Enhancing Human Capacities
Edited by
Julian Savulescu, Ruud ter Meulen and Guy Kahane

“This is clearly the most comprehensive and best collection on human enhancement. It provides needed clarification of both the relevant science and the ethical and policy issues – an indispensable contribution to the debates.”
Dan W. Brock, Harvard Medical School

Human enhancement is one of the most exciting – and troubling – areas of recent scientific advances. It raises new and profound challenges relating to the human condition as well as giving rise to serious questions surrounding the limits and ethics of changing human nature.

This stimulating volume is the first to review the very latest scientific developments in human enhancement. It is unique in its examination of the ethical and policy implications of these technologies from a broad range of perspectives, including philosophy, the biological and neurosciences, and the social sciences. The book covers all major forms of human enhancement: cognitive, mood, physical, moral and life extension, as well as general conceptual and ethical questions about enhancement.

Enhancing Human Capacities includes state-of-the-art science on the science of enhancement from different perspectives, ethical discussion of key concepts and questions, and concrete policy applications. The book concludes with general discussions of the policy implications of the enhancement technologies, as well as concrete policy recommendations for European and US contexts. All contributions are by world-leading ethicists, neuroscientists, and social scientists from Europe and North America.
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Preface

Guy Kahane, Julian Savulescu,
and Ruud ter Meulen

The rise of modern science and technology has radically transformed the relation between human beings and nature. Nature, which for millennia had seemed all powerful and immutable, has suddenly become an object for control and manipulation, something that can be systematically shaped to human ends. Yet throughout the dramatic upheavals of the modern era the fundamental constants of human nature—human mortality, a shared repertoire of emotions and moods, a range of basic perceptual and intellectual capacities—remained a relatively fixed reference point that could bridge cultural and ideological differences. But in recent decades, radical advances in genetics and the neurosciences, and in computing and other forms of technology, raise the possibility that we are on the brink of a further revolution, this time not in our relation to the natural world, but in our relation to ourselves. Our bodies, even our feelings, thoughts, and intellectual capacities, are also gradually entering the sphere of scientific control and manipulation. And as the scientific understanding of the biology of aging increases, some even begin to envisage technologies that would dramatically slow down, even stop, the aging process. It appears that soon we will be able to radically enhance human capacities well beyond the normal range. In some circles, there is even talk about an approaching post-human era, a prospect that is horrifying to many, but enticing to others.

Some aspects of this silent revolution are already around us, in the form of antidepressants and other drugs that control mood and attention, performance-enhancing drugs illicitly used by athletes, or cosmetic surgery to correct the results of the genetic lottery or to conceal the effects of aging. Others are only in early stages of speculative research: mind–machine interfaces, or neuropharmaceuticals that reduce aggression and increase cooperation. The use of pills to “brighten” mood, and the widespread diagnosis of controversial and pharmacologically treatable new psychiatric conditions such as attention deficit disorder, are putting in question the traditional conception of medicine as concerned only with the treatment and cure of disease. Traditional notions of human nature, normality and flourishing seem increasingly inadequate. Proponents of enhancement see these as positive developments. They argue that it is high time that we used biomedical science, not only to fight disease, but also to positively enhance human capacities and well-being. But opponents of enhancement see these developments as a grave threat to what is most dear in human life. These contrasting hopes and fears have already generated intense controversy.
A look back at similar disputes about past scientific and technological advances reveals that many past fears and hopes were deeply misguided or exaggerated. The real dangers were often overlooked, and the real benefits often misunderstood. If we are not to repeat this error, it is important that we set the debate on the right track. We will not find sound answers through armchair prophecy. Instead, the debate needs to be informed by detailed and accurate knowledge of the relevant science and its limits – an understanding of what is feasible and practicable, and what really is just science fiction – as well as by a clear view of the relevant concepts and values. It cannot, for example, be simply assumed that ethical conceptions and principles that have served us well in the past will be useful guides in this uncharted territory.

This volume, we hope, will contribute to setting the debate about human enhancement on the right path. It aims to offer a comprehensive view of the latest scientific developments in human enhancement, and a wide range of perspectives on its ethical significance. The chapters in this volume represent a diverse range of perspectives from several disciplines. Some focus on philosophical discussion of fundamental concepts, others engage in ethical analysis and argument. Others review the very latest empirical research in biology, neuroscience, and the social sciences, and attempt to predict future developments. Then others try to offer concrete policy prescriptions.

