
**EUROPEAN PARLIAMENT**

***Science and Technology Options Assessment***

**S T O A**

# HUMAN ENHANCEMENT

## STUDY

**(IP/A/STOA/FWC/2005-28/SC35, 41 & 45)**

**IPOL/A/STOA/2007-13** **PE 417.483**


DIRECTORATE GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY

SCIENCE AND TECHNOLOGY OPTIONS ASSESSMENT

# HUMAN ENHANCEMENT

## STUDY

**Abstract**

The study attempts to bridge the gap between visions on human enhancement (HE) and the relevant technoscientific developments. It outlines possible strategies of how to deal with HE in a European context, identifying a reasoned pro-enhancement approach, a reasoned restrictive approach and a case-by-case approach as viable options for the EU. The authors propose setting up a European body (temporary committee or working group) for the development of a normative framework that guides the formulation of EU policies on HE.

IP/A/STOA/FWC/2005-28/SC35, 41 & 45 May 2009

PE 417.483 EN

This project was carried out by the Institute for Technology Assessment and Systems Analysis (ITAS), Research Centre Karlsruhe, and the Rathenau Institute, as members of the European Technology Assessment Group (ETAG). It was commissioned under specific contracts IP/A/STOA/FWC/2005-28/SC35, 41 & 45.

## AUTHORS

Mr Christopher COENEN (ITAS)
Ms Mirjam SCHUIJFF (Rathenau Institute)
Ms Martijntje SMITS (Rathenau Institute)
Mr Pim KLAASSEN (University of Amsterdam)
Mr Leonhard HENNEN (ITAS)
Mr Michael RADER (ITAS)
Mr Gregor WOLBRING (University of Calgary)

## RESPONSIBLE ADMINISTRATOR

Mr Theodoros KARAPIPERIS
Policy Department A: Economic and Scientific Policy
DG Internal Policies
European Parliament
Rue Wiertz 60 - ATR 00K070
B-1047 Brussels
E-mail: theodoros.karapiperis@europarl.europa.eu

## LINGUISTIC VERSIONS

Original: EN

## ABOUT THE EDITOR

To contact STOA or to subscribe to its newsletter please write to:
poldep-stoa@europarl.europa.eu

Manuscript completed in May 2009.


This document is available on the Internet at:
http://www.europarl.europa.eu/stoa/default_en.htm

## DISCLAIMER

# CONTENTS

# EXECUTIVE SUMMARY

The umbrella term "human enhancement" refers to a wide range of existing, emerging and visionary technologies, including pharmaceutical products: neuroimplants that provide replacement sight or other artificial senses, drugs that boost brain power, human germline engineering and existing reproductive technologies, nutritional supplements, new brain stimulation technologies to alleviate suffering and control mood, gene doping in sports, cosmetic surgery, growth hormones for children of short stature, anti-ageing medication, and highly sophisticated prosthetic applications that may provide specialised sensory input or mechanical output. All these technologies signal the blurring of boundaries between restorative therapy and interventions that aim to bring about improvements extending beyond such therapy. As most of them stem from the medical realm, they can boost societal tendencies of medicalisation when increasingly used to treat non-pathological conditions.

In the present study, we do not rely on the still widespread conceptual distinction between "therapy" and "enhancement", but instead, in line with recent political statements on the issue, adopt a notion of human enhancement that includes non-therapeutic as well as some therapeutic measures. Defining human enhancement, for heuristic and politically pragmatic reasons, as any "modification aimed at improving individual human performance and brought about by science-based or technology-based interventions in the human body", we distinguish between (i) restorative or preventive, non-enhancing interventions, (ii) therapeutic enhancements, and (iii) non-therapeutic enhancements. We view human enhancement primarily as offering a specific perspective on developments in science, technology, medicine and society. The effects of human enhancement technologies (HET) can be either long term or even permanent (as in the case of genetic enhancements), or temporary (such as improved concentration levels brought about by drugs). The aim may be to improve our natural abilities (for example by making us stronger or happier) or to give us characteristics or abilities that no human being has ever possessed before, such as full night vision, or even extra senses.

The phenomenon of human enhancement shows a Janus face: on the one hand, there are a range of technoscientific developments, and of social and individual demands and desires that often appear in themselves to be highly relevant from an ethical or political point of view, yet also interact in a way that can be said to amount to a tendency towards an "enhancement society". On the other hand, the convergence of technologies and of the related visions of human enhancement is actively driven forward by a number of social groups and networks in science, technology and research policy, among them a couple of key players in these fields.

Faced with the often highly visionary and strongly ideological character of the debate on human enhancement, one must strive for a balance between advancing a rational discussion through critical analysis of the relevant visions and normative stances, and taking a close look at the diversity of HET and their actual social, technological and political significance.

The present study is a systematic attempt to bridge the gap between, on the one hand, the visions and their cultural and ideological aspects, and, on the other hand, the technoscientific developments in question and their social aspects and implications.

The tension between these two faces of the human enhancement topic is maintained throughout the study. It neither relies on views that discard the issue (and with it many of the technologies in question) on account of its speculative features, nor does it intermingle fantasies and vision with real or emerging developments in a way that hinders rational discussion and misleads policy-makers and the public.

Accordingly, instances of the use of existing or emerging technologies for non-therapeutic human enhancement are presented and discussed in some detail, with the goal of separating the hype and far-flung visions from the actual state of the art and realistic expectations. In general, one can say that the great majority of HET discussed in the debate on human enhancement are still therapeutic, and do not offer their users significant advantages over "non-enhanced" humans; indeed, the level of improvement is often well below the level of normal function. However, there are also strong indications that more and more effective means of non-therapeutic enhancement will be developed in the near future, and that some existing lines of research and development already have the potential to significantly alter human corporeality and cognition. Visions of human enhancement that are, for example, based on neurotechnologies which might allow for super-human performance or species-untypical abilities still have no real basis in research development, but the technologies in question show the potential to fundamentally change man-machine interrelations in the foreseeable future. Furthermore, there is still scarce evidence to prove the existence of effective, non-therapeutic cognitive pharmaceutical enhancers, especially if one compares them with traditional and modern non-technological and non-pharmaceutical means of improving or maintaining cognitive functioning; what is more, the results of the scant pertinent research are to some extent inconsistent. Only if we look at drugs that were developed to treat diseases and are now also used under conditions of sleep deprivation or stress do we find some evidence of performance enhancement in healthy individuals. However, these decreased conditions are more similar to a disease than to a state of well-being, and pharmaceutical cognitive enhancers in these cases are mainly used to counter the effects of the unhealthy behaviour that caused the deficits. Moreover, evidence of these drug uses does not exclusively show improvements, and some of the improvements are very short-lived and minor. On the other hand, many experts and studies agree that it is highly probable that more effective and safer pharmaceutical cognitive enhancers will be developed in the near future. If the development of medication for healthy people to improve cognitive performance were allowed, more targeted research would most probably boost this trend. In any case, it is safe to say that a side effect of the fast-growing research and development into pharmaceuticals for age-related neurodegenerative diseases will be a number of new drugs which can be used for the enhancement of performance of young, healthy people.

If one takes a closer look at certain segments of the discourse on human enhancement (e.g. gene doping, designer babies, use of drugs for cognitive enhancement, and mood enhancement by means of brain implants) and the involved technologies, it becomes obvious that these diverse cases all share certain characteristics.

They all relate, for example, to ideas that push back the boundaries of medical and scientific research. All the research on which these technologies are based stretches the known limitations of the scientific disciplines. Furthermore, novel applications for new technologies can be developed for derivative purposes other than those for which the technology was originally designed. Moreover, many HET have the potential to increase the incidence of currently illegal practices, and all raise questions of distributive justice now or in the future. They often throw up questions about fundamental cultural values and tend to challenge our view of what it means to be human. More pressing are concerns regarding the costs of the technologies in question, the unintended (side-) effects, the desirability of the social changes they will precede, and the acceptability of medical tourism benefitting from highly specialised medical or enhancement tourism.

The study outlines and discusses possible general strategies of how to deal with the topic of human enhancement and HET in a European context, rejecting a total ban and a *laissez-faire* approach as inappropriate, and identifying a reasoned pro-enhancement approach, a reasoned restrictive approach, and a systematic case-by-case approach as viable options for the EU. However, like all the experts we consulted, we hold that a strategic positioning of the EU with regard to the topic of human enhancement needs in any case to be based on a normative framework which does not yet exist. The development of such a framework should take into account those dimensions – not of "human nature" (a contested subject) but of the human condition – that we tend to consider fundamental to our self-respect and mutual cooperation.

As demonstrated in this study, human enhancement issues are not just academic: the technologies and trends involved can have both beneficial and adverse effects on several kinds of political domain, provide opportunities for individuals and for society, present new risks, create new needs and social demands, and challenge crucial cultural notions, social concepts and views of the human condition.

Currently however, the EU has no platform for monitoring and discussing human enhancement issues. Arenas are lacking where the normative issues can be politically deliberated and the gap between the needs and the concerns of the broader public and the practitioners and experts bridged. We believe that such a platform should be created on the basis of a critical vision of the phenomenon of human enhancement.

How could the EU initiate and politically organise a broader deliberation on human enhancement issues? What form could EU involvement in human enhancement issues take?

The essence of our proposal is to set up a European body for the development of a normative framework for human enhancement that guides the formulation of EU policies in this field. For the establishment of such a body, we see two institutional options, both of which have been chosen in the past for human genetics and genetic testing. The European Parliament could decide to set up a temporary committee. Alternatively the European Commission could decide to install a working group in which members of the European Parliament participate. In any case, the involvement of the European Parliament in such a body would be highly desirable in order to strengthen the body's intermediate and public role.

