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Is the use of modafinil, a pharmacological cognitive enhancer, cheating?

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ABSTRACT

Drugs used to provide improvement of cognitive functioning have been shown to be effective in healthy individuals. It is sometimes assumed that the use of these drugs constitutes cheating in an academic context. We examine whether this assumption is ethically sound. Beyond providing the most up-to-date discussion of modafinil use in an academic context, this contribution includes an overview of the safety of modafinil use in greater depth than previous studies addressing the issue of cheating. Secondly, we emphasize two crucial, but hitherto nearly overlooked, nuances to the issues: (a) the potential for modafinil to *decrease* inequality and disadvantage in academic settings, and (b) the fact that *how* modafinil is used dramatically impacts its effects on health, coercion, fairness, authenticity and effort. Finally, we explicitly defend the position that there are *no qualitatively morally relevant* differences between modafinil use and other enhancement modalities; any such differences are in degree, not kind.

KEYWORDS

Modafinil; pharmacological cognitive enhancement; cheating; safety; fairness; academic inequality

Introduction

A friend gave me a narcolepsy medication to help combat my jet-lag. It helped me deliver an important talk despite my fatigue. Later, I found that it increased my concentration and motivation even when not sleep-deprived. This helped me finish work early and have time left over for family, friends, fitness, hobbies, or, when busy, more work. For various reasons, many colleagues and students do not approve or make use of this opportunity. Is my advantage over them unfair? Am I cheating myself or others by using a pharmacological cognitive enhancer?

Pharmacological cognitive enhancers (PCEs), a class of drugs indicated to treat patients with cognitive or sleep disorders, are also used by healthy individuals to improve concentration and efficiency, offset jetlag or fatigue, or increase

motivation for carrying out tasks (Müller et al. 2013; Sahakian and Morein-Zamir 2007; Vrecko 2013). Trials show that healthy, non-sleep deprived volunteers given modafinil, the narcolepsy medication mentioned in the example above, score higher on tests of planning, learning, attention, delayed and working memory, as well as some measures of creativity (Battleday and Brem 2015; Müller et al. 2013). Memory and executive functions, including planning and attention, are important for learning, and programs training these skills have been shown to increase academic achievement (Titz and Karbach 2014). In what follows, we assume that drugs like modafinil, which affect the same functions, similarly improve academic performance. It must be noted, however, that, to our knowledge, no studies have explicitly addressed whether the use of PCEs such as modafinil does in fact translate into improved scores on academic tests.

Nevertheless, the cognitive effects of PCEs have led a number of universities to consider their use to be cheating (Aikins, Zhang, and McCabe 2017). This position is sometimes assumed without argument in the scholarly literature (Aikins, Zhang, and McCabe 2017). We think it appropriate to question whether the use of PCEs is a form of cheating – whether its use constitutes an unfair advantage – but also whether there might be other relevant moral considerations for its banning related to its harmful effects, the coercion for its use that may be exerted once it becomes widely accessible, its potentially unequal allocation, the erosion of the value of authenticity in effort and whether a societal benefit prompted by the enhancement of learning through PCEs trumps the remaining moral considerations. Indeed, whether the use of PCEs is cheating or unjustified by these concerns is an important question, as surveys indicate that PCE are used without prescription by a significant number of students and faculty in Europe and the United States, with prevalence estimates ranging from 2 to 35% (Maher 2008; Maier et al. 2013; Schelle et al. 2015; Smith and Farah 2011).

Whether or not a practice is in fact cheating depends on whether it violates established rules, be they moral or legal (Schermer 2008). We look at current rules that consider PCE use by healthy individuals cheating, to examine whether it *ought to be* so considered, using the wakefulness-promoting drug modafinil as a case study to be weighed by considerations based on fairness, harm, autonomy and beneficence. Because modafinil has a favorable risk-benefit profile compared to other PCEs, it is the main focus of our article, and thus some of the evidence we provide concerning the effects of modafinil cannot be generalized to other PCEs. Nevertheless, the theoretical and ethical questions remain relevant to PCEs of any kind.

