Chapter 10
Cognitive Enhancement – To What End?

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Abstract If human enhancement consists in the making of better humans, then we obviously need to have some idea of what "better" humans would be like and in what respect they would be "better." However, it can easily be shown that what counts as better is in fact highly context-dependent, so that there is no universal measure for human improvement. Cognitive enhancement is usually justified as boosting performance, but whether it is desirable for people to perform better very much depends on what they are getting better at, what end the improvement serves, and who benefits from it. Even an enhancement for an alleged "common good" can be, all things considered, highly undesirable.

Keywords Cognitive enhancement • Human improvement • Happiness • Freedom • Common good

In 1998, the eminent molecular biologist and Nobel laureate James Watson challenged critics of non-therapeutic human germ line interventions by posing the rhetorical question: "If we could make better human beings by knowing how to add genes, why shouldn't we do it?"[1] Indeed, why shouldn't we? Put like this, it seems decidedly irrational to object. Almost by definition, there cannot be anything wrong with making better human beings. How can it possibly be wrong to create something that is *better*? Thus to suggest that an enhancement could be bad, seems like a contradiction in terms. If it were bad it wouldn't be an enhancement. Perhaps we don't know how to make better humans yet, but that is a purely practical problem,

[1] Engineering the Human Germline, Symposium at UCLA, 20 March 1998.

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which doesn't affect the desirability of the general project. Perhaps it will turn out that "adding genes" does not have the desired effect, but again that doesn't mean that we shouldn't at least try. The question is, if we *knew* how to improve our nature and *knew* that it was safe to do so (that it had no detrimental side effects), then why should we not do it? The answer seems to be obvious: there is no such reason. In the absence of any negative side effects, human enhancement is necessarily good and hence desirable.

Let us call this position *meliorism* (Caplan 2006). Watson's question is, of course, designed to silence critics of meliorism by making them appear irrational and foolish. But in fact the question conceals at least three problems. The first problem is the assumption that the only knowledge we need in order to realize the meliorist programme is *technical* in nature. It is assumed that we already know the end, we all agree on the desirability of that end and that we only need to discover the appropriate means for achieving it. Perhaps we don't know yet how to make better humans, but we *do* know what being a better human would consist in. But the question is, do we really?

The second problem concerns the attitude which the question endorses. Even if we accept that humans can be more or less good, and that better humans are imaginable than the ones we have now, it is not obvious that striving to *make* better humans is a good thing (cf. Hauskeller 2011).

The third problem arises from the question of how we can *acquire* the technical knowledge that is needed to perform human enhancements safely and with precision. Given that we know what we want, how do we figure out how we get what we want? And can we justify what we need to do in order to find out?

10.1 What Does "Better" Mean in a Human?

While the two last problems are certainly in need of thorough reflection, in this paper I'm only going to address the first problem concerning the notion of "better" human beings. Talking about "making *better* human beings" implies that humans are not only different from each other, but that there are better and worse ways of being human. It only makes sense to speak of better humans if there are, at least theoretically, good humans and not-so-good humans. This means that there must be some standard by which to measure the quality of a human. But is there? And if there is, what might this standard be? When a car company promises to "make better cars" we have a fairly good idea of what they have in mind: cars that are safer, more comfortable, more economical, or more elegant. But even with cars, what you regard as better depends on what you regard as important in a car. Whether you think that Japanese cars are better than German cars or the other way around depends on your personal preferences. Perhaps Japanese cars are more economical and German cars are safer. It would be futile, though, to argue about which car is better as such, that is, *as a car*. That would only be possible if cars had one and only one purpose or function, for instance to get us from one place to another as fast as possible without

leaving the ground. If that were the case we would all have to agree that, if car A is faster than car B, then car A is the better car. Yet even cars have more than one purpose. What we expect of a car is not always the same.