It would be the task of such a body to further explore the topic and lay the ground for possible further regulation of human enhancement issues that affect such political domains as health, research and economy in the EU. As pointed out in the present study, a wealth of resources would be available for the work of such a body, some of them generated in EU-funded projects. The primary task of the body would be to develop a normative framework for human enhancement that should be based on evaluation criteria regarding the above-mentioned dimensions of the human condition. The normative framework would help to:

- Evaluate the effectiveness and risks of the technologies in question;
- Organise a comprehensive impact assessment of human enhancement technologies (taking into account political, ethical, legal, societal, cultural, political, safety, security, and health aspects);
- Assess whether the EU should fund technologies that are potentially disruptive to the social fabric, or European cultural value systems;
- Identify further research needs on the topic of human enhancement and single human enhancement technologies;
- Define the limits within which each country can regulate human enhancement within its own boundaries;
- Prevent undesirable (side) effects of human enhancement technologies within member states and the EU as a whole;
- Prevent inequalities arising in healthcare between member states;
- Prepare the ground for a policy on the funding of human enhancement research;
- Prepare and stimulate a social dialogue on the topic of human enhancement at large.

In order to achieve these objectives, the body would have to properly monitor the current and emerging developments in HET. By doing this, it would have to establish a solid ground for discussions on normative and regulatory aspects by carefully defining the subject of its activities. It must be ensured that the work of the body is not overloaded by highly visionary or ideological thoughts and aspirations currently triggered by the term "enhancement". It should, however, monitor relevant activities, in Europe or elsewhere, in which more radical visions of human enhancement are promoted. Without neglecting possible future societal changes, one of the most prominent tasks of the body would be to focus the debate on human enhancement on emerging technologies and observable societal trends that might lead to an increased use of enhancement technologies in everyday life.

# INTRODUCTION

Science and technology continue to provide more and more means to influence human bodily functions, both mental and physical. Such forms of "human enhancement", in particular "human enhancement technologies" (HET), are being used or developed or are envisioned in several fields of applications as diverse as assistive technology for disabled people, pharmacology, military research, reproductive medicine, and sports. Human enhancement is thus a phenomenon linking a range of technologies that at first sight appear very different. There is also an ongoing political, social and ethical discussion of human enhancement. Such discussion has not only become a fashionable topic in certain circles, but the literature on it has reached a "critical mass" (Selgelid 2009), qualifying it as a major topic of ethical research. The distinction between therapy and human enhancement is usually part of the arguments for or against allowing technological intervention in the human body or mind. Therapy is often defined as the attempt to restore a certain condition (e.g. normality, sanity, health), whereas human enhancement is regarded as transcending these boundaries. These issues have been discussed for some time now, mainly from the perspective of bioethics and with regard to doping, the non-therapeutic use of drugs and cosmetic surgery (cf. Parens 1998b).

Recently, however, advanced and visionary HET, based on new and emerging neuro-technologies, information and communication technologies (ICT) and other areas of research and development (R&D), have attracted strong public, political and academic attention. Some have even argued that with the emergence of so-called "second-stage" enhancement technologies (Khushf 2005; see Sect. 1.1.3) and the related visions we have entered "a new era of global bioethics" (Cole-Turner 2006, 1). In any case, the international discussion on human enhancement received a strong impetus from the release of the semi-official report "Converging Technologies for Improving Human Performance" (2002) on nanotechnology, biotechnology, information technology and cognitive science (NBIC) by the National Science Foundation and the Department of Commerce in the United States (Roco/Bainbridge 2002). In this debate on nanotechnology and "converging technologies" (CT), the enhancement of human performance was promoted as an aim of research, with particular regard to actual and visionary second-stage enhancements (e.g. by ICT implants) that may fundamentally alter human physical and cognitive functions (see for this debate: Andler et al. 2008; Coenen 2009; TAB 2008). Here we encounter the combination of a focus on the technological enhancement of individuals and somewhat technocratic ideas about how to steer societies and cultures.

### *Human Enhancement Technologies*

A short look at several technoscientific developments and their social relevance can provide an impression of how HET may change our societies and challenge our established systems and political decision making.

The first concerns the illicit use of Ritalin™ by students, scientists, workers and others who wish to improve their concentration. Ritalin™, a drug prescribed to treat attention-deficit hyperactivity disorder (ADHD), has been found to be able to promote concentration in both ADHD patients and in others. It has been labelled a "universal performance enhancer" because enhanced concentration is known to benefit any cognitive task.

And there are also a number of other drugs apart from Ritalin™ that appear to have the potential to promote wakefulness, e.g. modafinil, developed to treat narcolepsy. They promise to allow us to study, work and "party" much longer than usual, and possibly even to be more productive.

Secondly, many people use various anti-depressants to improve their mood. Around 3-5% of males and 8-10% of females are diagnosed with depression every year in North America (Kessler et al. 2000; Murphy et al. 2005), and one in eight adult Americans takes mood-brightening agents (PCB, 240), regardless of whether they suffer from severe long-term depression or not. It is not clear how much of this trend is due to a rise in the incidence of depression and how much to an increased readiness of people to use medication. In the future, it might be possible to pursue "mood enhancement" not only by taking pills but also with the aid of devices. A brain implant technique called deep brain stimulation is already being used to treat the symptoms of Parkinson's disease and has been used experimentally to alleviate severe depression. It could conceivably improve the mood of healthy people as well, and has already been presented as a spectacular case of "push-button happiness" in the mass media. Other, non-invasive devices such as transcranial magnetic stimulation that are currently being studied as treatment for depression and other psychiatric disorders might have beneficial effects on the mood of non-patients, too.

Other new technologies targeting the brain can be found in the field of brain-computer interfaces (BCI). BCI devices are being tested in various applications, such as those intended to enable paraplegics to control computers. Other BCI technologies undergoing trials for use in computer games might lead to enhanced human abilities to interact with "virtual" surroundings. In the U.S., the developments in this field have led to far-reaching visions of pilots controlling their machines "by thought alone". A number of different emerging BCI seem to offer real promise of merging "virtual worlds" and "real life" in the not too distant future. These and other potential HET are often studied or envisioned in the military context.

Genetic engineering can lead to genetic enhancement. Scientists have already succeeded in creating a genetically modified super mouse which is much stronger than other mice. Other examples are cosmetic plastic surgery, treatments claimed to be "anti-ageing" and the illicit use of performance-enhancing drugs in sports (colloquially known as "doping").

Finally, limb prostheses and exoskeletons already under development offer the potential of improving human functioning beyond what is typical of our species. Lifting heavy objects will become much easier if we can improve our musculature or use an exoskeleton to help us.

Some prostheses already let their users achieve performance (e.g. in mountaineering) that is impossible for humans with ordinary bodies (such as extending their legs to cross wide crevasses). And prostheses for daily use as well as new sport prostheses, such as those used by the South African sprinter Oscar Pistorius who tried to qualify for the 2008 Olympic Games with two artificial lower legs (Wolbring 2008a), are becoming increasingly sophisticated.

***Human Enhancement – The Debate***

The phenomenon of human enhancement is a highly contested issue. On the one hand, the participants of the debate assess the prospects of HET and even the actual state of R&D in such technologies very differently. On the other hand, their views on the acceptability and desirability of human enhancement widely diverge.

These debates on HET and the visions of their impact raise fundamental questions concerning our views of the human condition and corporeality as well as of the future of our societies. Moreover, several ongoing R&D processes confront the boundaries between the grown and the made, the natural and the artificial. And broader changes concerning the societal role of medicine and the health system, such as the tendencies toward medicalisation and commercialisation, apparently further the trend toward human enhancement.

Arguably, the most ardent supporter of HET is the "transhumanist movement", which has achieved a remarkable degree of influence in academic debates on ethics and also in political discussions in the course of this decade to the extent of being a driving force or avant-garde. The debate on human enhancement is still strongly influenced by extreme positions, which are sometimes denoted as transhumanism versus bioconservatism. It is important to notice that, in large parts, these lines of conflict and the related arguments date back at least to the first half of the twentieth century. What we are dealing with here is an often overlooked but influential and consistent ideology of extreme progress, whose ideas about the future culminate in visions of a posthumanist civilisation in outer space, and thereby advance the notion of the necessity of radical transformations of human biology (cf. e.g. Andler 2008, Appendix C, p. 14ff.). This ideology has triggered, also since the first half of the twentieth century, strong reactions by religious and secular conservatives and also by left-wing critics of scientism and some segments of our technological civilisation. The STOA project on CT concluded, in our view quite rightly, that there is a need to locate middle ground positions in this debate, as well as a need for a public arena in which the many normative issues involved can be discussed (STOA 2006). However, one must take into account that research funding and the public dialogue on these far-reaching visions ties up intellectual and material resources which might then not be available for assessing more urgent issues. A balance must thus be found between advancing a rational discussion through critical analysis of these visions and the further popularisation of the latter (Grunwald 2007; Nordmann 2007a, 2007b; Paschen et al. 2004).

There are two processes which have made human enhancement highly topical. On the one hand, there appear to be many people who want to improve their performance, their happiness, their beauty, or other features by technoscientific means. These desires and hopes are often related to broader societal tendencies and to structural features of our societies (such as the orientation toward competitiveness) that shape individual preferences in the direction of human enhancement. However, the scope of these tendencies is still unclear, and they might only be widespread in certain professions and sections of the population. On the other hand, there are numerous promoters of human enhancement who were able to create lobbying networks.

Far from being restricted to transhumanist organisations, these promoters include members and key players of the research and technology policy establishment, in particular in the U.S. (cf. Coenen 2009) and in the Anglo-Saxon world in general. They often adhere to the above-mentioned ideology of extreme progress. The development of this ideology and the influence it currently exerts are not only of academic interest, but relevant when it comes to the interrelationships between European value systems and the hopes and fears concerning our societal and technological future.

***Focus and Scope of the Report***

Given the highly visionary and ideological notions, it is obvious that the discussion of human enhancement is not straightforward. Yet beyond competing worldviews, it is characterised by conceptual diffuseness and a lack of differentiation. For example, with respect to health practice, the question is whether the distinction between human enhancement and therapy is tenable enough for policy purposes. The boundary between therapy and enhancement has never been clear cut. Is there a need to reframe the discussion? Some of the differences in the assessment of the state of the art in R&D in HET can be explained by the wide variety of definitions of human enhancement. Given the conceptual problems, there is a need for substantial efforts to develop a pragmatic notion of human enhancement and a heuristic to identify the relevant HET, both of which must be viable for handling the issue and the ongoing developments in a policy context.