Beyond providing the most up-to-date discussion of modafinil use in an academic context, this contribution advances the extant literature in several ways. Firstly, it provides an overview of the safety of modafinil use in greater depth than previous studies. Secondly, we emphasize two crucial, but hitherto nearly overlooked, nuances to the issues: (a) the potential for modafinil to *decrease* inequality and disadvantage in academic settings, and (b) the fact that *how* modafinil is used

dramatically impacts its effects on health, coercion, fairness, authenticity and effort. Finally, we explicitly defend the position that there are *no qualitatively morally relevant* differences between modafinil use and other enhancement modalities; any such differences are in degree, not kind.

What are the relevant ethical concerns?

In the *Emerald City of Oz*, students at the Royal Athletic College of Oz learn such subjects as algebra, Greek, Latin, literature and mathematics by swallowing pills: ‘One at night, on retiring, is equal to four hours of study’ (Baum 1910). Being thus free from ‘wasting time’ on the ‘lesser branches of learning,’ the students are able to spend all their time practicing athletics. It is true that students at the Royal Athletic College do not deserve praise for their achievements in algebra, Latin, etc. But real methods of PCE, unlike the pills taken by these students, do not directly convey information. Rather, they increase the ability to stay focused. This is certainly an advantage. But is it *unfair*?

Several ethical issues are relevant to this question. Surveys have found that appeals to fairness, safety, and coercion are the most widely shared concerns over the ethics of PCE use among scholars and the public (Schelle et al. 2014). Particularly relevant for the question of cheating is the argument that PCE use undermines authenticity and effort. We begin by examining these concerns, arguing that they fail to justify viewing PCE use, at least in the form of modafinil, as morally improper. We proceed to offer two arguments that convince us, more specifically, that modafinil use should not be considered cheating: firstly, the lack of a *morally significant difference* between modafinil and ethically uncontroversial enhancements; and secondly, that the furtherance of the *outcome goods* of improved cognition in general and academia in particular – knowledge, technology, and skill – morally outweigh the likely effects on an already intractably uneven competitive field.

Authenticity

Acquiring and producing knowledge in education and academia involves laborious hours spent in the lab or poring over books; writing and revising arguments; listening to and supervising others. Many admire the effort that goes into significant achievements such as a high mark or a valuable insight. In some cases, achievements reached without effort lose their meaning. For example, using a calculator on a test of long division fundamentally undermines its purpose. Similarly, attaching one’s name to work carried out by somebody else is not an achievement worthy of recognition or praise. In this vein, the President’s Council on Bioethics, chaired by Leon Kass, argued that excellence achieved through the use of drugs is ‘cheap’ by way of obviating the need for hard work and study, and not fully authentic because the excellence is partly attributable to the drug, not the individual (President’s Council on Bioethics’s 2003).

We value authenticity at least partly because it allows us to allocate praise or blame for achievements, rewards or punishments for behavior, accurately represent the value of objects, and infer the quality of skilled services or judgments, because we are not deceived in appraisals of its source. Inauthentic cheating such as plagiarism or ghost writing undermines this ideal. Michael Sandel argues a similar point in a different context: ‘... as the role of the enhancement increases, our admiration for the achievement fades. Or rather, our admiration for the achievement shifts from the player to his pharmacist’ (Sandel 2007, 25).

This line of reasoning may explain part of our attitude towards a graduate of the Royal Athletic College of Oz proudly displaying their mastery of algebra obtained entirely by chemical means. But what if students at the Royal Athletic College continued to engage in academic pursuits rather than spend all their free time on athletics? Let us imagine that, instead of spending hours in the library, the students use their extensive knowledge of current fields to make new discoveries and gain new insights. Consequently, their society flourishes, pushing back against disease and deprivation. They may not deserve praise for the effort they expended mastering algebra, but they do deserve praise for these new achievements.

Our point is that we value effort not for its own sake, but for its connection with worthwhile accomplishments. If more effort were itself praiseworthy in academics, then students and professors should be at least partially motivated to increase their efforts independent of the outcome of their labors. Imagine faculty members who choose to undergo repeated head trauma in the hopes of impairing cognitive function. The professors then work twice as hard as before, just to achieve the same level of academic output. Should they be given promotions and academic awards because of the extra effort expended? Are the achievements of their colleagues cheap because they expended less effort? Is their work twice as authentic? Or should they rather be chastised for missing the crucial connection between effort and worthwhile outcomes?