However, cars are at least purpose-built, so it is not unreasonable to ask what constitutes a good car (and hence, what constitutes a "better" car). Humans, on the other hand, are not purpose-built, at least not yet, and if we cannot even agree on what makes a good car, it seems highly unlikely that we will be able to agree about what makes a good human being. Watson himself had high hopes that through genetic intervention we may finally get rid of "stupid children" and "ugly girls."[2] So, according to Watson, making better humans would involve making humans generally more intelligent and more beautiful. Others may think that being a morally good person is more important and would not regard anything as an improvement that does not also improve our willingness to act morally. Some will argue that, on the contrary, as long as we adhere to old-fashioned moral ideals, which are nothing but prejudices, we will never be truly advanced. Some will say that it doesn't matter either way, because the only thing that *really* matters is whether or not we are happy. Better humans will be happier humans, and the best humans would be those who get the maximum amount of pleasure for as long as possible. This last suggestion is actually intuitively the most plausible of them all, since it can be argued that if there is one thing by which all so-called enhancements can be judged, it must be happiness. It is, after all, the one thing that appears to be intrinsically valuable, whereas everything else that we value is either valuable as a means to the end of happiness or not valuable at all.

Happiness or human well-being, however, depends on many factors and it is not at all obvious what we need to change in human beings to increase their happiness or at least the likelihood of their being happy. Will it help to provide smart drugs for children and students, cosmetic surgery, or performance-enhancing drugs that make us faster, stronger, and generally more skillful? The Oxford philosopher and leading transhumanist Nick Bostrom suggests that there are three areas where real enhancement is possible. The first is the extension of life in good health, which, Bostrom believes, everyone desires if they are honest (Bostrom 2008). The second is the refinement of our cognitive abilities: our intelligence, our memory, our alertness. The third is the enhancement of our emotions, "eagerly sought by many." It is obvious though that enhancement in the last two areas cannot just consist in having "more." It is quite obvious that having a vastly improved memory can easily become a burden. Who would want to remember every single detail of their lives, who always register every single detail? And rightly so, because such a memory can seriously hamper one's ability for abstract thinking and adequate functioning in a social environment (Luria 1987). And being very intelligent also is not always a blessing. Recent studies have shown that the higher the IQ of a child at the age of 8 is, the more likely it is that she will suffer from depressive symptoms during puberty from the age of 13 onwards (persisting in males even beyond the age of 17)

[2]DNA. British Documentary, 2003.

(Glaser et al. 2011). That is probably not what one wishes one's child to go through. And what about emotions? Should we be less aggressive, more loving? Will that always be a good thing? Will it make us happier or just shallower? Or perhaps we should transform ourselves in such a way that we generally have deeper emotions, that we feel more intensely. But that wouldn't work either, because sometimes we wish for less intensity (to feel anger, envy, or pain more intensely does not seem to be generally desirable).

A popular solution to these ambiguities is to see the real improvement in an extension of human freedom. Emotional enhancement is then understood as increasing the ability to *control* one's emotions (Bostrom 2005), and memory enhancement as increasing the ability to "remember important things when you want to" (Savulescu 2001, 420). Those abilities are considered to be "general purpose means," which are useful for any plan of life (Buchanan et al. 2000, 167; Savulescu 2001). So it seems that a better human being is one that has more control over things: what they feel, what they remember, when they die (it is argued that if immortality begins to get burdensome we can always kill ourselves). So being enhanced means basically having more *control* over one's life (by means of gaining more control over one's body and mind). Control is a good thing, the best short of the happiness that it will ensure. But is that really so? Is control always good? There are reasons to doubt that. It is quite obvious that the attempt to gain control over a thing is sometimes self-defeating. Seeking to acquire control cannot work because of the nature of what is sought to be controlled. Memories, for instance, strike me as one of those things. Our memories are an essential part of our personal identity, which cannot exist in a moment, cut off from the past and the future, but necessarily stretch back in time to incorporate the life that we have lived. We know who we are by means of the memories we have. If we lose our memory we lose the context that defines what we are. This is shown nicely in Michel Gondry's film *Eternal Sunshine of the Spotless Mind*, which is about memory erasure and how this affects the lives of those who undergo it. By voluntarily erasing their memories of each other the two protagonists destroy an important part of their identity. Likewise, in Christopher Nolan's *Memento* the main protagonist Leonard who suffers from anterograde amnesia is literally a nobody who, because of his condition, is incapable of entering into the various human relationships that make up our lives: genuine love, hate, friendship, or enmity, seem no longer possible without memories. Memories are clearly enormously important because they hold our lives together by connecting our present selves to our past selves, and this would no longer be the case once we had *control* over our memories. Once we can choose what we want to remember and what to forget, the connection has been severed, and our identity has in effect also become subject to choice (our own choice, but possibly also the choice of others). Control over them turns memories into fictions, and when our memories are fictitious our lives are too. In other words, controlled memories are not memories at all.