We define "human enhancement" as any "modification aimed at improving individual human performance and brought about by science-based or technology-based interventions in the human body", distinguishing between (i) restorative or preventive, non-enhancing interventions, (ii) therapeutic enhancements, and (iii) non-therapeutic enhancements. We thus regard human enhancement primarily as one specific perspective on developments in science, technology, medicine and society. The effects of HET can be either long term or even permanent (as in the case of genetic enhancements), or temporary (such as the improved concentration brought about by use of drugs). The aim may be to improve our natural abilities (for example by making us stronger or happier) or to give us characteristics or abilities that no human being has ever had before, such as full night vision or flying.

Much of the discussion revolves around highly visionary ideas which evidently shape the discourse on HET and could thereby change societal views on science, technology, and their future. There are, however, developments which are of rather short-term interest, and some HET already exist and are here to stay.

They are in the focus of our report and of the policy options we discuss. We discuss various developments in several fields of R&D which are related to human enhancement, the chances and challenges (individual, medical, cultural, political etc.) that are raised by HET, and how the ongoing discourse on human enhancement change the views on human corporeality, (dis)ability, tendencies toward medicalisation, and old and new visions of individual and societal perfectibility.

The present study provides both an overview and detailed analyses of HET and the pertinent political, academic and societal debates. The main question is what is relevant enough to be dealt with in policy making. The study develops recommendations and policy options for fostering an ethically reasonable political handling of HET-related issues and contributes to creating a strategy for stimulating a broader societal and academic discourse on the topic of human enhancement.

For the European Parliament it is, as a matter of course, of major importance to learn about the reasons and options for addressing the issue of human enhancement on a European level. The role played by human enhancement in some individual strategic discussions about European R&D policies appears to be just a beginning. The ethical, societal, technological and innovative aspects of the topic are becoming increasingly important at all levels, including that of the member states.

The structure of the present report is a systematic overview of the various facets of human enhancement and human enhancement technology (HET).

We begin Chapter 1 by defining and explaining our understanding of human enhancement and related concepts (Sect. 1.1), aware that conceptual questions are of utmost importance when it comes to discussing the issue in a meaningful way, in particular in a policy context. We then present and discuss instances of existing or emerging technologies for human enhancement with a focus on non-therapeutic uses for cognitive and physical enhancement (Sect. 1.2.), and with the goal of separating the hype and far-flung visions from the actual state of the art and realistic expectations.

In Chapter 2, we return to several technoscientific developments, discussing them in more detail and with a view to their actual societal, political, and cultural significance (see Sects. 2.4 – 2.7). Moreover, we (i) present and analyse some major lines of reasoning on human enhancement (Sect. 2.1), including very visionary aspects, (ii) briefly discuss various broader societal tendencies and issues that provide the context of the debate on human enhancement (Sect. 2.2), and (iii) give some evidence of the existence of influential networks promoting human enhancement (Sect. 2.8), also pointing out features of their ideological background that appear to be relevant to an adequate understanding of the challenges that the discourse on human enhancement poses to European culture and value systems. These and other issues are also raised in the concluding section of the chapter (Sect. 2.9), where we discuss some of these challenges and relate them to other trends towards an "enhancement society".

In Chapter 3, we first outline the major lines of the debate about human enhancement at the EU level (Sect. 3.1). The focus here is on rather high-level EU statements and on EU-funded activities and research projects, in particular with regard to nanotechnology and converging technologies. It also includes pertinent opinions of the European Group on Ethics in Science and New Technologies. In a section on EU-funded projects that conduct scientific research on HET (Sect. 3.2), we concentrate on projects that were funded within the Framework Programmes (FP) for Research and Technological Development. The following section (Sect. 3.3) presents the results of the first expert meeting carried out for this study, focusing on diverse challenges to the social, (dis)ability, medical, and ethical frameworks raised by human enhancement. Specific legal and regulatory aspects of human enhancement are separately discussed in section 3.4. The aim of this discussion is to point out some of the most relevant legal aspects and to identify a number of possible starting points for regulating HET in Europe. In the last part of this chapter, we discuss some possible first steps toward a governance of human enhancement (Sect. 3.5). This discussion is based on the results of the second expert meeting carried out for this study.

We start the final chapter of the report by discussing which political and societal domains appear to be most strongly affected by the trends towards an enhancement society (Sect. 4.1). Afterwards we outline and discuss possible general strategies of how to deal with the topic of human enhancement and with HET in a European context (Sect. 4.2). Finally, we present and explicate our proposal to establish a European body to oversee human enhancement technologies, and argue that the European Parliament should play a central role in establishing such a body (Sect. 4.3).

We wish to thank the following experts, who took part in the expert meetings, for their invaluable contributions to the project (for their affiliations, see section 1.1. of the Appendices): Eva Asscher, Stuart Blume, Rafael Capurro, Damiaan Denys, Helmut Dubiel, Arianna Ferrari, Loes Gabriëls, Nine Knoers, Laurens Landeweerd, Mohammed Maarouf, Ineke Malsch, Ruud H.J. ter Meulen, Ursula Naue, An Ravelingien, Maartje Schermer, Mariken Stoutmeijer, and Clare Williams. Reinhard Heil (University of Darmstadt) carefully read and perspicaciously commented large parts of the final draft which greatly helped to improve the study. Special thanks also go to Frans Brom, Huub Dijstelbloem and Rinie van Est, our colleagues at the Rathenau Institute, for their important contributions to the design and realisation of the project.

# 1. HUMAN ENHANCEMENT TECHNOLOGIES

It was still early in the debate on human enhancement when the argument arose that conceptual clearness and knowledge about the various uses of the term "enhancement" are important for policymakers faced with the prospect of using the expression "human enhancement" as a regulatory concept (Parens 1998a, 1998b). Unfortunately, the concept has not become clearer since then. On the contrary, the growing attention paid to processes of technoscientific convergence, the highly visionary character of many recent debates on science and technology, the rise of the extremely technophile transhumanist movement, and the radicalisation of positions, e.g. considering enhancements as a "moral obligation" (Harris 2005)—all of these have further increased obfuscation. Policy-oriented knowledge about the various uses of the term "enhancement" therefore appears to be even more important now then it was in the 1990s. This is all the more challenging since, in the ongoing academic debate, human enhancement is often deemed to be not only an ethically thorny issue, but also a fuzzy concept.

An important element of the project has thus been to clarify conceptual issues in a double sense. On the one hand, the project had to register and analyse a wide variety of positions on human enhancement, the purpose of which was to improve the conceptual approach to the topic. On the other hand, the project had to identify or develop a concept of human enhancement which is viable in a policy context.

Before sketching the progress and prospects of non-therapeutic use of selected human enhancement technologies (HET), we will therefore first present some thoughts about the conceptual issues as well as our definitions of human enhancement and HET.

## 1.1 Defining Human Enhancement and Enhancement Technologies

In this section, we will present some of the results of the work that was done in the course of the project regarding conceptual issues of human enhancement and that helped to shape our definitions of human enhancement and HET (for these definitions, see below and Sect. 1.1.3).

Our review of the literature and our interpretation of the results of the two expert meetings which were carried out for this study (see Sects. 3.3, 3.5 and the Appendices) have led us to the conclusion that a suitable notion of human enhancement

- should not comprise all forms of therapy (if only because of the implications of such a conceptualisation in a health system and policy context) and should take into account that the boundaries between medical treatments and human enhancement are often blurred (for example, when a medical treatment results in an enhancement of the patient's performance, if compared to the patient's performance before occurrence of the treated injury or disease),

- should not be based on conceptualisations of normalcy, (dis)ability or health according to which people who were born with certain bodily or cognitive characteristics are deemed as having curable or incurable defects and in which the social and psychological aspects of (dis)abilities and health are ignored,

- should be meaningfully limited and therefore exclude such practices as the ordinary use of body-external technological devices, education, physical exercise, mnemonic training, and the consumption of "natural" drugs, such as coca leaves, and food (although these practices can contribute to an enhancement of performance),
- should be restricted to the enhancement of individual performance by technoscientific means, and its definition itself should not include the goals of an improvement of the species or a betterment of humanity (although these goals are of utmost importance for the interpretation of the topic of human enhancement, the pertinent debates, and the relevant ideologies).

The reasons for us to believe that a notion of human enhancement has to meet these criteria to be suitable for the ethicopolitical and the broader academic discourse on this topic are given in the following sections.

We define "human enhancement" as a modification aimed at improving individual human performance and brought about by science-based or technology-based interventions in the human body. This definition includes "strong", second-stage forms of human enhancement with long-term effective or permanent results as well as "temporary" enhancements. Because it is not related to a specific definition of health, this is a non-medical concept of human enhancement. Moreover, we distinguish between purely restorative non-enhancing therapies, therapeutic enhancements and non-therapeutic enhancements (see the chart in the next section). In section 1.1.3, our definitions of human enhancement and HET are presented in more detail.

### 1.1.1 Therapy and Enhancement

The term "enhancement" has been most often used in medicine-related bioethics in the last decade, "to characterize interventions designed to improve human form or functioning beyond what is necessary to sustain or restore good health" (Juengst 1998, 29). Leaving aside at this point questions related to the variety of established and new concepts of health (cf. Wolbring 2005 and Sect. 2.2.2), we would like to emphasise that this notion of "restoration" is still useful for the conceptualisation of human enhancement: The restoration of a previous condition after a disease or after an injury (*restitutio ad integrum*) is a concise definition of a therapy which is clearly not an enhancement (Wiesing 2008).

However, all attempts to use the therapy-enhancement distinction for delineating medical treatments from human enhancement and for restricting the latter notion to non-medical practices are problematic. Such a definition of human enhancement excludes important, if not core aspects of the whole issue.

It ignores, for example, the fact that some therapies can have intended or un-intended effects that exceed the restoration of good health (see, for example, the debate around the ultimately overturned labelling as techno doping of the artificial legs of the above-mentioned Paralympic athlete Oscar Pistorius that allow him to outperform athletes with normal legs; cf. Wolbring 2008a).