Now imagine two students attending the same university. Anna and Bartholomew are equally talented and work equally hard. However, Anna’s professor is not much adept at teaching, preferring to spend his time on research. Consequently, Anna expends a lot of effort trying to stay awake and attempting to understand what the professor is saying. Bartholomew, in contrast, has been blessed with a highly engaging, motivating and brilliant professor with plenty of time for her students. Learning from this professor is a joy and requires no effort at all. We might well envy Bartholomew and pity Anna. But it would be wrong to say that Bartholomew’s knowledge is inauthentic, cheap or otherwise suspect because it did not involve effort, and ridiculous to hold that Bartholomew cheated or that his professor should stop making her teaching so easy to follow.

These considerations convince us that effort, in and of itself, is not ethically relevant, but becomes so only when connected to worthwhile goals and achievements. These goals and achievements are ethically relevant because they impact the health, well-being, and opportunities of others. There are, of course important

differences between the cases of Anna and Bartholomew and those of students who use PCEs to help motivate themselves where their professors cannot. Good pedagogy is not burdened by pharmaceutical side-effects, and it is a simple fact that there are not enough professors like Bartholomew's. These relevant differences will be explored below.

Inequality of access

As with high-quality teaching, modafinil might be available only to a few, due, for example, to high prices or selective distribution: then those few would benefit from an advantage not available to their competitors. If the prices or distribution of modafinil happened to be unfair, then this competitive advantage would also be unfair. But PCEs, at least in the form of modafinil, can be similar in price to a day's supply of coffee or tea if purchased in a generic form from overseas pharmacies (an informal search conducted in November 2017 yielded estimates of \$1–2 as compared to up to \$50 per branded pill on prescription). However, because PCE are controlled substances, access is systematically biased towards those willing to deal in the black market or falsely obtain a prescription. This is a genuine concern, as such purchases are subject to lesser quality controls, and we suggest that the legal status of nonmedical PCE use, at least of modafinil, should be reconsidered, a point we return to later. Scholars have proposed alternative methods of regulation which include over-the-counter distribution in approved pharmacies, perhaps contingent on taking of an exam on the risks involved; and provision by the academic institution, as is currently the case with coffee and tea (Dubljević 2013).

Coercion

The topic of coercion features prominently in the ethical debate over modafinil. If modafinil use were widespread, those who do not wish to use it might nevertheless feel pressured into doing so by others, or because they do not want to be disadvantaged relative to those who do. If this were the case, the autonomy of those who do not wish to use PCEs may be undermined. In a recent survey, students stated they would be more willing to take a hypothetical PCE if half or all of their peers were using it, relative to a condition in which few were (Sattler et al. 2014). In general, respondents in qualitative studies have indicated that PCE use should be an autonomous choice (Schelle et al. 2014). Students in one focus group viewed PCE as a lifestyle choice governed by personal values, but also as an understandable reaction to academic and social pressure (Forlini and Racine 2009). The tension between these two views could lead some to take PCEs in order to cope with academic or social pressure, even if, absent any pressure, they would not want to take PCEs. Similar factors could lead faculty members to use PCEs against their wishes in order to keep up with their colleagues.

Currently available data suggests that pressure to use PCEs is not widespread. In a survey of more than 6000 Swiss students, 9.8% of those who had used PCEs mentioned competitive pressure and only 2.8% cited other people's use of PCEs as a motivating factor for their use (Maier et al. 2013). In a survey of more than 1500 German university and high school students, 5.7% responded that they would take PCEs if their employers recommended this, and 7.5% would use PCEs if their friends were using it (Franke et al. 2012). In a third survey, only three of nearly 1,500 (0.2%) respondents mentioned social pressure as a reason for discomfort with PCEs (Cabrera, Fitz, and Reiner 2014). Nevertheless, these numbers may increase as PCE use becomes more prevalent, and the concerns of those affected must be taken into account.

Pressure to perform well is not necessarily a bad thing. The knowledge produced in academia and education is instrumental for the advancement of society and can directly and indirectly lead to saved lives and increased well-being. In addition, universities oversee the delicate task of training future professionals. Therefore, pressure to perform can be valuable insofar as it conduces to the production of knowledge and skill, or contributes to the performance of professionals whose efforts have significant consequences for others (e.g. surgeons, airline pilots). However, pressure arising from competition becomes more problematic when it is directed towards harmful activities, as illustrated by the following thought experiments.