The first part of this volume discusses key concepts and issues about enhancement, and is followed by parts focusing on the main categories of enhancement: cognitive, mood, and physical enhancement, lifespan extension, and, finally, moral enhancement. Except for the short section on moral enhancement, each of these sections begins with an introductory chapter that surveys the current state of the science and introduces some of the main conceptual and ethical issues, and ends with a chapter on the policy implications of that form of enhancement. The book ends with two chapters examining the general policy issues raised by human enhancement in the United States and European Union contexts.

**Part I: Key Concepts and Questions**

The chapters in this section attempt to clarify general issues in the debate about enhancement. What is meant by “enhancement”? Is it a descriptive or normative concept? What is its relation to human flourishing and well-being? The chapters also clarify the role of the concepts of nature and autonomy in current thinking on enhancement, and examine the ways our understanding of evolution might affect our attitude to human nature and its modification.

**Part II: Cognitive Enhancement**

Cognitive enhancement involves increasing human cognitive capacities: intelligence, memory, and attention. Such “upgrading” of our brains can be achieved using neuropharmacology or genetic intervention, but also through participation large-scale networking, not to mention “traditional” education. The chapters in this section
review the latest scientific advances in cognitive enhancement, and examine its possible benefits and risks, both in terms of individual well-being and the broader social impact.

**Part III: Mood Enhancement**

The widespread use of Prozac and other antidepressants, not to mention various forms of recreational drugs, is by now a familiar aspect of contemporary life. Do such drugs rob people of authenticity or do they rather enable their true selves to shine through? Might they corrupt our ability to properly appreciate the darker aspects of life? Chapters in this section also highlight the way mood enhancement raises questions about the proper goals of medicine, and about the viability of the treatment/enhancement distinction.

**Part IV: Physical Enhancement**

Radical forms of physical enhancement allowing humans to radically augment their physical abilities are already available – and extremely controversial. In certain forms they have been banned in sport, but it’s assumed they are nevertheless being used by some athletes. The chapters in this section ask whether this ban on “doping” in sports is justified. Is there a useful line to draw between permissible forms of physical enhancement and forms of it that amount to cheating? Does physical enhancement really contravene the “ethos” of sport?

**Part V: Lifespan Extension**

Reflection on mortality has been central to philosophy since its inception. Some philosophers have taken the limit imposed by death to be a fundamental source of meaning. But, at least in Western societies, the human lifespan is already far longer than that of our distant ancestors, and as science advances, it is no longer unthinkable that we might be able to radically slow, or even stop, the aging process. But if we could live for hundreds of years, would our present identity survive – and if not, how could this be a benefit to us, as we are now? And even if our selves could survive into the far future, wouldn’t this eventually lead to unbearable boredom? The possibility of radical lifespan extension thus raises profound questions about the value and meaning of life itself.

**Part VI: Moral Enhancement**

An area of enhancement that is vital but so far largely neglected in the current debate is the prospect of moral enhancement: using scientific means to increase the precious but frail human capacity to engage in moral behavior. Is this aim even coherent? Would, for example, pharmacologically induced altruism amount to genuine moral behavior or only to artificial mimicry of true morality? Indeed, given the urgent global crises facing
humanity, and the biologically limited human capacity for altruism and empathy, might moral enhancement be our most urgent task?

Part VII: General Policy

The volume ends with general discussions of legal and policy issues in the U.S. and European context. How should one deal with enhancements in a European context, with different cultures and diverse legislations in the various European Member States? Does the European Union have any role in the regulation of enhancement, or should it be left to the Member States? Do we need new regulations or new policy bodies to develop public policies on enhancement? What kind of normative framework should guide such public policies? Who should be involved in the development of such a framework and what could be the role of public deliberation in policy development?
Part I

Key Concepts and Questions
Well-Being and Enhancement

Julian Savulescu, Anders Sandberg, and Guy Kahane

Many chapters in this volume review current and future possibilities for enhancing human physical ability, cognition, mood, and lifespan. These possibilities raise the ethical question of whether we should enhance normal human capacities in these ways. We are not likely to agree on answers to this question without a clear and shared understanding of the concept of enhancement. The aim of this chapter is to offer such an account of enhancement. We begin by reviewing a number of suggested accounts of enhancement, and point to their shortcomings. We identify two key senses of “enhancement”: functional enhancement, the enhancement of some capacity or power (e.g. vision, intelligence, health) and human enhancement, the enhancement of a human being’s life. The latter notion, we suggest, is the notion of enhancement most relevant to ethical debate. We argue that it is best understood in welfarist terms. We will then illustrate this welfarist approach to enhancement by applying it to the case of cognitive enhancement.