Moreover, it ignores the facts that methods which are used for clearly therapeutic interventions can sometimes also be used for purposes that have nothing at all to do with the goal of a *restitutio ad integrum* (a kind of "dual use") and that more and more physicians, for example in the field of cosmetic surgery, deliberately offer treatments which evidently do not even have the goal of *restitutio ad integrum*. Any cosmetic surgery that is not used to remedy the effects of an injury or disease should be conceived as human enhancement, even if the patients have suffered since birth from a deviation from the social ideals of beauty. While such an intervention can help these persons to lead a happier life or even to overcome grave psychological problems, it is clearly not a *restitutio ad integrum*. At least in the case of a remedy of grave psychological problems (and with regard to a wider definition of health also in the absence of such problems), such an intervention can, however, not only be medical, but also therapeutic. One has to take into account here that psychological problems are, one the one hand, related to ever-changing changing social norms and cultural values, and, on the other hand, are extremely subjective, can vary by social status, personal values and other factors that are difficult to gauge objectively.

In a health policy context, it is important to realise that to label something as human enhancement does not preclude actors in the health system from classifying the intervention as a therapeutic measure which has to be paid by insurance funds. For the development of a notion of human enhancement which is suitable for the ethicopolitical and broader academic discourse, it therefore appears to be advisable for us to distinguish between therapeutic and non-therapeutic enhancements, on the one hand, and between medical and non-medical enhancements, on the other hand. The former distinction, which has already been used in a policy document of the European Union (EU; European Commission 2008), takes into account the existence of dual-use methods as well as the fact that some therapies can have effects that amount to an enhancement. The latter reflects the fact that interventions with the goal of human enhancement can also be carried out in a non-medical context and not only by physicians.

Finally, we consider a treatment to be enhancement if it is carried out to enable someone born with a bodily characteristic which is socially often considered a defect (such as a cleft lip) to achieve a species-typical or nearly species-typical functioning. Otherwise, the enhancement of performance would be ignored, and the effects of a disease or injury would be conceptually mixed up with bodily characteristics of a person that were not caused by a disease or injury. In any case, the concept of human enhancement should not be based on any predefined notion of normalcy.

The following charts summarises the main results of our conceptual considerations and classifications so far. As presented in this chart, we do not tie the classification of interventions to the question whether they are carried out by a physician or someone else.

This takes into account the fact that a great majority of the experts who took part in the expert meetings for this study as well as large parts of the literature share the view that in medical practice the boundaries between therapy and non-therapeutic enhancement are getting increasingly blurred.

The kinds of interventions which are characterised in columns 2, 3, 4 and 5 of our chart are those which mainly cause the boundaries to be blurred. While we hope that our distinctions are sharp enough to be at least suitable for the purposes of this study, we would also like to point out that there is often a high degree of arbitrariness in distinguishing a disease from a deficit requiring therapy. This is particularly in the case of a modification or removal of a congenital bodily characteristic (see columns 3 and 4 of Chart 1). Such distinctions as to how to define a certain bodily condition frequently result from a complex interplay between medical definitions, legal frameworks, the views of the people who undergo an intervention (or carry out themselves), and the social perceptions of the bodily characteristics, behaviour, or well-being of an individual.

Chart: Therapeutic and Non-Therapeutic Interventions

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Treatment of a disease or injury with *restitutio ad integrum* | Treatment of a disease or injury with (intended or unintended) effects that exceed *restitutio ad integrum* | Modification or removal of a congenital bodily characteristic which is deemed a disease, the cause of a disease, or expected to cause a disease | Modification or removal of a congenital bodily characteristic which is perceived as undesirable | Purposeful use of therapeutic methods or medical HET for a purely non-therapeutic enhancement | Use of non-medical methods and HET for any kinds of enhancement |
| Not an Enhancement | Therapeutic Enhancement | Therapeutic Enhancement | Non-Therapeutic Enhancement | Non-Therapeutic Enhancement | Non-Therapeutic Enhancement |

One example for such a complex interplay is the difficult assessment as to the degree that a non-pathological bodily feature contributes to an individual's grave psychological problems that then may require a therapy. Moreover, there is the complicated issue of lost body function or diminished health, whether of genetic origin or not. There are huge differences. While treatments, for example, of Retinitis pigmentosa or Alzheimer's disease are clearly therapeutic, some treatments of natural age-related conditions, such as face-lifting, are obviously non-therapeutic enhancements. The therapeutic notion of restoration does not apply here, because the aim is to restore a condition which was not altered by disease or injury, but by a long-term natural process. However, in the future HET which might be used to raise the physical performance of older people to the level of younger ones will possibly be classified as therapeutic.

It has also been argued that, rather than talking about the ethics of treatment versus enhancement "as though these were categorically different things" and abandoning the treatment-enhancement distinction altogether, one should focus on particular interventions, examining the ethics of these on a case-by-case basis and pinpointing them on a continuous spectrum, "the opposites of which are different, and where it makes sense to speak in terms of degree and prototypical cases" (Selgelid 2007, 1).

In the case of technological enhancements which are based on implanted human-machine-interfaces, the specifics of technological development have to be taken into account.

Grunwald (2008) exemplifies this aspect in the following way: Assuming one succeeds in technically recreating, for instance, a sensory organ like an eye with equally good results. An artificial eye of this kind would – as is customary in technical development and production – be given a version number by its manufacturer: this would be "eye 1.0". However, version 1.0 will not be the last one, because as soon as version 1.0 has been developed and tested, engineers and physicians will be thinking of the next version: enhancement is an imperative in modern technology. Hereby, there may be entirely different directions of enhancement, for example, a reduction in costs or the service interval for eye version 1.0. Version 2.0 thus by no means has to be improved with regard to human sensory capabilities (e.g., giving night-sight ability or zoom options) – but this enhancement forms part of the spectrum of the technological imperative, as applied to eye 1.0. A technical enhancement of humans thus is revealed as a consequential step of a technical restoration of failed or deficient body functions. The transition from interventions that are restorative to those that are enhancing is a gradual one from a technical perspective and by no means revolutionary. The efficacious technological imperative necessarily leads in this field from healing to enhancing, if it is not guided normatively by arguments of a different type. Enhancement, then, has no intrinsic limits or measures but opens up an infinite space of the possible. Once a status has been achieved in enhancing humans, this does not mean that the enhancement process stops in the sense of a target being reached; rather it serves as the starting point for the next enhancement, and so on. This feature radically distinguishes healing from enhancement: healing comes to an end when the patient is healthy, while enhancement does not come to an end even if it is successful, but is driven ever onwards by the restlessness of the technological imperative.

We will return to such conceptualisations of the relationships between therapy and enhancement and their dynamics in other sections of this study. In closing this section, it should be pointed out that non-therapeutic enhancements are at the focus of our overview on HET because these enhancements are at the centre of the ethical and emerging political debate on human enhancement. However, viewed anthropologically, the second-stage enhancements, whether therapeutic or non-therapeutic, constitute the greatest challenge. In the following sections, which mainly discuss the conceptualisations of human enhancement that are advanced by its ardent supporters, we would like to draw particular attention to these kinds of enhancements.

### 1.1.2 Enhancement, Technoscience and Nature/Nurture

In the publications and public statements of ardent promoters of far-reaching human enhancement, three main rhetorical strategies can be identified:

- Firstly, the second-stage enhancements are equated with, or portrayed as, the logical outcome of more or less established bodily practices or interventions into the body whose purpose is to improve performance or appearance, such as physical exercise, the consumption of coffee, or cosmetic surgery.
- Secondly, non-therapeutic enhancements are presented as expressions of an innate human striving for self-improvement and related to the fundamentals of human culture and civilisation, such as the longing for religious ecstasy, education, medicine, or the creation and use of tools.
- Thirdly, the significant progress in medicine, science and technology, which has also led to the emergence of various, often impressive new forms of therapeutic enhancement, is used to posit an ongoing revolution in science and technology that promotes the development of non-therapeutic HET. It is even considered an occasion to prophesise an imminent break in human history and in the development of the species (see Sect. 2.8.1).

There is much historical and recent evidence for the widespread interest in and use of substances, technologies and methods to improve performance. However, the claim that these substances, technologies and methods are used with the same or similar motivations as, for example, cutting-edge brain-computer interfaces (cf. e.g. Anderson 2008) or methods of gene transfer is a trivial one and misleading. It obfuscates the qualitative differences between our highly modern technoscientific culture and the past. Arguments that take the form, "we've always done or strived for it", tend to neglect "how new means to achieve old ends make a moral difference" (Parens 1998b, 25). This is in particular true with regard to second-stage and other enhancements that would threaten to damage or destroy the fabric of our societies. Certain of such anthropological notions of human enhancement, in which, for example, both the consumption of chewing gum and education are counted among the means of cognitive enhancement (Sandberg/Bostrom 2006), empty the term "human enhancement" of any useful meaning. According to this view, one can draw a straight line from the most archaic forms of human nature and nurture to the development of fantastically advanced HET, and all these phenomena can be traced back to the same desire for self-improvement.

While there certainly are many good reasons to emphasise that education, tool-making, the use of tools, and the longing for transcendence are extremely relevant for the emergence and development of humanity, these expanded anthropological notions even further obfuscate what is at stake if the ambitions to radically alter human beings by means of our most advanced or emerging technology and science were to succeed. If visions such as the use of an artificial hippocampus for boosting human memory capacity (see Sect. 1.2.1) or the non-therapeutic use of deep brain stimulation (see Sect. 2.6) as a tool for push-button happiness would become reality, it would also radically change our notions of man-machine interaction and the means of individual self-control, so much so that it would amount to a qualitative change or even a revolution in human affairs.

To sum it up, we can safely say that the use of far-fetched anthropological notions is merely part of a rhetorical strategy which serves, in certain tactical situations, to distract critics or sceptics from the radical character of some emerging technologies and of many envisioned ones.

