and seminars about the performance society, I usually tell my students that if they need drugs to find my teaching interesting enough to pay attention, I might better be replaced by another professor. I only half mean this as a joke: Results such as Vrecko's indicate that students have insufficient intrinsic motivation to do what they are supposed to do. Again, it must be stressed that this conclusion is not representative of academia at large. Perhaps these students chose the wrong program to study. To a certain extent, it is also normal that we, whether at school, at work, or anywhere else, are not always so absorbed by what we are doing that time flies and we feel a sense of flow.

What I want to point out here is the possibility that the students' lack of emotional connection with and motivation for what they are doing could also tell us something about their academic environment. Magon Inon, then a researcher in education at University College London, similarly suggested taking students' emotions seriously, as a meaningful response to the reality they live in (Inon, 2019). It is important to stress that individual adaptation by changing emotion is not the only option in such a situation. The environment could also be adapted to the individuals' needs—or individuals could move to surroundings better matching their own possibilities and needs. We neither can nor need to comprehensively resolve this issue here. For our purpose, it matters primarily that "cognitive enhancement", in spite of its high prevalence in the literature (Fig. 3.1), does not seem to be the appropriate description of the phenomenon, at least in some scientifically documented cases. I thus prefer the term "neuroenhancement" and will opt to even drop that nomenclature at the end of the chapter.

Vrecko's results are not the only ones suggesting such an alternative understanding of the phenomenon. A few years later, British researchers undertook a similar study at a university in England (Vargo & Petróczi, 2016). Unfortunately, their sample (eight habitual and five sporadic users)

was even smaller than that of the previous study. However, this in itself is an interesting fact: They started out with five students who they knew—from earlier research and their own social network—were engaged in neuroenhancement. These students were in turn asked to establish contact with other users. When they reached a total of 13, no further participants could be found. This clearly contradicts the notion of neuroenhancement being a mass phenomenon.

At first glance, these researchers seem to reinforce the idea of students using substances for performance enhancement: "Primarily, participants hoped neuroenhancement would help them to 'pull an all-nighter,' boost their concentration, energy and motivation toward the task at hand" (ibid., p. 5). However, the complete analysis of their interviews showed that the students' "motivations to neuroenhance resided in their need to 'catch up' and cope with their work related demands" (ibid., p. 8), particularly among lower achieving students. Consistent with earlier research showing that medical drugs containing amphetamine or methylphenidate are more difficult to obtain in the UK than in the US (Singh et al., 2014), the preferred substance of students was modafinil, with which we are already familiar from the chess study.

In conclusion, Vargo and Petróczi confirmed Vrecko's findings that neuroenhancement is mostly about emotion and motivation, especially coping with stress in competitive environments: "Neuroenhancement seems to be an adaptation to work-hard play-hard lifestyles, as well as to the competitiveness of contemporary higher education" (Vargo & Petróczi, 2016, p. 10). As previously, students' answers were remarkably consistent on that point. Remember that these qualitative findings from small samples are not the only evidence we have. We started out with the paradox that people are using prescription stimulants despite the results of experimental research on their cognitive effects being rather modest or ambiguous. This in itself calls for an alternative explanation, which the interview studies discussed here provide. These are, in turn, backed up by further surveys and experimental research that support the interpretation that the stimulant drugs primarily affect motivation—at least in healthy people who are not sleep deprived (see Ilieva & Farah, 2013, 2019; Müller et al., 2013).

Taken together, this evidence undermines the common narrative in neuroethics that "cognitive enhancement" is really about cognition or getting smarter, instead of coping with stress in a competitive environment or a lack of motivation, which we might simply call "boredom". This

implies that the common notion of "smart drugs" might be entirely misleading (see also Elliott & Elliott, 2011; Inon, 2019). There will be more evidence in this respect in the next section, where we finally discuss quantitative research on the prevalence of neuroenhancement.

3.2 How Common is It Really?

In the seminal publications on neuroenhancement summarized above, we found statements claiming that up to 16% or even 25% of students were using stimulant drugs non-medically, at least on some campuses. This practice has also often been described as common and increasing. However, the evidence for both of these claims is less clear than one may think. Early in the debate, one of my later collaborators (Quednow, 2010) and I (Schleim, 2010) cautioned against the proliferation of such high numbers more broadly. Similarly, researchers at the University of Queensland in Australia identified a "neuroenhancement bubble" (Lucke et al., 2011) or investigated the media hype about it (Partridge et al., 2011). According to the latter study, 94% of such articles presented neuroenhancement as common, increasing, or both, and 95% described the benefits, compared to only 58% mentioning risks or side effects. Exaggerating the benefits and downplaying the risks might actually also be characteristic of the ethical debate and not just what journalists are doing (Heinz & Müller, 2017). But what precisely does the scientific evidence tell us about the prevalence of the phenomenon?[5]

This question was the subject of a comprehensive review of 28 individual studies as early as 2011 (Smith & Farah, 2011). However, the results ranged between 1.7% and 55%, with so much variability indicating inconsistent approaches among researchers. For example, how did they each define the phenomenon, and how did they subsequently measure it in practice? The research groups seem to have different answers to these questions. It is noteworthy that Smith and Farah also found that in some surveys the reported prevalence correlated with the competitiveness in that context.