Definitions of Enhancement

Although there is much debate about the ethical implications of new technologies, only a few authors have attempted to provide an explicit definition of enhancement. Often discussion focuses on a particular application such as muscle strength, memory or lifespan, or a definition of enhancement is implicitly assumed. However, without an adequate shared understanding of what is meant by “enhancement,” we are not likely to resolve these debates and reach sound ethical conclusions.

The sociological pragmatic approach

In the literature there is a great deal of uncertainty and confusion about the term “enhancement.” Erik Parens (1998) states that:

… some participants think the term enhancement is so freighted with erroneous assumptions and so ripe for abuse that we ought not even to use it. My sense is that if we didn’t use enhancement, we would end up with another term with similar problems.
He then continues by using the term as a focus for a discussion of the goals of medicine and society. A similar pragmatic approach is taken by Paul Root Wolpe (2002) who also states that enhancement is a slippery socially constructed concept: “Yet, ultimately, any exclusive enhancement definition must fail, in part because concepts such as disease, normalcy, and health are significantly culturally and historically bound, and thus the result of negotiated values.” Likewise, he then turns to discuss issues of reimbursement, public policy, and normative behavior. James Canton (2002) stresses the relativism inherent in such an approach:

The future may hold different definitions of human enhancement that affect culture, intelligence, memory, physical performance, even longevity. Different cultures will define human performance based on their social and political values. It is for our nation to define these values and chart the future of human performance.

This approach is broadly social and pragmatic: Enhancement captures a certain historically and culturally specific value-laden domain of discourse related to human performance rather than having a substantive transcultural independent meaning. The sociological pragmatic approach describes how particular social groups delineate and value (or disvalue) various technological advances. It is less helpful when we want to ask whether these valuations are valid. This account merely tells us that, for example, some cultures or groups value intelligence more than others.

The ideological approach

Another superficially similar approach is to avoid defining the term at all. This move is made both by proponents and opponents of enhancement. Typically a list of technologies or enhancement goals are stated and the field is defined or marked by them (Kass, 2003; Naam 2005). For example, the President’s Council on Bioethics delineates the domain of discourse, after stating the problems of definition and the smooth blending between therapy and enhancement, as one related to human desires and goals. As stated by Kass: “The human meaning and moral assessment must be tackled directly; they are unlikely to be settled by the term ‘enhancement,’ any more than they are by the nature of the technological intervention itself.”

This approach differs from the sociological pragmatic approach by aiming directly at deep values, invoking concepts of metaphysics or spirituality. It is an ideological approach: A set of often controversial values are applied to a range of possible technological advances, and these are directly classified as morally wholesome or problematic. Thus the ideological approach offers a range of specific and contentious value claims but no general conceptual framework for thinking about enhancement.

The “not-medicine” approach: treatment vs. enhancement

Another influential approach has been to define enhancement in terms of going beyond health-restoring treatment or health. Eric T. Juengst (1998) defines it as: “The term enhancement is usually used in bioethics to characterize interventions designed to improve human form or functioning beyond what is necessary to sustain or restore good health.”
Edmund D. Pellegrino (2004) uses a similar definition just for the purpose of arguing against enhancement on the grounds that it goes beyond medicine as a healing enterprise:

...my operating definition of enhancement will be grounded in its general etymological meaning, i.e., to increase, intensify, raise up, exalt, heighten, or magnify. Each of these terms carries the connotation of going “beyond” what exists at some moment, whether it is a certain state of affairs, a bodily function or trait, or a general limitation built into human nature... For this discussion, enhancement will signify an intervention that goes beyond the ends of medicine as they traditionally have been held.

One problem with this approach is that the definition of medicine and treatment itself is contested. Even a maximally inclusive definition such as medicine being the “science and art of diagnosing, treating, curing, and preventing disease, relieving pain, and improving and preserving health” (McKechnie, 1961) still leaves us to define disease and health, equally complex terms (Smith, 2002). For example, Robert Freitas Jr. (1999) reviews nine disease concepts (disease relativism, statistical disease, disease idealism, functional failure, and so forth), and if enhancement is defined as going beyond preventing disease/improving health, this will give us nine different enhancement concepts. The not-medicine approach is thus indeterminate. Indeed, there is some doubt whether it is even possible to draw a consistent and useful distinction between treatment and enhancement.