What about the third rhetorical strategy, the positing of an ongoing revolution in science and technology which may even amount to a fundamental break in the history of our species? If we accept some of the more visionary forecasts of technoscientific developments as being realistic, this may appear to be a serious attempt in futurology instead of a rhetorical strategy. However, the positing of such a fundamental break in human history is only one element of a more comprehensive worldview which can be classified as a technological eschatology (see Sect. 2.8 and 2.9). It is less about predicting what will occur in the near or mid-term future (although leading, quasi-messianic promoters of this ideology are awaiting the advent of the "singularity" in their lifetimes; Kurzweil 2005), but about an apocalypse in the sense of the coming of a new time and about the distant future of the universe. In the discourse on human enhancement, these mythologems serve the purpose of raising attention and often of equating humans and machines. They also make the more mundane goals of the promoters of a radical human enhancement appear to be down to earth and the visions of second-stage enhancements rather short term (cf. Coenen 2009).

By equating highly advanced technoscientific methods and interventions into the human body with age-old human techniques and practices and by giving the discourse an eschatological framing, the promoters of radical human enhancement obscure the scarceness of evidence for the actual existence of effective non-therapeutic HET.

### 1.1.3 Our Definitions and the Further Aims of the Study

For the purpose of this study, "human enhancement" is defined as a modification aimed at improving individual human performance and brought about by science-based or technology-based interventions in the human body. This definition includes "strong", second-stage forms of human enhancement with long-term effective or permanent results as well as "temporary" enhancements. Because it is not related to a specific definition of health, this is a non-medical concept of human enhancement. We distinguish between purely restorative non-enhancing therapies, therapeutic enhancements and non-therapeutic enhancements (see the chart in Sect. 1.1.1).

Any technoscientific improvement of an individual's performance that not only restores lost functions or a previous condition of health is seen as human enhancement, even if the resulting performance is still sub-average, i.e. less than typical for the species. However, we also deem potential or emerging enhancements which enable "super-human" performance or create "species-atypical" abilities highly relevant. Super-human performance can be defined as any performance which is vastly better than the best human performance ever known (such as sprinting as fast as a cheetah). Species-atypical abilities are abilities which do not naturally occur in humans (such as flying). The latter class of enhancements, which largely relate to visionary, but also to some emerging HET and which tend to imitate the performance of non-human beings or artefacts (Siep 2006), can also be subsumed under the notion of an "alteration" of human composition such as inventing new organs or bodily functions (Jotterand 2008).

Grunwald (2008) emphasises that for many first-stage enhancements which do not alter human composition, normative frameworks do exist, which can be taken into account; for the enhancement of human beings, however, in terms of the production of "superhuman" or "transhuman", species-atypical capabilities and features, these do not exist at all.

The normative insecurities involved differ in terms of category – and for this reason it is recommended to make this distinction and work with it. The conceptual means with which we speak of these things should reflect this.

The tools, substances or methods used for the purposes of enhancing interventions are referred to as "human enhancement technologies" (HET). If the improvement is real (at least as conceived by the enhanced persons themselves, by practitioners in the field of human enhancement technologies, and by their immediate society), we speak of "effective HET". In case it is evident that the desired improvement has not been achieved, we use the notion of "non-effective HET". However, both categories should not be misunderstood as normative notions, and they cannot be used for broader assessments of the impact of an intervention on the well-being of an individual. They therefore do not imply value-based judgments of the results of an intervention and do not take any negative side-effects into account. And in the case of HET that are used for interventions that to most people do not appear to bring about any improvement (such as cosmetic surgeries to slightly change inconspicuous bodily features or body modifications which are performed to create "monstrous" bodily features), we speak of "effective HET" if the aim of the intervention is achieved.

Excluded from our working definition of human enhancement are improvements of human performance which are realised by the use of devices which are not implanted or not robustly fixed to the body. Under societal aspects and as alternatives to body-interventionist technologies, such external devices are, however, important points of reference (cf. Anderson 2008). This applies, in particular, to external mobile devices which are used by their owners permanently or almost permanently while awake (such as wheelchairs and contact lenses). In light of our working definition, one could argue that this has nothing to do with human enhancement at all, but only amounts to a rather ordinary application of technology. And even in the case of removable exoprostheses and explantable implants, one could argue that such devices are not part of the biological body of a human being and thereby do no contribute to human enhancement in a strict sense.

We prefer, in contrast, the view that exoprostheses and any other assistive devices outside the body which are in almost continuous use are functional elements of human corporeality, regardless of their non-biological character, and thereby enhance human performance in a way that is more similar to human enhancement than to the ordinary use of artefacts. At least insofar they give their users species-atypical abilities or allow for super-human performance, they deserve attention in this context. The same holds true for externally worn devices that enable users to control machines and, for example, to act or interact in "virtual" surroundings or "worlds" (e.g. games or flight simulations). In our context, we also believe that existing technologies that could form the basis for second-stage HET in the future are highly relevant, as are those that play a central role with regard to cultural and ideological aspects of the debate on human enhancement. In particular, our focus here is on reproductive technologies such as pre-implantation genetic diagnosis (PGD; see Sect. 2.4).

Another important distinction is that between rather well-established nutritional, surgical, pharmaceutical and other traditional medical enhancements and the recently much-discussed enhancements that are based on or appear to emerge from progress in brain research and neuro-technology, bionics, and biotechnology and the sciences.

It is this latter group of enhancements that George Khushf (2005) referred to with his term "second-stage enhancements".

According to Khushf, the new tendencies in human enhancement are conceptualised as (a) "self-aware evolution" (direct engineering of the next stages of the processes guiding the development of life, by genetically altering existing living systems or through direct creation of artificial life), (b) "human–machine hybrids" or "humanity 2.0" (following the tendency for technologies to make as stronger, faster, and more agile since they are getting smarter by increasingly seamless human–machine interfaces and getting directly incorporated, whether by implanted chips, neural interfaces, or simply by remote sensing capacities), and (c) "medical enhancements" (refinement of medical tools, enabling and enhancement of normal function and radically new uses, by introducing new capacities that humans have never had before). We would like to add here (still largely visionary) pharmacological HET which are designed to alter fundamentals of an individual's psychological identity (such as in the case of drugs for memory erasure) and basic human traits (such as empathy or aggressiveness).

With regard to such second-stage enhancements, military research as well as civilian prosthetic, and other assistive technologies appear to be the most relevant fields of research, development and application. Similar to the case of genetic enhancements in sports and to the case of younger people's use of neuropharmaceuticals and recreational drugs, the societal, political and ethical discourse on such enhancements is thereby framed within specific contexts of application which also have, in each case, specific implications for ethical frameworks. In general, we deem second-stage enhancements to be more challenging from an anthropological view than other HET. However, due to their present relatively marginal societal and economic relevance, anthropologically less significant HET, such as substances used to suppress the effects of sleep deprivation, can be of more interest in an ethical and political context.

While the latter HET often only reinforce existing societal tendencies (such as the "flexibilisation" of work life) and may only pose challenges in terms of degree, some second-stage HET could alter the fundamentals of the human condition and the fabric of our societies.

With regard to the ultimate goals of human enhancement, three dimensions can be distinguished: (a) the improvement of one or more bodily and cognitive functions of an individual, (b) the improvement of the species (in a purely biological sense, but possibly including the use of more and more human–machine interfaces), and (c) the betterment of humanity in a holistic sense. This distinction refers to the discursive strategies and explicit claims in the debate, not to psychological motivations. Historical aspects (such as the collectivist utopian visions to create a New Man or the role of the eugenics movement) as well as sociological, cultural and psychological aspects (such as bodily aspects of identity or social norms) are here of particular interest.

Although the discourse on human enhancement is therefore ideologically framed by references to the notions of a biological improvement of the species and of a betterment of humanity, it is necessary to conceptually separate these motivations from the actual practices of human enhancement.

Accordingly, we define human enhancement exclusively in terms of interventions into the human body that have the sole aim of improving an individual, for two reasons: it is our goal to realistically assess the current situation, the near-term prospects, and the actual chances and challenges linked with the technological developments in question. In our view, this can only be accomplished by first looking at specific interventions and initially separating them from their ideological framings. On the other hand, we also intend to provide policy-makers, other governance actors, the public and academia with an analysis of such ideological framings and undercurrents of the debate on human enhancement, but precisely without taking the dominant ideological assumptions in the discourse for granted. In doing so, we also aim to set the debate about human enhancement in the context of the historical development of the diversity of European cultural values and their recent dynamics.

## 1.2 Progress and Prospects of Non-Therapeutic Enhancements

In this section, we will concentrate on existing non-therapeutic means of human enhancement and on the realistic prospects of non-therapeutic HET related to various human faculties, focusing on the enhancement of cognitive skills and perception (Sect. 2.2.1) and of motor skills and strength (Sect. 1.2.2). The impact of technologies on other human faculties is discussed in other parts of the study, and the reader will be provided with more information on specific HET in other parts of the study (see Sects. 2.2.4, 2.3, 2.4, 2.5, 2.6, and 3.2). Highly visionary HET are only taken into account if there is at least one instance of significant public funding. Much of this funding is provided by the U.S. Defense Advanced Research Projects Agency (DARPA; see Sect. 2.8.3 and 2.8.5; cf. TAB 2008) which focuses on revolutionary high-payoff ideas and therefore also funds projects which other agencies would reject due to their high risk of failure.

In this section, we do not analyse applications of HET which relate to appearance or longevity, because the latter are extremely visionary, and both, if realised, would not enhance cognitive or physical performance, or would do so only indirectly by changing the mood of the treated persons.

We will, however, discuss so-called mood enhancement in other parts of the study (see e.g. Sect. 2.6). Although it is difficult to determine what may count as a mood enhancement, and although evidence for pharmaceutical enhancements in healthy people is scarce (Repantis et al. 2008), mood is important for performance. Moreover, it is obvious that: (i) the wide-spread non-therapeutic or off-label use of mood-altering drugs such as Prozac™ is an important factor in the recent strong tendency of blurring lines between medical and non-medical uses of drugs (cf. Sects. 2.2.2, 2.2.4, 2.5), (ii) in the case of mood-altering interventions the notion of human enhancement as an "anthropological constant" appears to be viable, and (iii) technology and science-based means to alter mood are a very old phenomenon, as known from the history of alcohol distillation. Finally, it should be mentioned that mood-altering interventions appear to be of utmost importance with regard to conceptions of normalcy, health, and self identity (for some evidence of reluctance to enhance traits believed to be fundamental to self-identity, see Riis et al. 2008).