Suppose recent research on the benefits of sleep (Ellenbogen 2005; Ferrie et al. 2011; Ficca et al. 2010; Lovato and Lack 2010) had penetrated strongly into academic practice, with the result that faculty were now engaging in competitive napping. Proponents of the napping fad cite greater retention of material and increased writing efficiency. Opponents dislike naps, but feel pressured into napping to publish at the same rate as their colleagues. They argue that their autonomy has been compromised because they are coerced into taking naps. The only appropriate response, they say, is to ban napping, because nappers benefit from an unfair advantage not available to those who wish to stay awake. What action should university administrators take?

Banning napping would not be justifiable in this case, as the autonomy and well-being of faculty members are not undermined by the napping fad. The option to stay awake remains, albeit now at a relative disadvantage. The degree of coercion may well be high, but naps are not the kind of thing that can be reasonably banned, and even if they were, such a ban would itself be strongly coercive and nigh-impossible to enforce. Besides, napping for cognitive enhancement might well be something worth promoting to the extent that it benefits academic output and health.

Now imagine the opposite scenario. Faculty members have begun working antisocial hours, citing increasing competition. Some of them work an astonishing 20 h per day, including weekends. The reduced efficiency associated with sleep deprivation means that the output produced is similar to that in the competitive

napping scenario, despite the extra hours, but the glorification of long work hours stigmatizes napping. Months later, faculty who refuse to work antisocial hours are no longer promoted, and some are even let go because of their perceived lack of dedication. Their colleagues suffer from record numbers of personal, health, and psychiatric complaints, but keep their jobs. Some faculty members submit that their autonomy has been breached because they have been coerced into unhealthy working conditions. What action should university administrators take?

This scenario presents a strong case for banning antisocial or unhealthy working hours. The option to work healthy hours is not realistic, as it would result in loss of employment. There is thus a high degree of coercion. There is also a high degree of health risk involved in chronic, severe sleep deprivation (Covassin and Singh 2016; Ferrie et al. 2011; Gallicchio and Kalesan 2009). This combination of high risk and high level of coercion is dangerous, undermining autonomy and harming those involved.

The studies and examples surveyed above suggest that most students and academics do not perceive coercive pressure to use modafinil. In addition, we do not hear of complaints that the benefits of napping are such that some feel coerced into napping against their will. Nevertheless, it remains an important problem for the minority that do feel such pressure. And the ethical weight of potential coercive pressure increases with the severity of the harm involved. We suspect some will object here on the grounds that napping is clearly beneficial for health, whereas modafinil is potentially harmful. Safety and harm are ethically relevant parameters of this discussion because they directly influence the well-being, autonomy, and prospects of individuals and their dependents. In the next section, we review the evidence on the safety of modafinil use.

Safety

Data suggest that short-term modafinil use is relatively safe. Modafinil is considered to be well-tolerated, with little abuse potential (Jasinski 2000; Kumar 2008; Porsdam Mann and Sahakian 2015). In a retrospective review of all modafinil overdoses with follow-up to known outcome reported to the California Poison Control System over a ten year period, no cases of high clinical severity, 11 cases of moderate severity, and 54 cases of minor severity were reported (Carstairs et al. 2010). The most commonly reported side effects are insomnia, headache, nervousness, nausea and hypertension (Kumar 2008). However, at least five cases of serious skin reactions have been reported in adolescents and children with ADHD from 1999 to 2007, and there has been one report of death attributed to multi-organ hypersensitivity, the only such case to our knowledge (Rugino 2007; Sabatine et al. 2007).

Recent meta-analyses investigating the safety and efficacy of modafinil in psychiatric conditions have also concluded that short-term use is safe and well-tolerated (Andrade et al. 2015; Chapman et al. 2016; Wang et al. 2017). One of these found a threefold larger incidence of mild or moderate adverse events in groups

receiving modafinil for obstructive sleep apnea as compared to control groups, but no difference in serious adverse events (Chapman et al. 2016); another found no significant differences between intervention and control groups in the rate of adverse events observed (Andrade et al. 2015); and the last found no significant differences in headaches, blood pressure, heart rate, or rates of discontinuation due to adverse effects between groups (Wang et al. 2017). Summarizing the results of these and other less recent meta-analyses, Wang et al. noted that 'modafinil's dropout rate due to all cause and adverse events is either comparable to or worse than placebo;' that 'in terms of safety and tolerability, modafinil was generally well tolerated;' specifying that 'above all, most of side effects observed in both groups were mild or moderate in severity;' but that 'regular monitoring of blood pressure changes in patients treated with modafinil should be considered because multiple studies suggest its cardiovascular risks,' referring to the above-mentioned analysis that found increased risk for mild or moderate, but not severe, adverse effects (Wang et al. 2017).