It is worth mentioning, however, one influential view of disease – Christopher Boorse’s (1975) “species-typical functioning” account. By determining the natural functional organization of members of a species it is possible to create a normal function model, which should be, according to Daniels (2000), the standard of functioning a society has an obligation to help reach. This model has been employed influentially by Norman Daniels in addressing enhancement (Sabin & Daniels, 1994). On this view, disease is defined as:

**Normal species-functioning conception of disease**: Any state of a person’s biology or psychology which reduces species-typical normal functioning below some statistically defined level.

And enhancement can be thus defined as improvement in human functioning that goes beyond what is needed for medical treatment:

**Normal species-functioning definition of enhancement**: Any change in the biology or psychology of a person which increases species-typical normal functioning above some statistically defined level.

For example, low intelligence is defined as intellectual disability and treated as a disease when Intelligence Quotient (IQ) falls below 70. On this species-functioning or naturalistic conception of disease and enhancement, raising someone’s IQ from 60 to 70 is treating a disease and raising someone’s IQ from 70 to 80 is enhancement.

On a normal distribution of function, about 2.5% of the population will have a disease. Improvements in function of the other 97.5% counts as enhancement. For example, the bottom 2.5% of hearing counts as deafness. The other 97.5% of people are counted as...
having “normal hearing” even though those at the bottom of that distribution will have impairments in hearing almost identical to those classified as “deaf.” But they fell on the wrong side of the statistical line to be eligible for “medical treatment.” Improving their hearing, even if they hear very little at all, would, on this view, be an enhancement.

The functional approach

A related fourth approach is the functional approach. Rather than avoiding defining enhancement or mainly seeing it as not-medicine, it is defined in terms of enhanced functions of various kinds (whether cognitive function generally or vision or hearing more narrowly).

The archetypal example of this approach is Douglas C. Engelbart’s (1962) *Augmenting Human Intellect*: “By ‘augmenting human intellect’ we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems.”

Here, cognitive enhancement is defined simply in terms of improved general information-processing abilities. The difference from the Daniels’ approach is that no weight need be given to some level of normal, species-typical functioning which would determine whether some manipulation is to count as treatment or enhancement. On this view, any increase in IQ or hearing could count as an enhancement.

The Welfarist Account of Human Enhancement

Enhancement of what?

Enhancement is, indeed, a wide concept. In the broadest sense, it means “increase” or “improvement.” For example, a doctor may *enhance* his patient’s chance of survival by giving the patient a drug. Or a doctor may enhance the functioning of a person’s immune system or memory – enhancement in the functional sense. These are no doubt enhancements of a sort – enhancements in an attributive sense. But enhancing a permanently unconscious person’s chance of surviving might not be good for the person. It might not constitute human enhancement. It might not enhance intrinsic good – or good in a predicative sense.

As the example of life extension shows, these two senses of enhancement can come apart. Consider memory. Genetic memory enhancement has been demonstrated in rats and mice. In normal animals during maturation expression of the NR2B subunit of the NMDA receptor is gradually replaced with expression of the NR2A subunit, something that may be linked to less brain plasticity in adult animals. Tang *et al.* (1999) modified mice to overexpress NR2B. The NR2B mice (commonly known as the “Doogie” mouse) demonstrated improved memory performance, both in terms of acquisition and retention. This included unlearning of fear conditioning, which is believed to be due to learning a secondary memory (Falls, Miserendino, & Davis 1992). The modification also made them more sensitive to certain forms of pain, showing a potentially nontrivial trade-off (Wei *et al*., 2002). It is possible that even though memory is improved, their lives are worse.
The term human enhancement is itself ambiguous. It might mean enhancement of functioning as a member of the species *homo sapiens*. This would be a functional definition. But when we are considering human enhancement, we are considering improvement of the person’s life. The improvement is some change in state of the person – biological or psychological – which is good. Which changes are good depends on the value we are seeking to promote or maximize. In the context of human enhancement, the value immediately in question is the goodness of a person’s life, that is, his or her well-being.

The welfarist definition

These reflections suggest a fifth possible definition of human enhancement:

**Welfarist definition of human enhancement**: Any change in the biology or psychology of a person which increases the chances of leading a good life in the relevant set of circumstances.

In line with the welfarist definition of enhancement, we can classify states of a person as *enhancing* or *advantageous states* or *abilities*:

Any state of a person’s biology or psychology which increases the chance of leading a good life in the relevant set of circumstances.