For the following discussion of technologies that are or might be used for non-therapeutic enhancement, we relied on a comparison of a number of other overviews and systematic studies of the state of the art in HET as well as on other pertinent literature (Berger et al. 2007; BMA 2007; Farah et al. 2004; Fiedeler 2008; Hennen et al. 2008; JASON 2008; Merkel et al. 2007; Moreno 2006; Normann/Berger 2008; PCB 2003 and the related documents at the PCB website). Wherever we make general statements about the state of the art in, or about the prospects of HET, these statements are based on this comparison. Some of the studies were commissioned by political institutions, such as governments or parliaments of Member States or U.S. military research institutions. We also looked at works with strong normative claims for or against human enhancement (e.g. CSPO/ACG 2006; ETC Group 2006; PCB 2003; Sandberg/Bostrom 2006), and, for certain aspects, at relevant journalistic accounts (such as Garreau 2005).

### 1.2.1 Cognition and Perception

There are a variety of reasons why technologies for the enhancement of human cognition and perception should be at the top of the list of HET:

- Many studies concur in classifying pharmaceutical cognitive enhancers as the HET with greatest potential for widespread non-therapeutic use, due to their relatively easy availability and use (if compared, for example, with HET which require surgery), the often only temporary character of their effects, and the widespread cultural familiarity with legal and illegal drug use.
- The growing problem of neurodegenerative diseases in ageing societies has turned research and development in therapeutic cognitive enhancers into a very dynamic field with significant resources.
- In a "knowledge society", HET that promise to improve cognitive functioning will most probably be highly attractive to many people (see Sect. 2.2.2).
- Widespread societal tendencies, such as the trend towards a 24-hour society (POST 2007) and the higher competitive pressure that is perceived, at least subjectively, in all kinds of professions, could motivate more and more people to use pharmacological cognitive enhancers to enable them to stay awake longer and maintain normal levels of attention and of other cognitive functions under conditions of sleep deprivation or mental stress.
- The apparent increased use (in the U.S. at least) of pharmaceutical cognitive enhancers by minors (including young children), many of whom are diagnosed with attention deficit/hyperactivity disorder (ADHD, see Sect. 2.5), raises serious ethical and health-related questions.
- In countries such as Germany, Switzerland and the U.S., the greatly increased use of Ritalin™ and trends towards "brain doping" in work life and society as a whole have generated significant attention in the media, occasionally even making it to the headlines of national newspapers, as well as arousing the interest of some policy-makers.

- Cognition is the human faculty that is most relevant in the working lives of those who develop most of the HET (scientists and engineers), so arguably there is a professional affinity for cognitive enhancement. There is already some initial evidence to support this (see Sect. 2.2.2 and 2.8.2).
- The highly prestigious science journal *Nature* has recently started a campaign to legalise non-therapeutic uses of pharmaceutical cognitive enhancers (see Sect. 2.8.2).
- Some existing and several visionary brain-computer interface (BCI) technologies could have the potential to fundamentally change human cognition and perception and thereby challenge anthropological notions regarding the relationships between humans and their tools; this could lead to the development of more and more radical visions of a man–machine symbiosis.

In general, one can distinguish between pharmaceutical and neurotechnological means of enhancement. Both are relevant for elements of cognition such as attentiveness, memory and executive functions. New neurotechnologies, however, can also enable new kinds of control of external devices as well as new modes of perception.

*Pharmaceutical Enhancements*

With regard to pharmaceutical cognitive enhancers, we would like to emphasise the following points:

- Evidence for effective non-therapeutic cognitive enhancement is still scarce, and sometimes contradictory.
- Most pharmacological cognitive enhancers are only effective in the case of decreased conditions such as sleep deprivation. While such uses are non-therapeutic, the conditions in question are more similar to conditions in need of treatment than to a state of normal functioning.
- It appears highly probable that more and more effective pharmacological enhancers for non-therapeutic use will be developed in the near future, mainly as a side-effect of the growing R&D into medication for neurodegenerative diseases. If the development of pharmaceutical cognitive enhancers for healthy young people were to be accepted as a legitimate goal of R&D, this tendency could be boosted.

In overall terms, R&D into new pharmacological means to enhance specific cognitive functions are at a very rudimentary stage. Even publications that include strong normative claims for human enhancement or argue in favour of legalising non-therapeutic uses of pharmacological cognitive enhancers do not provide other examples which could otherwise change this overall impression.

Arguably the most prominent example of pharmacological attempts to alter cognition and improve human performance is the medical and non-medical use of amphetamine and its derivates, which is anything but a new approach. Such substances have been widely used for decades by war pilots, pop musicians and other people, such as in the case of Dexedrine™. In the discourse on human enhancement, the most prominent example is Adderall™ which in some countries, such as the U.S., is still indicated for Attention Deficit Hyperactivity Disorder (ADHD) and narcolepsy.

Amphetamine derivates for non-therapeutic enhancement are often used under the decreased conditions of fatigue or sleep deprivation, and are aimed at bringing about improvements in terms of attention, concentration and general cognitive performance under such conditions. Improvements are only possible if the substances are not overdosed (in which case other effects such as increased motor activity or nervousness have a negative impact on concentration); there is some evidence that they are only effective as memory enhancers in persons with a sub-average working memory and may even have a detrimental effect on people with a good memory. However, the most important reason why these substances, in spite of their (moderate) effectiveness, are not very attractive as HET is the fact that they have severe negative side-effects, including a high potential for addiction.

It can be argued that the most prominently featured pharmaceutical product in the debates on cognitive enhancement is methylphenidate, best known as Ritalin™, an amphetamine-like substance which again is widely used for the treatment of ADHD and is also indicated for narcolepsy. It appears to be less effective than amphetamine derivates, having fewer, and less significant, negative side-effects as well as fewer cognitively enhancing effects in non-therapeutic use, if any at all. Due to its high relevance in the debate on human enhancement, we will discuss the case of Ritalin™ separately in section 2.5.

Currently, the drug modafinil is considered, for example by the military, to be an attractive alternative to amphetamine derivates and to amphetamine-like substances, in particular with regard to its wake-promoting properties. In therapeutic contexts it is used for treatment of narcolepsy and sleep disorders, and thought to be effective in the treatments of addictions, some mental disorders, and ADHD. How modafinil works is largely unclear. In a recent review study, Minzenberg and Carter (2007) point out pre-clinical studies that suggest a complex profile of neurochemical and behavioural effects, distinct from those of amphetamine.

In addition, modafinil (at well-tolerated doses) improves function in several cognitive domains, such as working memory and episodic memory. These effects are also observed in healthy, young adults. Negative side-effects and potentials for addiction or abuse appear to be minimal, or not to exist at all, and the mood of the users is not changed. However, there is no consistent evidence of any enhancement of cognitive performance by modafinil in healthy adults who are not sleep deprived.

The use of pharmaceutical cognitive enhancers can lead to an overestimation of actual cognitive performance, and some evidence suggests that culturally long-established substances such as caffeine can more effectively counteract sleepiness than new pharmacological cognitive enhancers (Klöpping et al. 2005). Furthermore, it appears that certain non-pharmaceutical, non-technological methods of cognitive enhancement, many of them developed in teaching and learning research, are more effective than pharmacological HET (cf. Sandberg/Bostrom 2006), as has recently been pointed out (in personal communication) by Ralph Schumacher, who has worked together with Elsbeth Stern on such a comparison in the context of an ongoing project on human enhancement conducted by the Office of Technology Assessment at the German Parliament (cf. TAB 2009).

There is already a certain amount of political interest in developing highly effective pharmacological enhancers for non-therapeutic use, namely for military purposes. Many U.S. soldiers already take prescription drugs and other substances to enhance their performance.

One item that has been at the focus of military research for decades are means to counter the effects of sleep deprivation. Arguably, most of the work on drugs such as modafinil is conducted in military research. Recently, high-level scientific advisors of the Pentagon conducted a study on human performance enhancement and came to the conclusion that a "significant sleep advantage" of an opposing force would pose a "serious threat" to the U.S. military. However, they assessed the technical likelihood of such a development as "small at present" (JASON 2008, 1).

While psycho-stimulants are the group of drugs that are most prominently discussed in the debate on cognitive enhancement, there are other groups of drugs that deserve attention in this context.

In a review study on the use of antidepressants for neuroenhancement in healthy individuals, Repantis et al. (2008) included single or double blind randomised or quasi-randomised controlled trials that compared a placebo to one or more of the following antidepressants: bupropion, citalopram, duloxetine, escitalopram, fluoxetine, fluvoxamine, moclobemide, paroxetine, reboxetine, sertraline or venlafaxine in any dose or dosing schedule. Eligible studies were those involving healthy people of any age and either sex who showed no evidence of a psychiatric disorder, cognitive decline or other disease. The main results were, firstly, a small yet significant negative effect on wakefulness and, secondly, a positive effect on memory, found after several measurements; this result, however, could be traced to the results of one study out of all of those included. The analysis of trials with repeated drug administration (mean duration 14 days, standard deviation 9) yielded the following effects: with regard to attention, a fluctuating effect was found, while for memory, the fact that the two groups started with a group difference confounded the results.

For wakefulness there was no significant effect at all, while for executive functions, the small number of studies did not allow for any effect to emerge. The authors summarise that no consistent evidence for the enhancing effects of antidepressants could be found. In the view of the authors, this may be explained by the fact that most of the trials were not designed to examine neuroenhancement effects. Repantis et al. emphasise that the growing public interest in neuroenhancement stands in stark contrast to the paucity of data on such effects from the available psychopharmacological agents.