Like memories, emotions are by their very nature uncontrollable. An emotion that we could fully control would no longer be an emotion, because having an emotion means *being moved* by something – something that is beyond our control.

It is precisely for this reason that emotions connect us to the world; that they make things real for us. Thus having an emotion does not mean making ourselves move, or causing ourselves to be moved. But if that is correct, then we cannot possibly be in control of our emotions. If we can choose to be happy or to be sad at will, then happiness and sadness become fabrications that have lost touch with reality. Perhaps that is also true for other things, such as happiness itself. If it is, i.e., if a certain lack of control is a requirement of happiness, then making better humans in the sense of happier humans is downright impossible.

10.2 Cognitive Enhancement

Let us now have a closer look at what is normally referred to as cognitive enhancement. Cognitive enhancements are, roughly put, all interventions that, through the manipulation of the human brain, improve the human knowledge situation by facilitating or accelerating knowledge acquisition, processing, storage, application, or range. We can distinguish between pharmaceutical, neurotechnological, and genetic means of enhancement. While the latter is still largely science fiction, at least as far as humans are concerned, pharmaceutical and neurotechnological enhancement devices are already being used. Ritalin, which was initially prescribed to treat ADHD, or modafinil (designed to treat narcolepsy) are now widely used to enhance concentration and wakefulness (which appears to be useful for many cognitive tasks). Other drugs such as Dexedrine® or Adderall® can be used to similar effect. Beta-blockers, which reduce anxiety, and mood enhancers, such as the anti-depressant drug Prozac®, can also be understood as cognitive enhancers in a wider sense in so far as they make it easier for people to adhere to their tasks and to use their cognitive faculties effectively. Happier and less angst-ridden people are more likely to be alert and to perform well. In any case, the primary purpose of both pharmaceutical cognitive enhancers and mood enhancers in terms of their actual *usage* is the same, namely, to boost performance and thus to enhance productivity. This is actually the very reason why they are considered enhancements in the first place. So it is not because Ritalin® improves our ability to concentrate that we see it as an enhancement drug, but rather because by means of improving our ability to concentrate, it allows us to *perform better* in situations that involve the completion of certain cognitive tasks. Only in relation to the task which is meant to be performed can the effected change in a person's abilities be seen as an enhancement. In other words, we have become better (if we have), not as human beings, but as performers of a certain task or pursuers of a certain goal. We may have chosen this goal for ourselves, or it may have been imposed on us. Either way, whether we think that the enhancement is desirable, ultimately depends (or should depend) on whether or not we think that the task is worth performing, the goal worth pursuing. That an intervention helps someone to perform better is in itself not a good reason to support and endorse the intervention. We always need to ask what a better performance in a specific context is *good* for, and of course also,

for *whom* it is good. (Sometimes a better performance may only be good for the profits of pharmaceutical companies.) Often, it will increase our chances to compete with others, which might be good for the individual, but not necessarily in the long term interests of the community in which the individual lives, and for the individual only if she happens to live in a competitive society. If the guiding principle were not competition, but, say, cooperation, the situation might be very different, so that other performance requirements would hold. Generally speaking, what counts as cognitive enhancement is highly context-dependent. It depends on what someone wants or what the goal is. This is why forgetting can be as much an enhancement as remembering, high intelligence as much as low intelligence. This is quite obvious when you look at the intervention from the perspective of the individual and with regard to their desire, not to perform well, but to be reasonably happy. Thus having an artificial hippocampus that boosts memory capacity need not be a blessing at all. It may equally well be experienced as a burden. And whether a drug that partially erases (or dampens) one's memory is an enhancement or not, depends on so many aspects of the situation that we can only decide the question by focusing on particular aspects and ignoring others. Thus, if we suffer from the haunting memory of a traumatic experience, a drug that helps us forget may be seen as an enhancer, and the successful, chemically induced forgetting as an enhancement – but only if we ignore everything else and look only at the specific suffering that has now disappeared. If, instead, we took into account the inevitable distortion of our self-image and our relation to reality, we would perhaps be more hesitant to call the effected change, all things considered, an enhancement. But perhaps we are not interested in the perspective of the individual at all but want to base our assessment on the consequences an intervention has for society as a whole. In that case, too, we may come to the conclusion that we would all be better off if we were less intelligent and remembered less.