[5] The following paragraphs of this section are adapted from my report on brain doping (Schleim, 2022b), which can be accessed online at: https://doi.org/10.33612/227882920

More recently, a new paper was published, which summarized 111 studies (Faraone et al., 2020). Their results varied even more—between 2.1% and 58.7%. These authors also regretted that, due to the different methodologies of the individual studies, they were unable to conduct a formal meta-analysis that would have allowed them to summarize the empirical findings in a standardized manner. The evidence base in 2020 has thus hardly improved since 2011. The honest answer to the prevalence question is, therefore, that we cannot really say with any certainty how many people engage in neuroenhancement. We can, however, reflect on what is plausible.

For example, the results of studies that are more methodologically sound, in which substantially more people (N > 10,000) were surveyed—ideally using a representative method and conducted at different locations—are usually in the single-digit percentage range. By contrast, the extreme value of 55% originated from a nonrepresentative survey of a few (n = 307) male members of fraternities at only one North American university (DeSantis et al., 2009). Young men and members of such fraternities are known for their excessive substance use. In contrast to this, the representative US National Survey on Drug Use and Health 2015–2016 (n = 102,000) found that only 2.1% of respondents had used prescription stimulants such as amphetamine or methylphenidate without a prescription (Compton et al., 2018). Furthermore, a large-scale, international comparative study reported that substance use is higher in English-speaking countries (e.g., Canada, the US, and the UK) than in German-speaking countries (Germany, Austria, and Switzerland; Maier et al., 2018). This indicates cultural differences in neuroenhancement.

Many of these studies, however, did not specifically focus on cognitive or neuroenhancement, but on the "non-medical use" of stimulants and other substances. This includes motivations such as wanting to party longer, wanting to overcome social anxiety or shyness, wanting to lose weight (some substances suppress hunger), or simply wanting to experience a "high". Yet, these crucial differences are often overlooked in many reports, both in scientific publications and in general media. Improved concentration or staying awake longer to study were also frequently mentioned as reasons for substance use. However, this could simply reflect the fact that most of the surveys were conducted among students. In their stage of life and situation, these are, after all, essential activities.

The evidence discussed in the previous section, furthermore, showed that the more "academic" reasons might refer to improving motivation or

coping with stress rather than the genuine wish to become smarter. However, such nuances are difficult to consider in quantitative research, although they can, as we have seen above, substantially affect the interpretation of the results. Unsurprisingly, those studies that focus exclusively on enhancing academic performance rather than asking about "non-medical use", in general, report considerably lower frequency of use.

The clearest indication that there has been *any* increase in use at all is provided by researchers at the University of Michigan (McCabe et al., 2014). They repeated a nonrepresentative survey at the same university on six occasions between 2003 and 2013. This revealed an increase in non-medical use of prescription stimulants from 5.4% to 9.3% over that period. It is important to note that the survey participants were asked whether they had consumed stimulants *at least once in the last year*. This obviously does not tell us anything about the frequency of the use, which could be several times a day, a few times a week, or also just once in a whole year. Fortunately, the same research group examined this issue in a separate investigation (Teter et al., 2010). According to that study, 82.1% of the users had taken stimulants less than ten times in total. So, even though more students had tried such substances, around four out of five stopped using them after a few times. Apparently, they neither became dependent nor found the stimulant drugs very useful.

Comparison to the Past

These and many other findings strongly suggest that cognitive or neuroenhancement has never been a mass phenomenon and by no means can we say with any certainty that it has increased in the last 20 years. Contemporary figures may even be lower than those of surveys from the 1960s to the 1980s, which are summarized in more detail in previous publications (Schleim, 2020b; Schleim & Quednow, 2017, 2018). Similarly to the precursors of contemporary brain stimulation or moral enhancement, the neuroethics debate was oblivious to these empirical findings. But let us discuss here a few historical examples at least briefly.

One review paper covered 21 individual surveys from 1966 to 1980 (McAuliffe et al., 1984). In these, between 11% and 54% of the participants stated that they had previously taken amphetamines, mainly for the purpose of staying awake longer, to perform better on a test, or in sports. Note that methylphenidate was not well known at the time. Not long

after, the same research group published a detailed but nonrepresentative survey of health science professionals and students (n = 1308; McAuliffe et al., 1986). Some 16% of the doctors and 17% of the medical students surveyed reported that they had taken drugs or medication to stay awake longer, to work more effectively, or to be better at sports. The professionals estimated that they had done so roughly 44 times on average; for the students, the figure was 66 times. This is significantly higher than the numbers presented by the researchers in 2010 (Teter et al., 2010). It is therefore entirely conceivable that cognitive or neuroenhancement was even more widespread in the past than it is today, even if people did not yet call it that.