Beta-blockers are another group which have the potential to enhance human performance in a non-therapeutic context. Due to their anti-anxiety effect in stressful performance situations (such as stage fright), some beta-blockers, such as propranolol (indicated, for example, for high-blood pressure and essential tremor) and oxprenolol (indicated, for example, for angina pectoris and high-blood pressure) can enhance attention and concentration in such situations and thereby allow for a better performance. These effects of beta-blockers have been known for quite a long time (cf. Neftel et al. 1982), and are used by musicians, and in certain sports, such as shooting.

U.S. military research also investigates another class of drugs, the ampakines, which show some promise in treating dementia and symptoms of schizophrenia by improving cognition when used with antipsychotic medication (Moreno 2006): Clinical trials have not found therapeutic value, but results from a company-sponsored study using an ampakine drug in sleep-deprived rhesus monkeys were encouraging. The monkeys' performance was reduced 15% to 25% when sleep-deprived, and reaction times doubled. But a single dose of ampakine eliminated their performance deficit and sleep deprivation changes.

There is also some evidence that ampakines can enhance short-term memory in healthy young people (cf. Wezenberg et al. 2007).

There are several companies and research groups which are engaged in R&D in the field of pharmaceutical memory enhancers (cf. Lynch 2002, Rovner 2007). Nobel Prize winner Eric Kandel's company Memory Pharmaceuticals which is now a wholly owned subsidiary of Roche counts among the most prominent players in this field. However, drug development appears to be slow (Rover 2007): only a few modestly effective drugs for treating memory problems associated with Alzheimer's disease are available – this is partly due to legal obstacles to the marketing of such drugs. Caffeine and nicotine still appear to be just as effective if not more effective than new drugs for memory enhancement. In this context, one researcher criticised that age-related memory impairment is not really accepted as a medical need by regulatory bodies.

On the other hand, genetic experiments with rodents have raised expectations that memory could be significantly enhanced in the future (Moreno 2006): When adult mice were given, for example, extra copies of a receptor, the mice showed superior learning skills. Moreno (2006) also points out experiments with mice which were bred without a gene which is associated with both, innate and learned fears. The researchers bred mice without the gene and put them in aversive situations, such as giving them a mild shock at a certain point in their cage. Normal mice exhibited traditional fear behaviour by freezing in place, but the altered mice froze less often.

***Non-Pharmaceutical Enhancements***

Non-therapeutic cognitive enhancement might also be possible through brain stimulation, however this will most probably only be attractive to a significant number of healthy people if no invasive surgery is required. There are two main forms of brain stimulation in use: deep brain stimulation (DBS), which is also experimentally used for treatments of depression, obesity and alcohol addiction, and transcranial magnetic stimulation (TMS). DBS appears to be more relevant in our context and is therefore discussed in detail in section 2.6 of this study.

In transcranial magnetic stimulation (TMS) a brief magnetic pulse is applied over the scalp overlying a particular part of the subject's cortex (BMA 2007). It provides a non-invasive way to directly stimulate the brain. It has been suggested that it could be used as a form of cognitive enhancement in the future ("Botox for the brain"). According to the British Medical Association (BMA), several studies designed to increase our understanding of how the brain works in relation to aspects of cognition have heightened speculation that TMS may be useful as a cognitive enhancer in healthy individuals (BMA 2007). The BMA points out that, given the non-invasive nature of the procedure, there may be demand for this procedure—particularly amongst those who are suffering from age-related memory lapses—if significant improvements in memory, learning etc. were to be found, and if safety issues could be addressed. Not only from the view of the BMA, such speculation is, however, premature and from existing findings it appears that those who hold out hope for this development may be disappointed.

One of the major disadvantages of TMS is that its enhancement effects appear to be only temporary and usually short-lived after the stimulation has ceased. In addition, TMS has demonstrated limited success with very simple tasks, and enhancements have been much more difficult to produce with more complex tasks. The BMA concludes that these factors, taken together, raise serious doubts about any future possibility for using TMS as a non-invasive type of cognitive enhancer although this cannot be ruled out entirely. The DARPA has funded a project that aimed at developing a portable TMS device to be used to counter fatigue.

A highly visionary example of brain prosthesis is an implantable brain chip that could restore or enhance memory, a kind of artificial hippocampus (cf. EGE 2005). The hippocampus plays a key role in recalling memories. In contrast to devices such as cochlear implants, which merely stimulate brain activity, this chip implant should perform the same processes as the damaged part of the brain it is replacing. It promises to be a means to help people who have suffered brain damage due to stroke, epilepsy or Alzheimer's disease. If realised, it could open up the prospect of a new quality of neurotechnological enhancement. The project leader is quoted as seeing potential commercial and military applications for the brain chip, arguing that learning how to build sophisticated electronics and integrate them into human brains could one day lead to cyborg soldiers and robotic servants (cf. Rosenwald 2003).

Implants that compensate for deafness or provide blind people with replacement sight are already widely used or are undergoing rapid development. While the latter technology is still only emerging and provides very minimal compensation, there are a large number of users of the rather efficient cochlear implants worldwide (see Fiedeler 2008; Hennen et al. 2008). In any case, the state of the art in this field of R&D is still a long way from achieving non-therapeutic applications.

However, there are a few experiments with implants to provide species-atypical senses, with regard to magnetism for example (cf. ETC Group 2006). Moreover, the British researcher Kevin Warwick, whose goal is to become the first cyborg, has done some interesting self-experiments in this field (cf. e.g. Warwick 2008): A microelectrode array was implanted into his median nerve fibres of a healthy in order to test bidirectional functionality in a series of experiments. A stimulation current applied directly onto the nervous system allowed information to be sent to the user, while control signals were decoded from neural activity in the region of the electrodes. In this way a number of experimental trials were successfully concluded, in particular: (i) extra-sensory (ultrasonic) input was successfully implemented and made use of, (ii) extended control of a robotic hand across the Internet was achieved, with feedback from the robotic fingertips being sent back as neural stimulation to give a sense of force being applied to an object, (iii) a primitive form of direct telegraphic communication between the nervous systems of two humans (Warwick and his wife) was performed, (iv) a wheelchair was successfully driven around by means of neural signals, and (v) the colour of jewellery, and the behaviour of a collection of small robots were changed as a result of neural signals. For other examples of unusual or visionary HET, we refer the reader to the works of the EGE (2005) and other overviews (cf. e.g. ETC Group 2006; Fiedeler 2008; Hennen et al. 2008).

In the fields of cognitive control of external devices, "augmented cognition" and non-invasive assistive technologies, there are a large number of projects and evidence for significant progress (cf. e.g. Eizmendi 2007). These technologies do not meet our definition of HET, and are therefore not discussed here in detail.

However, we would like to emphasise that some aspects of these developments veer toward a new quality of man-machine interaction insofar the machines are directly interacting with the brain. Several studies have demonstrated that monkeys can use signals from the brain to guide computer cursors (for an overview and an advanced technology, see: Santhanam et al. 2006). Some paraplegics or patients with locked-in syndrome can now use computers for communication (e.g. Hochberg et al. 2006). A man paralysed from the neck down by knife injuries sustained five years ago can now check his email, control a robot arm and even play computer games. One long-term goal of such kind of research is to enable quadriplegics to control their own limbs via electrical stimulation of their muscles (cf. Biever 2006).

Such technologies which might create more and more, and faster means of direct communications between brains and computers are also of particular interest in the military research context, with, for example, DARPA funding several cutting-edge research projects in this field (e.g. Nicolelis 2002; cf. Hennen et al. 2008; Moreno 2006; TAB 2008).

DARPA also funds R&D on "augmented reality" in which virtual and physical surroundings are blended. The computer game industry funds brain-computer interface (BCI) technology that is designed to enable users to directly control their avatars in "virtual worlds", an application with an interesting economic perspective (cf. e.g. Nijholt 2008). Other relevant non-medical arenas for the use of BCI are the automotive and robotics industries (Berger et al. 2007). Other cutting-edge research, mainly driven forward by the military, is interested in or is already developing other high-tech devices such as binoculars connected with the brain of their users.

The first devices are also emerging that enable carefully trained persons to send nerve signals to their vocal cords without making a sound (Simonite 2008): these signals are picked up by the devices and relayed wirelessly to a computer that converts them into words spoken by a computerised voice.

Users must think specifically about voicing words for them to be picked up by the equipment. Such devices have been successfully used to control wheelchairs, and might also be used for silently making private calls while out in public. However, the usable vocabulary is still very limited.

Refractive eye surgery, in particular LASIK (Laser Assisted In-Situ Keratomileusis) is used by athletes such as golfers and others to optimise their vision. While adverse effects are possible, the surgeries can effectively and significantly enhance performance, and are therefore discussed in the context of the debate on human enhancement and doping (cf. e.g. Saletan 2005).

### 1.2.2 Motor Skills and Strength

When it comes to the non-therapeutic enhancement of strength and motor skills, one can observe that external tools are often far more advanced, and obviously also often the only attractive choice, if compared to invasive technologies. A prominent example here is the R&D on exoskeletons which allow for super-human strength.

However, artificial limbs appear to be an issue that deserves more attention in the discourse on human enhancement, although they belong to the less contentious field of therapeutic enhancements. One reason for this is the fact that some of them already give their users species-untypical abilities, and that they may allow super-human performance in the future.

R&D carried out by researchers such as MIT's Hugh Herr demonstrate that not only can today's prostheses allow for super-human performance and species-untypical abilities (in Herr's case, for example, in the area of mountaineering), but also that highly efficient neuro-prosthetic limbs might be feasible in the relatively near future (cf. e.g. Heinz Awards 2007). R&D funded by the EU or in Member States also demonstrates that artificial arms, legs and hands are increasingly becoming not only the functional equivalents of biological limbs, but also more like them in terms of usability, appearance and sensual perceptions.

The EU-funded project CYBERHAND, for example, represents an attempt to simultaneously address four main objectives: (i) to obtain a cosmetic and dexterous artificial hand, (ii) to develop a bio-inspired artificial sensory system to provide the patient with active perception, (iii) to implement a neurocontroller for the prosthesis by extracting motor commands from the peripheral nervous system (efferent system), and (iv) to deliver sensory feedback (on touch, proprioception) to the subject by stimulation of the sensory nerve fibres (afferent system). All such prostheses might in principle be designed with extra functions, including species-atypical ones.