We may also want to take into account what people are actually going to do with improved cognitive abilities. Very often we find descriptions of already-available or merely envisaged cognitive enhancement technologies, both in the popular media and in scientific journals, informed by the assumption that those technologies will eventually be used to benefit humanity. Fairly common are statements such as the following from an article that appeared 3 years ago in *Time Magazine* (Szalavitz 2009): "Indeed, it would be hard to argue against promoting the use of an intelligence enhancer if it were risk-free and available to everyone. Imagine a legion of cancer researchers on smart drugs, racing toward a cure. Or how about a better class of Wall Street executives, blessed with improved thinking and wiser judgment?" That would be nice indeed. Unfortunately, it is not a very likely scenario. Legions of extremely smart cancer researchers racing toward a cure? Far too good to be true. Wise Wall Street Executives? Sounds more like a contradiction in terms. It seems far more likely that the latter will use their improved brains to find even more effective ways to amass wealth, and the former may also feel that they have got far better

things to do than spending all their time and energy on finding a cure for cancer. The assumption that improved cognitive abilities will naturally be used for the common good is hardly convincing. It ignores human selfishness, which we have no reason to believe is less common or less articulated among the more intelligent than it is among the cognitively less fortunate. That is why the philosopher Julian Savulescu, one of the most prominent promoters of human enhancement in the UK, has recently demanded that research into, and development of cognitive enhancement be complemented by an exploration of the possibility "of biomedical means of *moral* enhancement" (Persson and Savulescu 2010). According to Persson and Savulescu, "biomedical moral enhancement, were it feasible, would be the most important biomedical enhancement. Without moral enhancement, other techniques of biomedical enhancement seem likely to increase global injustice" (S. 12). And not only that: it would also make the world a far more dangerous place, with super smart terrorists being in a much better position to successfully follow through on their evil schemes. And because it is so important, Persson and Savulescu suggest that moral enhancement be made compulsory. Interestingly, this last statement has prompted John Harris, who is usually in total agreement with Savulescu, to write a surprisingly sharp response, in which he basically attacks Savulescu and his co-author for their lack of trust in the self-purifying power of cognitive enhancement and, of course, for their apparent willingness to sacrifice human freedom for more security (Harris 2011). The argument between Savulescu and Harris shows nicely how what we are willing to regard as an enhancement does not merely depend on the overall context, but also on the value system that we happen to endorse. If we value human freedom more than anything else, then we will see certain changes as enhancements that we would not regard as enhancements if we valued security more. However, even if we are pretty clear about our values, the essential contextuality of every concrete biomedical intervention, cognitive or otherwise, makes it difficult, perhaps impossible, to decide once and for all whether an intervention should, ultimately, count as an enhancement or not. If I value individual freedom, I should, it seems, welcome interventions that help me and others get more control over our lives. But the trouble is that whatever manipulation of my body, including my brain, helps me gain more control, is likely to be usable by others to gain more control over *me*. As C.S. Lewis pointed out more than 50 years ago (Lewis 1955, 68–70), every power that "we" acquire is a power that can equally well be used against us (just think of the atomic bomb). If we can construct brain-computer interfaces that, say, allow army pilots to control their machines by thought alone, then the possibility of manipulating the soldiers' minds directly by means of the same device is never far away – not to mention the danger of allowing people to set in motion deadly devices by a purely mental act, which may make killing other human beings even easier than it already is. None of this is probably in the interest of the individual. Is it in the interest of society instead? Is it, as some have argued, for the common good? And if it were, would that make it permissible or even desirable?

10.3 Enhancement for the Common Good?[3]

In a paper published last year in AJOB Neuroscience (Vedder and Klaming 2010), Anton Vedder and Laura Klaming (both work at the Tilburg Law School) argue that the neurotechnological improvement of eyewitness memory through transcranial magnetic stimulation (TMS) would be an enhancement "for the common good" and that many of the objections commonly raised against cognitive enhancement in general would cease to apply if we looked at it from the perspective of the common good rather than from that of the individual. So let's see how convincing this claim is.