Importantly, the reported motives correspond to what we know about the use of stimulant drugs and similar substances today. We thus find consistency in how they have been used at least since the 1960s, possibly even longer (see Rasmussen, 2008). When addressing the distinction between medical and nonmedical use below, we will actually see some data allowing us to draw an even stronger conclusion. However, let us first relate what we have learned so far to the common illustration of the phenomenon in the media.

Neuroenhancement in the Media

It may be unlikely that, at least on a global level, a substantial number of students and other potential substance users actually follow scholarly debates in neuroethics. However, there is at least some agreement in the academic literature that the way enhancement is portrayed in the media affects people's expectations and decisions (see Coveney & Bjønness, 2019; Coveney et al., 2019; Partridge et al., 2011; Vargo & Petróczi, 2016). It has previously been argued that past hype, for example, about the possibilities of brain surgery and stimulation or psychopharmacological drugs, were fueled by optimistic accounts in popular media and that their portrayal of therapeutic options influenced patients' decisions (Racine et al., 2010; Schleim, 2014b; Snyder, 2009). The media thus seem to play an important role when it comes to informing potential consumers correctly and supporting "responsible use" (Greely et al., 2008).

However, the summary of past and recent prevalence surveys above has already put a big question mark behind the frequent portrayal of neuroenhancement as common and increasing. It goes without saying that there is

also no fixed standard for when something is "common". In the debate among experts discussed above, Nora D. Volkow, director of the US National Institute on Drug Abuse, mentioned that 8% of 12th graders in the US had used amphetamine nonmedically in the previous year (Hyman et al., 2013). This number is accurate, and we will address it in a broader social and historical context in the next section. But does this figure, which might in many cases simply mean trying it out once, make nonmedical stimulant use *common*? We will look now in more detail at a few telling examples of how such figures are interpreted and presented.

For example, one study was repeatedly cited at the beginning of the enhancement debate, according to which 16% of students engaged in the practice (Babcock & Byrne, 2000). In addition to the poor methodological quality of this nonrepresentative survey, it also explicitly did *not* ask about cognitive performance enhancement but instead about the use of various drugs/medications "for fun". Another misleading interpretation referred to what was in itself a sound nationwide study conducted at various colleges in the US with a large number of participants (n = 10,904; McCabe et al., 2005), but focused on only *one* among the 119 educational institutions at which students were surveyed. At this single institution, 25% of respondents had answered "yes" to the question of whether they had used nonmedical prescription stimulants at least once in the past year, while, by comparison, this figure was 0% at 21 colleges and the average for all respondents across the 119 institutions was 4.1% (incidentally, this figure was only 2.1% for use in the past month).

Despite these findings, influential media outlets and even leading researchers repeatedly reported the 25% as if this applied to all (American) students. This is a very biased presentation of the scientific evidence, as it emphasizes extreme outliers that might simply reflect measurement problems and neglects important information about the frequency of substance use. Imagine throwing 119 darts at a board when blindfolded and then telling your friends only about the one single time you hit the "bull's eye". Moreover, this does not even take into account the fact that the study did not explicitly examine cognitive or neuroenhancement, but rather the broader concept of "non-medical use", as is common in such surveys (McCabe et al., 2005). Where the frequently reported figures of 16% and 25% of alleged nonmedical users come from is just one striking example of how the phenomenon has been and still is being turned misleadingly into an urgent problem.

There is no doubt that the media have a vested interest in generating a lot of attention. I analyze two examples from my own university's independent newspaper in Box 3.2 in detail to illustrate how the media construct such stories—and how they respond to critical remarks. My own past experience of following and writing about the topic for more than 15 years, as well as the limited scientific evidence available, indicate that such cases are not untypical (Partridge et al., 2011). However, even within academia, researchers are in competition with each other for research funding. Those who can convince their intended audience that they are tackling an urgent and societally relevant problem have an advantage over their competitors. In addition to questions of accuracy and honesty, adopting such a strategic approach could eventually lead to a situation where the public no longer believes science when it comes to real matters of life and death (such as climate change or infectious diseases).

Box 3.2 Examples from the Universiteitskrant of Groningen

The independent newspaper of the University of Groningen in the Netherlands has covered the topic of performance-enhancing substance use repeatedly over recent years, just like many other media outlets. The first of two examples I want to analyze here was presented as a "success story" in 2016 and described the collaboration between a medical and a business student.[6] The title already promised "better focus with a little pill". The text introduced the product as a "study pill" and linked it to the methylphenidate that students were allegedly increasingly using during exam periods. One of the founders of the company called "Braincaps" compared the product to Ritalin, but without the downsides. The article stated that due to the "overwhelming success", the entrepreneurs wanted to market their pills at places other than in Amsterdam and Groningen. One of their marketing methods was to put flyers on tables in the university library.