And similarly define contrary *disadvantageous states* or *disabilities*:

Any state of a person’s biology or psychology which decreases the chance of leading a good life in the relevant set of circumstances (Kahane & Savulescu, 2009).

This account of enhancement makes no use of the distinction between medical treatment and enhancement. On this view, any increase in IQ could count as enhancement – so long as it tends to increase a person’s well-being. But, contrary both to the species-functioning and functional approaches, in contexts where increase in IQ is not beneficial to some person, such increase would not count as an enhancement, even if it raises the person to (or well beyond) the level of normal functioning, that is, even if it were a functional enhancement.

Unlike the sociological pragmatic and functional approaches, the welfarist account is inherently normative. It ties enhancement to the value of well-being. Unlike the ideological approach, however, it offers a general framework for thinking about enhancement. It offers more than a mere list of value claims. It singles out well-being as one dimension of value that is constitutive of genuine human enhancement. But it leaves open substantive and contentious questions about the nature of well-being, and important empirical questions about the impact of some treatment on well-being. Moreover, whereas the ideological approach only offers us all-things-considered value judgments about various treatments, the welfarist approach distinguishes ways in which some treatment might benefit a person from other relevant values, such as justice. It thus allows us to say that although some treatment is an enhancement (i.e. contributes to individuals’ well-being), it might nevertheless be bad overall, because its employment in the current social context will lead to far greater injustice.
On the welfarist account, common medical treatments are enhancements, or more precisely, a subclass of enhancements, and diseases are best seen as a subclass of disabilities or disadvantageous states.

Folk usage of the term enhancement supports this account (Pellegrino in fact gestures towards this definition in his account). According to the *Oxford English Dictionary*:

**Enhancement**

The action or process of enhancement: the fact of being enhanced

**Enhance**

to raise in degree, heighten, intensify (qualities, states, powers, etc.)
to raise (prices, value)
to raise or increase in price, value, importance, attractiveness, etc.
(Formerly used simply, = “to increase in price or value”; esp. to raise the intrinsic value of (coin). Also (rarely) = “to increase in attractiveness”, to beautify, improve.)

The spirit of all these definitions is that to enhance is to increase value. In the context of human enhancement, to enhance is to increase the value of a person’s life. This notion is best captured by the welfarist account. Henceforth, we will refer to human enhancement simply as enhancement for brevity’s sake.

Subclasses of enhancements

Enhancements include different kinds of improvements:

1. Medical treatment of disease.
2. Increasing natural human potential – Increasing a person’s own natural endowments of capabilities within the range typical of the species *homo sapiens*, e.g. raising a person’s IQ from 100 to 140.
3. Superhuman enhancements (sometimes called posthuman or transhuman) – Increasing a person’s capabilities beyond the range typical for the species *homo sapiens*, e.g. giving humans bat sonar or the capacity to read minds.

By accepting the welfarist definition of enhancement, the question of when should we enhance becomes: when should we increase human well-being?

One of the advantages of a welfarist account of enhancement is that it reframes existing debates in a more productive manner. The ideological approach is really a debate about what constitutes a good life and resistance to enhancement is often not really resistance to enhancement *per se*, but resistance to accepting an overly narrow or mistaken conception of human well-being.

**Applying the Welfarist Account:**

**The Case of Cognitive Ability**

**Expected value**

An intervention constitutes an enhancement when it is expected to increase the chances of a person leading a good life. It is important to recognize that something expected to
increase the chances of leading a good life may, in a probabilistic world, not result in a
good life. Those born with the greatest gifts and talents may squander them while those
born to great biological and social hardship may overcome enormous obstacles to lead
the best of lives.

The term “expected” thus does not mean “will.” It is a technical term taken from
decision theory. The expected value of an outcome is the value of that outcome
multiplied by the probability of it occurring. In the debate around enhancement, the
outcome of value is a person’s life and how well it goes.

This approach derives from decision theory. The standard way of making decisions
under uncertainty is to choose that option which maximizes expected value. While this
may not be the way we make decisions all the time in ordinary life, it is one standard
norm of rationality for how an ideal agent who has no computational limitations should
make decisions. In general terms, the expected value of adopting any course of action
can be given by:

\[ \text{Pr}(\text{good outcome given that course taken}) \times V(\text{good outcome}) + \text{Pr}(\text{other outcomes given that course taken}) \times V(\text{other outcomes}). \]

We often use this approach in a rough and ready way in everyday decisions. Consider a person trying to decide whether to buy a house or rent. The decision will
usually be made by weighing the pros and cons, how bad these are and how likely they
are. She needs to know how far each residence is likely to be from work, schools,
friends and amenities. She needs to know how big the house and land of each are
likely to be, and the quality of each. And of course she needs to know the cost of each
both in the short term and long term, and how this will affect her financial position
overall.