Unfortunately, Vedder and Klaming say very little about what, in their view, *constitutes* the common good, except that an enhancement for the common good would be one that is "neither primarily self-regarding nor self-serving and potentially benefits society as a whole" (22). It is not immediately clear, though, what kind of enhancement should count as beneficial for society, and for what reason exactly. Nor is it clear whether and under which circumstances common good should take precedence over individual good.

Vedder and Klaming discuss the neurotechnological improvement of eyewitness memory as a paradigmatic example of an enhancement for the common good. They do not explicitly argue their case, which suggests that they believe the connection to be obvious and undeniable. However, we can reconstruct their *implicit* argument as follows:

1. Eyewitness testimony "plays an important role in the apprehension, prosecution and adjudication of criminals" because the decisions made by law enforcement officials rely heavily on it.
2. Relying on eyewitness testimony can only be justified if it can be trusted, i.e., if there is sufficient reason to believe that it is accurate.
3. The accuracy of an eyewitness's testimony depends on the accuracy of her memory, which, however, is notoriously malleable and hence unreliable.
4. Therefore, any means of improving the accuracy of memory is desirable with respect to the purpose of apprehending, prosecuting and adjudicating criminals.
5. Since it is in everybody's interest that criminals are found out and get convicted (and innocents do not), improving eyewitness memory is therefore beneficial for all of us (except perhaps for criminals), that is, for society as a whole.

The crucial step of this argument is of course the last one, where the interests of a particular societal subgroup (i.e., law enforcement officials) are identified with the interests of society as a whole. The problem with this step is that there are all sorts of possible technical and legal innovations that appear good for law enforcement

[3] A version of this last section has already been published as Hauskeller (2010).

officials (the police, prosecutors, lawyers and judges) by allowing them "to do a better job" (22), but which we would be very hesitant to regard as good for society as a whole.

Thus, it would arguably be a lot easier to apprehend and convict criminals if the doings of all citizens and visitors were permanently monitored by the police. For the sake of the common good, we should therefore strive to make state surveillance as widespread and thorough as possible. "Enhanced interrogation techniques" no doubt also help the police and prosecutors do a better job, as does the practice of detaining suspects without trial for as long as needed to ascertain their guilt or innocence. In general, individual legal rights often present an obstacle to law enforcement, which makes it appear immensely desirable to be permitted to suspend them. Although all these measures are clearly in the interest of law enforcement, and all upright citizens presumably have an interest in seeing the law enforced, many people would still disagree with the proposition that they are all "for the common good." This indicates that there must be something wrong with Vedder and Klaming's reasoning. The fault lies in the assumption that just because we all share a certain interest (e.g. that crime be prevented), we must also have a derivative interest in whatever serves that first interest. The reason why this is not so is that we have, in fact, various interests, which cannot all be fully satisfied because they are, to a certain extent, mutually exclusive. We may have a strong interest in being protected from crime, but we also have a strong interest in having our privacy and autonomy respected. (It's again the conflict between the value of security and the value of freedom that I pointed out earlier.) However, since we cannot be *fully* protected from crime without accepting a drastic infringement on our privacy and autonomy, the best we can hope for is a compromise that allows *both* interests to be satisfied to the greatest possible extent. Thus we can never infer from the fact that one of our interests is served by a particular practice that this practice is for the common good, i.e., in our own best interest, unless we know for certain that none of our other interests are violated or threatened by it. For the common good is nothing if not the individual good of all people.

Although Vedder and Klaming concede that "the protection of privacy and autonomy of individuals seems important" (22), they leave open whether eyewitness memory improvement by means of TMS should be made mandatory or remain voluntary, i.e., whether or not we should allow eye witnesses to refuse the enhancement – and this despite the fact that admittedly TMS may cause "unpredictable responses such as unwanted or even traumatic memories" (ibid.), which is surely not in the interest of the witness. The authors' willingness even to *consider* forcing people, in the name of the common good, to undergo a treatment that is not entirely without risks, shows clearly enough how dangerous it can be to adopt the perspective of a presumed 'common good' that Vedder and Klaming recommend we *always* adopt when we look at "cognitive enhancement in general" (ibid.). There is a tendency here to view the common good as something absolute that exists irrespective of what is good for the individuals concerned, that is more important than the latter, and that, therefore, occasionally requires that the merely individual good be sacrificed.