(*continued*)

[6] "Better focus with a little pill", *Universiteitskrant*, April 20, 2016, online at: https://archief.ukrant.nl/english/better-focus-with-a-little-pill-2.html

Box 3.2 (continued)

"Braincaps" still exists today.[7] The company is now based in a residential area in the small city of Apeldoorn. Neither the university newspaper then nor the company's website now refer to scientific studies about the product's effects. The website explains that it was tested by the company's owner and his former fellow students in Amsterdam. The primary product, "Braincaps Boost", is described as containing caffeine and theanine, thus substances also naturally found in coffee or green tea, as well as golden root (*Rhodiola rosea*). In the US, the *Food and Drug Administration* has warned several companies that have made false claims about the that plant's safety and efficacy.[8] For "Boost", theanine is described as increasing mental energy, but for their alternative product "Zen", it is described as relaxing. The products sell for €21.95 and €21.45, respectively, for 30 capsules. People could brew a lot coffee and tea at home for that amount of money.

At the time, I contacted the editors of the newspaper to argue that the evidence claims made in the article were implausible given the scientific literature (some of which we discussed earlier in this chapter). I pointed out that it was published right before the resits, and thus when students might be particularly desperate and vulnerable, leading them to try out new things, and I asked them to publish a comment based on my own research. The editor-in-chief turned down my request, explaining that the article was part of a series that was not focused on *what* students were selling, but *how* they were doing so. It was not the science, but the creative story behind it that mattered.[9]

The second example is more recent. In March 2021, the university newspaper published a feature article with the title, "Stimulant use is

(*continued*)

[7] https://www.braincaps.com/

[8] See https://www.fda.gov/inspections-compliance-enforcement-and-criminal--investigations/warning-letters/peak-nootropics-llc-aka-advanced-nootropics-557887-02052019

[9] Personal correspondence, April 25, 2016.

Box 3.2 (continued)

alarmingly high: What student doesn't love Ritalin?"[10] It referred to a survey carried out at my faculty by some of my colleagues (Fuermaier et al., 2021), allegedly showing "that a staggering 16 percent had taken methylphenidate". However, in the nonrepresentative sample of 1071 students, only *two* had stated that they did so regularly for nonmedical purposes, thus only 0.2%. Furthermore, the most frequent motive given was "leisure" and not in an "academic context". The 16% thus referred to lifetime prevalence and mostly reflected recreational use.

What happened next is—at the present moment—partially based on speculation, but it is likely that this article drew the attention of the secretary of state at the Dutch Ministry of Health, who sent a formal letter to the Dutch Parliament with the request to take measures to fight the use of ADHD medication among students for whom it was not intended. In his letter, he repeated the mistaken conclusion that "16% of the 1,071 surveyed students of the University of Groningen are using the medical drug Ritalin without a doctor's prescription to study".[11] Remember that this is based on a double confusion because, first, only 0.2% of the students were regular users (9.2% said they did so occasionally, which was not defined clearly), and, second, only a minority used it for academic purposes. Nonetheless, the university newspaper then wrote a follow-up article titled "Students need to stop using Ritalin as a study pill", describing the political intervention.[12] The article started with the unfounded statement that "[s]tudents are increasingly using drugs like Ritalin and Dextroamphetamine in order to focus" and repeated that,

(*continued*)

[10] *Universiteitskrant*, March 15, 2021, online at: https://ukrant.nl/magazine/what-student-doesnt-love-ritalin/?lang=en

[11] Paul Blokhuis's letter to the Dutch Parliament (*Tweede Kamer*) of November 15, 2021, correspondence number 3278642-1019312-GMT; my translation.

[12] *Universiteitskrant*, November 24, 2021, online at: https://ukrant.nl/students-need-to-stop-using-ritalin-as-a-study-pill/?lang=en

Box 3.2 (continued)

according to the study, "no fewer than 16 percent of first-year students take methylphenidate".

Again, I contacted the editors. They called the secretary's letter a reliable source, although that might have been biased by their own earlier misrepresentation. After a lengthy debate that went on for about a month, they at least distinguished between the figures for regular, occasional, and lifetime use in the articles and published a short interview with me—but only in Dutch, while the original article was also published in English.[13] It should be clear that such a correction will receive little attention weeks to months after the original exaggerating articles were published. The misrepresentation of primarily recreational as academic use was not corrected. After repeated invitations to comment on these issues, the editor-in-chief eventually replied that he felt not inclined to comment on a six-year-old story and further referred to the politician's letter.[14]

Meanwhile, the Dutch government started an initiative to fight the unintended use of ADHD medication. Based on a new but representative report, the figures in the Netherlands were found to be actually much lower than communicated by the university newspaper, with the past-month prevalence of 2.4% (men) and 1.5% (women) among students.[15] This is consistent with other surveys and the reviews we summarized above. We might at least consider the whole story as having a positive outcome, as the new Dutch Minister of Health and the initiative now aim to raise awareness for stress, coping issues, and performance pressure, as well as the guidelines for prescribing stimulant drugs.[16]

[13] *Universiteitskrant*, December 14, 2021, online at: https://ukrant.nl/ritalin-tegengaan-als-studiepil-is-niet-nodig/

[14] Personal correspondence, September 14, 2022.