Unlike modafinil, methylphenidate and amphetamine do have some abuse potential (Kollins, MacDonald, and Rush 2001; Smith and Farah 2011). One retrospective study found that prescription stimulants for ADHD sufferers was associated with a 20% increase in relative risk of hospitalization for cardiac events compared to nonuse, categorized as severe adverse events (Winterstein et al. 2007)

Importantly, there are no data on the long-term health consequences of modafinil use. So although the short term use of modafinil appears relatively benign from a health perspective, no one knows if this is also the case for chronic use, and PCEs other than modafinil appear to be associated with more negative health consequences.

It should be noted that the health risks of PCE depend on how they are used. Those who use PCEs to chronically reduce their quantity of sleep face serious risks due to the association between sleep deprivation, chronic disease and all-cause mortality (Gallicchio and Kalesan 2009). Increased productivity and motivation could be used to make time for nurturing relationships, meditation, or exercise, all of which are associated with a host of beneficial effects on health (Khoury et al. 2015, 2017; Thornton et al. 2016; Umberson and Montez 2010). The way academic work is often carried out – sitting, alone, inside – is likely to be physically harmful, so steps to reduce its duration may be beneficial for health (Olthof et al. 2013). Although there is little scholarship on this important area, anecdotal evidence suggests that some users of modafinil use its effects to work longer, whereas others seek to increase efficiency to free up time. This is an important area worthy of further research.

Another thing to keep in mind is the level of risk we accept from everyday over-the-counter medication. Although estimates vary, it is clear that thousands of premature deaths are caused each year in the US alone by the use of non-steroidal anti-inflammatory drugs such as aspirin (Cryer 2005; Lanus et al. 2005; Singh 1998).

Is modafinil use unfair?

We have argued that work produced by cognitively enhanced individuals is not inauthentic. PCE may preferentially benefit those less-well-off and is not prohibitively expensive to come by, so disparities in efficacy and purchasing power cannot ground allegations of unfairness. Barriers to access deriving from the controlled status of PCEs are genuinely problematic and should be revisited, but do not affect the poor or vulnerable more than others; indeed the effects may be stronger for those most in need of them. The use of PCEs, at least for short term use of modafinil, is associated with such low risk that it seems much closer to the ‘napping’ scenario than the ‘antisocial working hours’ scenario. Perceived levels of coercion seem to be modest, and although there have been rare reports of significant adverse reactions for modafinil, the health risks involved are not so high that they justify a ban on paternalistic grounds. Such a ban would set the bar very high indeed, and many activities we do not wish to ban (e.g. high levels of caffeine consumption) would fail to clear it. We argue that these considerations fail to show that the advantage purveyed by modafinil use is unfair. We now turn to two arguments that persuade us that modafinil use should not be considered cheating.

The importance of academic outcomes

There are strong reasons to maximize the production of useful knowledge, and these reasons are relevant to the question of how knowledge is to be pursued. Knowledge contributes to meaning and success everywhere, enabling its possessor to adapt to novel situations and to improve upon old ones. Plato and Aristotle viewed education as fundamental to the achievement of a virtuous life, and thus, to the functioning of society. As Hirsch has pointed out, ‘[g]iving everybody more knowledge makes everybody more competent, and creates a more just society, benefitting everyone (quoted in Roth 2014, p.179). This statement has since been empirically verified. Research demonstrates that education improves health, political participation, and income, as well as reducing crime, recidivism, family problems, mortality, and inequality (Abdullah et al. 2015; Behrman and Stacey 1997; Lochner 2011). Knowledge is, in the lingo of economics, a global public good with a host of positive externalities (Stiglitz 1999).

The role of academic institutions is intimately tied to the production and dissemination of knowledge. In his discussion of the topic, Lewis quotes Josiah Royce, the American idealist philosopher: ‘The modern University has as its highest business, to which all else is subordinate, the organization and the advance of learning’ (Lewis 2006, 41). An important part of this role is the training of future professionals and citizens. Here is Thomas Jefferson on the key objectives of his newly founded University of Virginia:

To form statesmen, legislators and judges; to expound on principles of government; harmonize agriculture and commerce; develop reasoning facilities of our youth; And,

generally to form them to habits of reflection and correct action, rendering them examples of virtue to others, and of happiness within themselves. (quoted in Roth 2014, 27)

The knowledge produced by academia enriches our experience but it also saves and improves lives. In addition, improvements in cognitive functions lead to economic and social benefits for society (Beddington et al. 2008).