This approach can be formalized. The golfer Tiger Woods is reputed to have had laser
surgery to give him better than 20/20 vision. Imagine someone like Woods, a
professional golfer wanting to win the British Open, but who is also knowledgeable
about decision theory. He is trying to decide whether to have laser surgery to give 20/
20 vision. The following figures are purely hypothetical.

Assume that without surgery, his life will go very well and he will win many golf
tournaments. If 1 is the perfect life, his life overall will be of value 0.96. If he has laser
surgery, he will win slightly more tournaments. His life will be slightly better (0.97).
However, there is a risk (1/1000) that the surgery will damage his eyesight and he will
win slightly fewer tournaments and his life will go slightly less well (0.95):

The expected value of life without surgery is 0.96
The expected value of life with surgery = \( V(\text{life, given successful surgery}) \)
\[ \times \text{Pr}(\text{surgery successful}) + V(\text{life, given unsuccessful surgery}) \]
\[ \times \text{Pr}(\text{surgery unsuccessful}) \]
\[ = 0.97 \times 999/1000 + 0.95 \times 1/1000 \]
\[ = 0.96998 \]

Even though the benefits of surgery are small, it is rational to have the surgery given its
risks are also very small. As the probability of harm rises, or it becomes more serious,
there is less reason to opt for surgery.
Dimensions of well-being

Whether, on the welfarist account, something counts as a human enhancement depends on how we understand the notion of well-being. There are various theories of well-being: hedonistic, desire-fulfillment, objective list theories (Griffin, 1986; Parfit, 1984). According to hedonistic theories, what matters is the quality of our experiences, for example, that we experience pleasure. According to desire-fulfillment theories, what matters is the degree to which our desires are satisfied. According to objective list theories, certain activities are good for people, such as achieving worthwhile things, possessing dignity, having children and raising them, gaining knowledge of the world, developing talents, appreciating beautiful things, and so on.

As an example, consider cognitive enhancement, such as improvement of memory. Improving memory is, by definition, a form of functional enhancement. But is cognitive enhancement also a human enhancement? The answer to the question lies in the answer to the question: Is cognitive enhancement likely to lead to a better life, to a life with more well-being?

It is clear enough how enhancing human cognition is likely to increase human well-being. First, cognitive capacities are the required for deployment of any kind of instrumental rationality – the capacity to reliably identify means to one’s ends and projects. Better cognition means better access to information about one’s surroundings and about one’s own biology and psychology, as well as better abilities to use this information in rational planning. Persons need to exercise instrumental rationality in order to obtain pleasure and avoid pain, in order to fulfill their desires, and in order to realize objective goods. So cognitive enhancement should promote well-being on all major theories of well-being.

Second, on some views of well-being certain cognitive capacities are necessary conditions for a good life. For example, on a Millian view of pleasure, forms of pleasure that do not involve the exercise of sophisticated cognitive abilities have less value. Persons with greater cognitive capacities will have access to higher hence more valuable pleasures. Human beings with cognitive capacities far beyond those available to existing people may thus have access to far higher pleasures than those accessible to existing humans. Similarly, Mill placed great value on the power of “vivid imagination” to decide which of two pleasures is more valuable, when we are unable to experience both. Such imaginative powers require complex cognition involving memory, logical inference, and other higher order faculties.

Similar remarks apply to objective theories that emphasize the value of knowledge and achievement. Persons with low cognitive capacities will, on objective views, be able to achieve only moderate levels of well-being even if they lead healthy and happy lives. Only cognitive enhancement will offer them access to the greater objective goods which require sophisticated cognition. The same will be true to a lesser extent of most human beings with normal cognitive capacities. Most people cannot fully grasp the intricacies of quantum mechanics or enjoy complete appreciation of the highest aesthetic achievements of human culture. Some great objective goods are now accessible only to a few.

Although improvement of cognitive ability is a major form of enhancement in all of these ways, it is partly an empirical question whether human beings with great cognitive capacities actually successfully use them to promote their well-being. It is a common