[15] *Instituut Verantwoord Medicijngebruik*, "Gezonde focus: terugdringen van oneigenlijk gebruik van ADHD-medicatie", online at: https://www.tweedekamer.nl/downloads/document?id=2022D28239

[16] Ernst Kuipers's letter to the Dutch Parliament (*Tweede Kamer*) of June 30, 2022, correspondence number 3379693-1030624-GMT.

Medical or Nonmedical Use

Above, we discussed the paradox that substance users use the drugs in spite of scientific evidence that they are of no use. The best explanation for this incongruence was that researchers focused on cognitive factors, while the consumers took the stimulant drugs for their emotional and motivational effects. Now, we seem, again, to face a paradox: On the one hand, scholarly publications on neuroenhancement, as well as the general media, often exaggerate the phenomenon, while, on the other hand, the prevalence studies—with all their complexities and shortcomings—do not actually find the nonmedical use of prescription stimulants to be very common. This is particularly so under the narrower definition of academic performance enhancement.

As before, this prompts us to look differently at the data. Here, what we have learned in Chap. 2 about mental health and disorders, in combination with our theoretical considerations on how to distinguish disease, health, and enhancement, becomes useful. As a matter of fact, the production of the prescription stimulants of amphetamine and methylphenidate *has* increased greatly, particularly in the US (Fig. 3.2). Although the

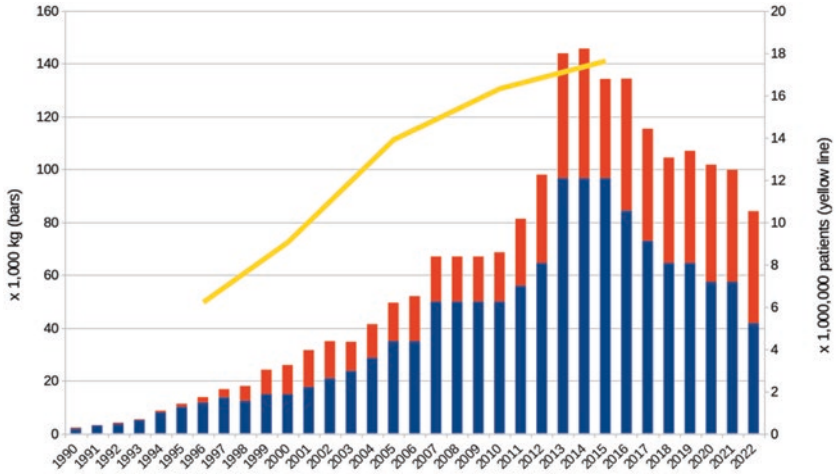

Fig. 3.2 Annual Production of Prescription Stimulants in the US. Since the 1990s, the annual production quotas of amphetamine (red) and methylphenidate (blue), as determined by the US government, increased greatly and reached a peak in 2014 (in 1000 kg, left scale). For comparison, the number of patients receiving antidepressants (yellow) in the US is shown here as well (in 1,000,000 patients, right scale). (Sources: *U.S. Federal Register*; Luo et al., 2020)

amounts have decreased somewhat after a peak in 2014, we were still seeing an *annual* production higher than that in the whole *decade* of the 1990s.

So, how can we reconcile the greatly increased production of stimulant drugs with the results of the surveys investigating the prevalence of their use? The answer has to do with what, by definition, the neuroenhancement debate and the surveys commonly are about: nonmedical use! This limited focus and framing ignored changes in the prevalence of ADHD diagnoses in children and adolescents, which in the US rose from about 6% in the late 1990s to 10% in the mid-2010s (Xu et al., 2018). These diagnoses often lead to the medical prescription of drugs containing amphetamine or methylphenidate (see also Bachmann et al., 2017) and are thus the best explanation for the increase in production.

There are also interesting cultural differences, with these prescription practices common in the Netherlands and the US but not in the UK, while Denmark and Germany lie somewhere in between (ibid.). This could be discussed along the rational of Chap. 2, that is, what kind of behavior is perceived as a medical problem (see also Singh & Wessely, 2015). The same goes for the fact that in the US, children with a white, non-Hispanic cultural background are much more likely to be given the diagnosis than others; and while children from poorer families are generally diagnosed more frequently, those from upper income families are most likely to receive prescription treatment (Xu et al., 2018). What is much more relevant in the present context is that after a long controversy, ADHD was eventually also acknowledged as a mental disorder common in adults and not only children and adolescents (Lange et al., 2010). This greatly increased the share of the population that could potentially receive the diagnosis and thus also the drugs.