On the other hand, academia may be viewed as a competitive arena in which contestants strive to distinguish themselves and earn attractive positions in society. A good education may serve as a status symbol or stepping stone for selective careers, which often discriminate between applicants based on their academic record. The number of prizes, grants, honors, and faculty positions are limited, which leads to intense pressure to outperform one's peers. Seen in this light, we understand why authenticity is valued so highly, and practices that are clear instances of cheating such as plagiarism are punished so harshly – they misrepresent the academic potential of the perpetrator, assigning credit to some factor beyond their abilities, causing the distribution of coveted positions to shift away from the meritocratic standard on which it is supposed to be based.

We suspect that those who consider PCE to be cheating have this latter aspect of academia in mind. They may believe that the use, by others, of a motivation-enhancing chemical which they do not themselves wish to make use of, may place the unenhanced at an unjustified disadvantage in the race for academic accomplishments and accolades. This point of view is easy to empathize with. When he was a high school student, the first author was similarly struck by the fact that some of his classmates had access to professors as private tutors whereas others were never taught the importance of time management, social, physical and mental discipline, nor the importance of perseverance and extra-curricular reading.

But there is an important, yet underexplored, dimension to the issue of distributive justice. In fact, there is some evidence that PCEs may most benefit those that have the greatest need. For example, some studies have found a greater effect of modafinil and methylphenidate in lower-IQ participants (del Campo et al. 2013; Finke et al. 2010; Mehta, Sahakian, and Robbins 2001; Randall, Shneerson, and File 2005). Those starting from a lower baseline of dopamine and noradrenaline may experience more of an effect from modafinil, whereas those that start from a high baseline may have less to gain. If this is the case, broad access to modafinil and similar PCEs could lead to less inequality in cognitive capacity. In addition, qualitative work has found that students who have the greatest problems with exam anxiety and procrastination are also the ones most likely to use PCE (Sattler et al. 2014). Some of these students might rely on these drugs to finish their education.

At any rate, fair access is more easily achieved in the case of cognitive enhancement by modafinil than in the cases of cognitive enhancement by private tutors, expensive private schools, after-school activities, or the luxury to have enough time to attend to enhancement by habits such as meditation and physical exercise. If we do not wish to ban these practices on the grounds of inequality of access, we would be inconsistent in doing so for modafinil alone. To be clear, we are not

arguing that, simply because unfair inequalities are already accepted, other methods with a less unequal distribution are automatically justified. Rather, we point to the under-appreciated fact that modafinil use could decrease the gap between those advantaged by circumstance and those that have been less lucky. Indeed, it appears to be one of the most cost-effective ways to do so.

We conclude that the competitive aspect of academia does not provide sufficient grounds for considering PCE cheating; that the primary purpose of academia is the production and dissemination of knowledge and the improvement of cognitive function; that the furtherance of said knowledge and capacities are of vast importance for society; and that these considerations morally outweigh concerns about competitive disadvantage even if academia were viewed as a primarily competitive enterprise.

Is there a morally significant difference between PCE and other methods of cognitive enhancement?

If modafinil is to be considered cheating, it must differ in a morally significant way from other methods of cognitive enhancement which are not viewed as cheating. We consider a difference to be morally relevant if there are moral reasons – based upon considerations of autonomy, well-being or interests of agents – that justify the disanalogy between modafinil and the rest of accepted methods of cognitive enhancement. In this section we examine some candidate differences, arguing that they all apply to at least one accepted and morally uncontroversial method of cognitive enhancement.

Modafinil is a prescription drug that comes in the form of pills. In contrast, knowledge obtained in the lecture hall or by reading a book seems to be more ‘natural’. There is something intuitively appealing about partitioning the world into natural and unnatural domains – with big, chemical factories that produce PCE being a good example of the latter. Michael Sandel has argued along these lines in the context of enhanced athletes: ‘The real problem with genetically altered athletes is that they corrupt athletic competition as a human activity that honors the cultivation and display of natural talents’ (Sandel 2007). Could something similar be argued for cognitive enhancement using modafinil in the academic context?