Now, if that is not regarded as entirely out of the question with respect to innocent bystanders of a crime, it would appear that we are even more justified to make sure that law enforcement is assisted as best as possible when we know or suspect that the witness was not innocent at all, but in fact actively involved in committing the crime. When Vedder and Klaming highlight the importance of accurate eyewitness testimony, they disregard the fact that eyewitness reports are often unreliable not because the witness forgot what really happened, but rather because they, for one reason or another, choose to *lie* about it. In that case, memory enhancement would do nothing to secure greater accuracy. Instead, we would need to apply some kind of truth serum. (That truth serums have proved unreliable in the past is of no account because, first, we may develop better ones in future, and second, because TMS is, according to Vedder and Klaming, not entirely reliable either.) After the Mumbai massacre in November 2008, in which more than 170 people died, Indian officials were planning to use such a truth serum on the sole surviving gunman, Azam Amir Kasab, to make him disclose the details of the attack.[4] I don't know whether they really did, and if they did, whether they succeeded, but the point is that if we accept the argument proposed by Vedder and Klaming, then we must conclude that such a 'veracity enhancement' would clearly be for the common good and hence desirable. It also appears reasonable to say that, given the circumstances, we would be more justified to administer the drug by force. For that is what the advancement of the 'common good' seems to require. And why stop here? It is no doubt in the public interest that perpetrators are found out and punished, but surely it would even be better if they didn't commit any crimes in the first place. If that is the case, then developing and distributing a pill that prevents people from committing crimes (in accordance with Savulescu's suggestions for moral enhancement) would clearly be an enhancement for the common good in Vedder and Klaming's sense.

Now I'm not saying that improving eyewitness memory in the way proposed by Vedder and Klaming is such a bad thing. Perhaps it is, and perhaps it isn't. What I'm worried about is the *argument* that the authors use to support their claim that the use of TMS would be an "enhancement for the common good," and the *suggestion* that we generally look at enhancement proposals from a "common good perspective." Any notion of common good that is worth its salt must be informed by what is good for the individual, and the connection must always be born in mind and properly considered. The concession that even common good enhancements must always be voluntary is not sufficient. Once memory enhancement (TMS), veracity enhancement (truth serums), or morality enhancement (no-crime pill) are available, it's going to be very hard to refuse them. For why would anyone refuse to assist the law, unless they got something to hide?

[4] *Scientific American*, 4 December 2008.

References

Bostrom N (2005) In defense of posthuman dignity. Bioethics 19(3):202–214
Bostrom N (2008) Why I want to be a posthuman when I grow up. In: Gordijn B, Chadwick R (eds) Medical enhancement and posthumanity. Springer, Dordrecht, pp 107–136
Buchanan A, Brock DW, Daniels N, Wikler D (2000) From chance to choice. Cambridge University Press, Cambridge
Caplan A (2006) Is it wrong to try to improve human nature? In: Miller P, Wilsdon J (eds) Better humans? The politics for human enhancement and life extension. Demos, London, pp 31–39
Glaser B et al (2011) Age- and puberty-dependent association between IQ score in early childhood and depressive symptoms in adolescence. Psychol Med 41:333–343
Harris J (2011) Moral enhancement and freedom. Bioethics 25(2):102–111
Hauskeller M (2010) Human enhancement and the common good. AJOB Neurosci 1(3):37–39
Hauskeller M (2011) Human enhancement and the giftedness of life. Philos Pap 40(1):55–79
Lewis CS (1955) The abolition of man. Macmillan, New York
Luria AR (1987) The mind of a mnemonist. Harvard University Press, Cambridge, MA
Persson I, Savulescu J (2010) Moral transhumanism. J Med Philos 35(6):656–669
Savulescu J (2001) Procreative beneficence: why we should select the best children. Bioethics 15(5–6):413–426
Szalavitz M (2009) Popping smart pills: the case for cognitive enhancement. TIME Magazine, 6.1.09
Vedder A, Klaming L (2010) Human enhancement for the common good: using neurotechnologies to improve eyewitness memories. AJOB Neurosci 1(3):22–33