It is difficult to fathom in detail what these changes in mental health care practices mean in a big country like the US, with more than 300 million citizens, and in a period spanning more than three decades. But it is obvious that the drugs prescribed to millions of people for daily use have to be produced—and this is what we see on Fig. 3.2. Researchers calculated that, for 2008, the supply of prescription stimulants for ADHD was sufficient to treat about 6.4 million individuals for all 365 days of the year (Swanson et al., 2011). Combining this with the official production quotas, we can estimate a theoretical upper boundary of 14 million *daily* users in the US in 2014! If they take the drugs on a doctor's prescription, none

of them would appear in the prevalence studies discussed above, which explicitly exclude medical use.

Swanson and colleagues also pointed out that, in addition to the formation of large parental advocacy groups leading to the increasing recognition of the disorder since the late 1980s, the Individuals with Disabilities Education Act of 1990 included ADHD as an educational disability and made provisions for school-based services (ibid.). They argued that this explains at least part of the increase in diagnoses and prescriptions. In other words, getting the diagnosis became beneficial in certain school and academic settings. Even today, my own university gives students with an ADHD diagnosis 25% more time to complete an exam. Others have suggested that changes to the DSM criteria have also contributed to the increase (see, for example, Frances, 2013; Thomas et al., 2015).

However, for the present chapter, two other ideas are much more relevant: First of all, some people are feigning ADHD symptoms to receive the diagnosis and what they perceive as its associated benefits. This has actually prompted clinical psychologists at my own institute to develop methods to distinguish the "feigned" from the "real" disorder (Fuermaier et al., 2021; Tucha et al., 2015). Secondly, other people might knowingly or unknowingly eschew psychiatric diagnoses and use prescription or illicit drugs to treat their symptoms. This is discussed as "self-medication" in the literature (see, for example, Coveney et al., 2019; Lopes et al., 2015; Lucke et al., 2013).

Thus, reminiscent of the results of the previous chapters, the situation can be described as such: People using stimulants and saying "no" in the prevalence surveys (investigating nonmedical use) would have to answer "yes", *if* they feigned the symptoms successfully—or were misdiagnosed by a clinical expert. By contrast, people using stimulants and saying "yes" would have to answer "no", *if* their stimulant use is a valid case of self-medication. Recently, there has been increasing criticism of clinicians for diagnosing mental disorders too frequently and that general practitioners and psychiatrists prescribe too many psychopharmacological drugs (see Hengartner, 2022; Taylor, 2017). From this perspective, at least some "medical use" is mislabeled.

This apparently unlimited complexity has much to do with the theoretical as well as practical difficulty of distinguishing diseases/disorders, health/normalcy, and treatment/enhancement. The implication for the present question is that the available evidence cannot give a

conclusive answer to whether nonmedical use of prescription stimulants—and other substances we will address in the next chapter—is increasing or decreasing. Above, we have at least discussed evidence from the 1960s to the 1980s which strongly suggests that nonmedical use—and with it neuroenhancement—has *not* become more common today. Given all these limitations, the best and realistically possible evidence would have to come from a longitudinal study asking people in the same situation, say, 12th graders, the same questions about their substance use over and over again. This is actually what the "Monitoring the Future" study at the University of Michigan has been doing for decades, again with the findings neglected by neuroethicists. Their results on amphetamine use without a doctor's prescription are shown on Fig. 3.3.

Above, we addressed the expert debate in which Nora Volkow referred to the 8% of 12th graders in the US that had been using amphetamine nonmedically in the previous year (Hyman et al., 2013). That was the situation in 2012, as we can see on the graph (Fig. 3.3). The much-lower

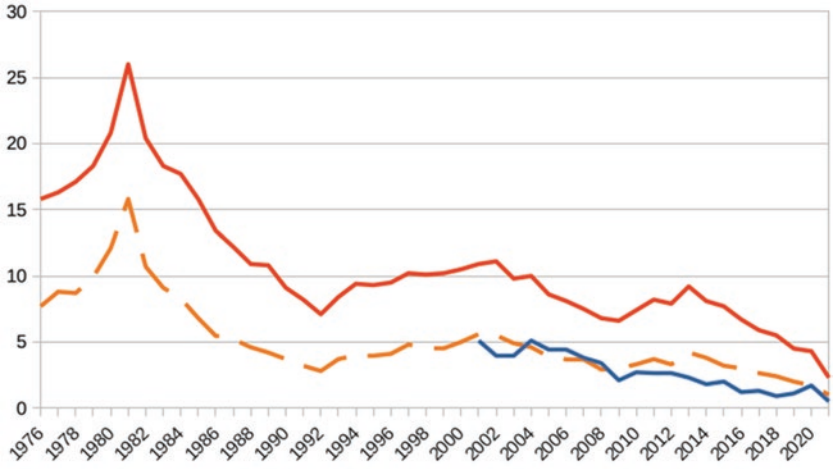

Fig. 3.3 Nonmedical Amphetamine Use of US 12th Graders. The graph shows the 12-month (red line) and 30-day prevalence (dashed orange line) of nonmedical amphetamine use among 12th graders in the US. The blue line shows the 12-month prevalence of nonmedical Ritalin use in the same group, which has been investigated for a shorter period of time. (Source: Monitoring the Future (Miech et al., 2022))