Yet, we are ordinarily not bothered by artificial means to achievement. Indoor lighting, corrective lenses, the internet, textbooks, and other educational aids are no more natural than modafinil and other methods of PCE. None of them are found in nature, and all of them require significant human intervention to produce. Besides, the natural course of things is not always to be preferred. It is perfectly natural for newborns and mothers to die during childbirth, or for anyone to die of malaria. Indeed, the whole of medicine has been described as ‘the comprehensive attempt to frustrate the course of nature’ (Harris 1985, 38). Labelling something as unnatural says nothing about whether it is ethical or not, to be preferred or to be avoided.

Modafinil could be different in that there is limited access to it; currently it is only obtainable via a prescription, the internet, or the black market. But as we said above, this situation could be remedied by offering modafinil over the counter in pharmacies, perhaps contingent on demonstrating an understanding of the risks and benefits of doing so (Dubljević 2013). And it is worth reminding that problems of inequitable access apply to many other methods of academic enhancement. Very few people can afford to hire private tutors or personal assistants, attend expensive summer schools, and purchase all the study or lab materials from which they could benefit.

One might think that modafinil is special because it is invasive. Unlike a book, modafinil must be ingested in some way for it to have an effect. Once ingested, the effect is transient and largely irreversible, and directly affects the brain. However, nutrition is equally invasive, and has also been shown to affect cognitive function (Northstone et al. 2012). More generally, any method of impacting cognition must by necessity be reflected at the level of the brain. Meditation, for example, is associated with structural changes in the brain (Fox et al. 2014).

Caffeine in coffee and tea may be ingested in a drink or pill form. As with caffeine, the effects of modafinil appear to be partially mediated by dopamine and norepinephrine, two neurotransmitters that have many other functions in the brain (Volkow et al. 2009), but *any* intervention that affects the brain will be associated with changes in neurotransmitters, neural connectivity or both.

We might think that modafinil is unique in having safety risks. Short-term use of modafinil appears to be safe. As we discussed above, modafinil and other PCEs will have some side effects, but all methods of cognitive enhancements come with unwanted attendant effects. Private tutoring, for example, is expensive both in terms of time and money. Caffeine overdose has adverse physical effects. As noted above, the health consequences of PCEs depend in part on how they are used. If a cognitively enhanced individual uses his enhanced concentration to finish his tasks early so that he has time to go for a run and socialize with friends, the net effects on health are likely to be beneficial.

Another possibility is that PCE is special because its effects occur without the need for further action. That is, all one must do is swallow a pill for it to work; one does not have to spend hours in the gym or meditating. But, crucially, PCE itself does not impart knowledge. A scholar using PCEs must still read, discuss, and think to gain knowledge; it is just that the scholar will be slightly better at concentrating and remembering what was learned. Similarly, the beneficial effects of a private tutor raise the amount or quality of knowledge that can be gained from the same level of input, rather than directly conveying more knowledge.

Conclusion

Drugs used to provide improvement of cognitive functioning have been shown to be effective in healthy individuals. These drugs have small to moderate effects on various aspects of cognitive function as well as task-related motivation and

enjoyment. They are used for a variety of reasons, including to make boring tasks more enjoyable, increase the length of time for which students and academics can focus, and to combat jetlag and sleep deprivation, but also to achieve a better work/life balance. It is sometimes assumed that the use of these drugs constitutes cheating when used in an academic context. This may be motivated by a fear that they are dangerous, unfairly distributed or unnatural, or that they undermine authenticity and effort. However, these considerations fail to show that modafinil use should be considered cheating and banned on these grounds. The available literature does not indicate that there is a significant perception of coercion to use modafinil amongst students, and the medical risks are not so severe as to justify a ban on paternalistic grounds. Modafinil cannot be distinguished in an ethically meaningful way from other ethically permissible and widely used methods of cognitive enhancement on the grounds examined in this paper. Finally, modafinil does not confer an unfair advantage. It would be perfectly consistent with this analysis to hold that PCE is problematic on the grounds of inequality, if one were also willing to hold that private schools, gymnasiums and sports teams, meditation, and benefitting from extraordinarily talented teachers are all problematic on the same grounds. In the absence of this conviction, there are no grounds that justify viewing PCE and only PCE as cheating. Such a view would be arbitrary or inconsistent and would undermine the legitimate goals of academia for no good reason.

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