30-day prevalence of 3.3% in the same year confirms what we discussed above: Most of these students are not regular users. However, the graph actually illustrates three more important findings: Firstly, also in line with our previous discussion, nonmedical use is less frequent than in the 1970s and 1980s. Secondly, although there was a slight rebound effect from the preliminary low in 1992 until 2002, the overall negative trend persists until today. Thirdly, the further substantial decrease from 4.3% in 2020 to 2.3% in 2021 suggests the common recreational use of the drug: During pandemic-related lockdowns and periods of home schooling, the emotional/motivational demands on students remained high, but they had fewer opportunities to go out and have fun with their peers.

We can thus conclude with considerable certainty that the nonmedical consumption of stimulant drugs has been decreasing continuously and that much of that use is recreational. This clearly contradicts the frequently communicated message that neuroenhancement is common and increasing (see also Partridge et al., 2011; Schleim & Quednow, 2018). It further shows how misleading headlines and descriptions in the media are when they suggest that almost all students are taking drugs to improve their academic performance (Box 3.2). As we saw above, on the basis of misrepresented data, the Dutch government recently launched an initiative to fight the nonintended use of ADHD medication in the country. But is there really much to fight, if the last-month prevalence is as low as what is shown in the last figure?

3.3 Nonpharmacological Alternatives

Substance use is obviously the focus of this book. However, when one discusses a phenomenon, knowing more about its alternatives often improves one's understanding as well. With respect to the broader topic of mental health and enhancement, learning more about nonpharmacological options is also informative and helpful. We have already seen above that researchers summarizing the neuroenhancement debate have pointed to "biobehavioral strategies" as complementary ways to enhance cognition (Dresler et al., 2019; see also Dresler et al., 2013). They listed physical exercise, sleep, meditation, learning a new language, mnemonics (i.e., specific techniques to improve one's memory), and computer training as such strategies.

Other researchers have described the beneficial effects of physical exercise on the brain as well (Hötting & Röder, 2013). They emphasized

our greater understanding of how the nervous system is affected by physical training, particularly regarding an increase in neuroplasticity. This refers to the brain's capacity to respond to the demands of people's life situations, resulting in long-lasting structural changes. The benefits, Hötting and Röder explain, could be maximized through a combination of cognitive training and overall cardiovascular fitness.

Linking the book's general topic with this section on alternatives in a convenient way, Caviola and Faber compared computer-assisted learning, sleep, and exercise more specifically with pharmacological neuroenhancement (Caviola & Faber, 2015). We have already seen in the discussion above that the experimental evidence in favor of that is ambiguous. This, of course, in itself limits comparability with alternative approaches. However, according to this specific review, people who do not take the drugs at least do not seem to miss out on beneficial effects:

> We find that all of the techniques described can produce significant beneficial effects on cognitive performance. However, effect sizes are moderate, and consistently dependent on individual and situational factors as well as the cognitive domain in question. […] [W]e can conclude that pharmacological cognitive enhancement is not more effective than non-pharmacological cognitive enhancement. (Caviola & Faber, 2015, p. 1)

Psychology in general has, of course, a long history of understanding memory, learning, and intelligence. While this body of research is much too vast to be summarized here, Roger N. Walsh, professor of psychiatry, philosophy, and anthropology at the University of California, Irvine, has reviewed knowledge about the relation between lifestyle and mental health that has proved useful as a complement to psychotherapy (Walsh, 2011). He, along with many other researchers, also describes the benefits of physical exercise for multiple body systems and even cognitive improvement. Walsh particularly points to physical exercise as a means to both prevent and treat mild to moderate depression. Nutrition and diet are important factors as well, comprising food selection and supplements. Spending time in nature is also being increasingly investigated for its beneficial effects and contrasted with unbalanced media immersion, such as spending too much time watching television or using digital media.

There are many more factors that are actually reminiscent of the "pillars of health" that we discussed briefly in the introduction. Walsh also reviews the important role of relationships, recreation and enjoyable activities,

relaxation and stress management, religious and spiritual involvement, as well as contribution and service (Walsh, 2011). He thus advocates a very comprehensive account of health and well-being. By contrast, a strong emphasis on more physiological aspects such as healthy diet, sufficient physical exercise, and avoiding unhealthy substance use has generally drawn attention away from the importance of social relationships and integration, in spite of their strong effects on mortality (Holt-Lunstad et al., 2010). Social psychologists have confirmed that many people underestimate the importance of social factors (Haslam et al., 2018).

Neurotechnology in general or substance use in particular may seem so attractive to many because these strategies "do the work for us", so to speak. Most, if not all, of the abovementioned alternatives demand our time and attention. The more commonly discussed ways to achieve neuroenhancement can simply be applied (e.g., brain stimulation) or consumed (e.g., substances), even if they still come at a financial cost. Perhaps it helps us here to realize that our present bodies are the product of a long evolutionary history with their selection and survival pressures, which can be understood as a continuous process of adaptation and optimization. This implies that if there were simple ways to make us even more efficient, they probably would have evolved naturally. That the neuroenhancement debate has, after 20 years, been unable to identify a real "game changer" might simply testify to the fact that we are already functioning on a very high level, perhaps even at too high a level, considering the negative consequences of human action on the global scale. These thoughts remind us that the time is ripe for a general conclusion to this chapter.

3.4 Interim Conclusion: Hype or Reality?

At the beginning of this chapter, we situated the neuroenhancement debate in the competitive performance society of the early twenty-first century. Our time's obsession with measuring, comparing, ranking, and then optimizing everything is characteristic of it. In the sections that followed, we discussed data and findings that make more sense in this context than that suggested by neuroethicists. I am actually aware of no evidence at all indicating that a considerable number of students are taking drugs based on their own will to become smarter, to become a "little Einstein". This also makes sense in light of the tentative conclusion that—at least in healthy consumers without sleep deprivation—stimulant drugs primarily affect emotion and motivation, not cognition.

Ethicists have repeatedly emphasized the importance of considering both safety and coercion. However, regarding the former, it has to be conceded that even after some 20 years of research and debate there is still no reliable data on the consequences of the long-term use of these drugs. Moreover, neuroethicists cannot complain that there has been a lack of funding for their endeavor. By contrast, it was a booming field with numerous research projects and opportunities around the globe. The conclusion is less obvious with respect to coercion, also because it is complex to decide at what point tolerable pressure becomes intolerable coercion. Yet, we do have some reliable and consistent qualitative, as well as quantitative, evidence that competition and performance pressure increase students' likelihood of taking prescription stimulants—whether we label this medical or nonmedical use. Their practice primarily seems to be a way of increasing their motivation and coping with stress. While some individuals might prefer to reflect on whether they are in the right environment, we should also critically analyze what that environment is like, what it demands of people, and which behaviors it rewards or punishes.

The recent reviews by Dresler et al. (2019) and Racine et al. (2021) are helpful in that they summarize and systematize a large part of the debate on neuroenhancement and make useful suggestions for future research. However, their accounts also emphasize the sheer complexity of this approach by identifying numerous factors that have been insufficiently addressed over the past 20 years. It is presently unclear whether another 20 years would yield a substantially different outcome other than concluding (again) that the questions are more complex than previously thought.

Here, we should also mention the possibility of a serious conflict of interest: In neuroethics, so to speak, a distinct group of people identifies the topics that are relevant and thus define the agenda on ethical, legal, and social issues related to neuroscience. Many major research initiatives on the brain currently have dedicated funds for research of this kind (Amadio et al., 2018). The people setting the research agenda in advance are thus the same as those eventually employed to carry out the investigations. But what might the agenda look like if it was determined in a democratic decision-making process? Would people value neuroenhancement higher than, say, good housing, fair employment, and a safe environment? The strong emphasis on cognitive performance might simply misrepresent the priorities of the majority of people (Schleim, 2014a) and doesn't even seem to match the priorities of these professors' own students (see Vargo & Petróczi, 2016; Vrecko, 2013).

Raymond De Vries and Fernando Vidal were two of the very few investigating these structural issues concerning the preconditions of a field such as neuroethics (De Vries, 2007; Vidal, 2018). We thus face a reiteration of the "Who watches the watchdog?" problem. That this not only matters theoretically can be illustrated by the fact that, in contrast to the common narrative in neuroethics, enhancement is emotional rather cognitive, moral enhancement is not new, and nonmedical stimulant use is decreasing not increasing. This book is not meant as an exercise in the sociology of science, as important a field as that may be. But understanding the structure of an area of research helps us to understand the answers it can provide and the knowledge that it creates.

Instead of pursuing these questions here any further, we will stick to our topic. With respect to neuroethics—or at least neuroenhancement—the conclusion seems that *the hype is the reality*. That is, old trends of substance use have been reframed using different words—enhancement—and then put on the research agenda with the help of powerful media partners. Whether and when the "neuroenhancement bubble" (Lucke et al., 2011; see also ter Meulen et al., 2017) bursts, depends on the decisions of researchers and their funders. Considering this conclusion in combination with the persistent inability to draw clear lines between disorder/disease, health/normalcy, and enhancement, it seems justified for us to look at substances independent of mental disorder categories and to drop the concepts of cognitive and neuroenhancement altogether. This thus paves the way for a fresh look at substance use in the next chapter.

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