In fact, Hugh Herr likes to point out that his artificial legs are better than his old biological ones (cf. e.g. Heinz Awards 2007). Special wedge-like artificial feet allow Herr to slide into cracks in the rock face that he could never use before. For ice climbing, Herr can slip attach spiky crampons to the end of his prostheses. Or he can use extending legs for extra reach. While such technologies, as Herr also points out, could be used by anyone, such developments further the tendency to blur the line between being physically disabled and able-bodied. However, for the time being prostheses of this kind will only be available to a small number of people such as impaired veterans.

However, there is also rapid progress in the development of prostheses already in use by a broad spectrum of users. While a significant number of users are not happy with their devices, the majority appear to be highly satisfied with regard to such mundane tasks as the climbing of stairs, but also with regard to mountaineering and the like. Some users, on the other hand, seem to encounter problems with the IT-based tuning of the prostheses to their individual needs.

As evidenced by the case of the South-African, double leg-amputee sprinter, Oscar Pistorius, there is another important tendency, namely the advances in sports prostheses which, due to the rules of sports, must do without the above-mentioned high-tech applications. Meanwhile, the artificial legs of Pistorius and other athletes allow some of them to be competitive in non-Paralympic sports. The regulatory and legal quarrels and the public discussions about them which took place in the Pistorius case are highly relevant to some of the comprehensive aspects of the topic of human enhancement (cf. Wolbring 2008a).

Widely funded cutting-edge R&D on neuro-prosthetic limbs could not only revolutionise prosthetics in the long run, but also lead to a cyborgisation of human corporeality. Progress made in the research on prostheses that are designed to function as biological limbs, including the sensations of their wearers (with regard, for example, to temperature or proprioception), has raised such hopes or fears.

Moreover, several neurotechnologies are already improving or have the potential in the near future to improve the physical performance of people suffering from diseases (BMA 2007; Fiedeler 2008; Hennen et al. 2008). However, the experiences of people who suffer from physical handicaps due to diseases and actually use these devices have not yet been well-researched.

Two relevant technologies are (a) vagus nerve stimulation (VNS), a pacemaker-like chest implant which can be used for more than 10 years to control seizures in epilepsy patients and has recently been approved for treating drug-resistant cases of clinical depression, and (b) the spinal cord stimulator (SCS) which is already used relatively frequently in the clinical treatment of chronic pain and several diseases (cf. for an overview: Fiedeler 2008; Hennen et al. 2008).

Another field which is increasingly being discussed under the label of human enhancement are nutritional means of enhancing physical and cognitive human performance of young people and adults (HoC S&T Committee 2007). This is, however, largely beyond the scope of this study.

However, we would like to point out that DARPA, in the work on biology of its arguably most visionary unit, the Defense Sciences Office (DSO), has funded research with the goal of creating technologies that would allow combatants to maintain peak physical and cognitive performance in the battlefield environment. This "Peak Soldier Performance" programme has several areas of interest, including improved nutrients and supplements to overcome the physical stresses of combat, as well as broad basic scientific explorations into the biochemical aetiology of muscle fatigue. In addition, the programme seeks to determine whether it is possible, and if so whether it is beneficial, to provide highly customised vitamins matched to each individual's unique metabolism.

DSO declares that the programme has had several successes, having identified several candidate nutrients that promise to improve the content and efficiency of mitochondria following short-term dietary supplementation. Furthermore, it announced that it has recently identified a key biomolecule that is altered by stress and may be responsible for muscle fatigue following rigorous exercise. Other DSO-funded programmes that are relevant from a human enhancement perspective are (i) "Predicting Health and Disease" which aims to devise methods of assessing whether an individual will develop an infectious disease prior to the onset of symptoms; its vision is to maintain 100-percent combatant readiness by detecting, intervening and eliminating disease before the emergence of symptoms; and (ii) "Surviving Blood Loss" whose goal is to develop novel strategies, including hormone-induced resistance to the effects of trauma and blood loss, to radically extend the time combatants can survive critical levels of blood loss on the battlefield before initiation of fluid and blood resuscitation.

DSO has also developed a suite of programs aimed at restoring full physical and cognitive function to injured warfighters, even after they have experienced significant traumatic injuries. Technologies are under investigation to fully restore complex tissues (muscle, nerves, skin, etc.) after traumatic injury, and to develop neural-controlled upper extremity prostheses that fully recapitulate the motor and sensory functions of a natural limb. Some of the researchers in the above-mentioned field of brain-computer interfaces see it is a long-term goal of their R&D to enable quadriplegics to control their own limbs via electrical stimulation of their muscles (cf. Biever 2006).

There is, however, rapid progress in all kinds of non-invasive assistive technologies that allow for motor substitution and even motor recovery. Projects such as the European integrated project TOBI ("Tools for Brain-Computer Interaction"; cf. http://www.tobi-project.org) aim to develop non-invasive brain-computer interfaces for a wide range of purposes; there are also a large number of technologies that are not based on brain-computer interfaces at all, but can significantly enhance the quality of life of their users (cf. e.g. Eizmendi et al. 2007).

Another important testing ground for physical enhancements, albeit under conditions of illegality, is sports, including body-building. New methods and visions such as gene doping have already attracted public attention, in particular by policy-makers (cf. e.g. Gerlinger et al. 2008). This topic is therefore discussed in more detail in section 2.3.

### 1.2.3 Conclusion

In general, it is our impression that the majority of HET discussed are still therapeutic, and do not offer their users significant advantages over "non-enhanced" humans; indeed, the level of improvement is often well below the level of normal function. However, we also hold that there are strong indications that more and more effective means of non-therapeutic enhancement will be developed in the near future, and that some existing lines of R&D already have the potential to significantly alter human corporeality and cognition. Moreover, there appear to exist significant market potentials for some of the technologies in question, for example in the fields of pharmaceutical cognitive enhancement and with regard to some applications of brain-computer interfaces.

Our overall impression is that evidence is still scarce to prove the existence of effective, non-therapeutic cognitive HET, in particular if one compares HET with traditional and modern non-technological and non-pharmaceutical means for improving or maintaining cognitive functioning. In general, we know very little about how cognitive pharmacological enhancers affect the performance of healthy people; what is more, the results of the scarce pertinent research are to some extent inconsistent. Only if we look at drugs that were developed to treat age-related diseases, narcolepsy, ADHD and other diseases or problems and are now also used under conditions of sleep deprivation or stress do we find some evidence of performance enhancement in healthy individuals (including counteracting nervousness). However, these decreased conditions are more similar to a disease than to a state of well-being, and pharmaceutical cognitive enhancers in these cases are mainly used to counter the effects of the unhealthy behaviour that caused the deficits. Moreover, evidence of these drug uses does not exclusively show improvements, and some of the improvements are very short-lived and minor.

On the other hand, many experts agree that it is highly probable that more effective and safer pharmaceutical cognitive enhancers will be developed in the near future. If the development of medication for healthy people to improve cognitive performance were allowed, more targeted research would most probably boost this trend. In any case, it is safe to say that the fast-growing R&D into pharmaceuticals for age-related neurodegenerative diseases will be instrumental for the development of a number of new "dual use" drugs.

Moreover, large pharmaceutical companies appear to be interested in a market for memory enhancers for healthy middle-aged and even younger people. Arguably, military research agencies are the major players in public funding of R&D with the explicit goal of developing non-therapeutic HET. However, the amount of this funding pales in comparison with the funding of military research into closely related fields such as external devices for enhancing soldier performance, new methods of man-machine interaction and the entire field of "augmented cognition".

Neural implants that replace perception functions are examples of highly innovative therapeutic HET. Nevertheless, the excitement generated by media reports on neural implants should be put into perspective (Fiedeler 2008): at least in civilian research, the implants are mainly designed to re-establish one particular function that was lost through accident or illness or was missing from birth. It is undisputed that these implants can mean great relief for the patient and can significantly increase the range of possible action.

However, comparing the result with what is possible for a healthy person reveals a considerable discrepancy, one that is eclipsed by the nature of media reporting or by U.S. policy-makers who argue that hype and hope end up fuelling the social passion that forms politics and gets budgets passed and, therefore, talk about the prospects of "the deaf to hear" and "the blind to see" and conclude that this is "just for starters" (Bond 2002). A recent overview of neural implants came to the conclusion that the status of neural implant development varies greatly (Fiedeler 2008): some implants, such as cardiac pacemakers and cochlear implants have been in use for decades. Others have either been under development for years without any breakthrough having been achieved (retina implants and stance and gait prostheses), or are far from clinical application (hippocampus implant).

However, some neural implants that have long been in use for certain therapeutic purposes have now been modified and used in the brain, such as in the case of deep brain stimulation (Fiedeler 2008; Hennen et al. 2008; cf. Sect. 3.6). In any case, this is an area of rapid development. It is notable in this regard that it is less the technical development and enhancement of the implants that dictate this acceleration than the combination of imaging techniques, new surgical options and increased knowledge of the human brain and its functional areas. Nevertheless, there is still a huge gap between the far-reaching visions of HET and the state of the art.

With regard to the field of assistive technologies as a whole, one should be aware of the fact that invasive brain-computer interfaces are but one of many options for using advanced technology to meet the special demands of elderly and other people with unwanted physical limitations. However, it is highly probable that interest in all kinds of assistive technologies will significantly rise in ageing societies (cf. Eizmendi et al. 2007), creating attractive markets and also giving fresh impetus to the development of HET.

In general, visions of neurotechnological HET that might allow for super-human performance or species-untypical abilities still have no real basis in R&D. Nevertheless, most pertinent studies agree that the man-machine interrelations may be fundamentally changed in the foreseeable future. Such tendencies have been discussed, often in a more speculative vein and under the label "cyborg", for quite some time now (Fiedeler 2008; Hennen et al. 2008).

A human capability to "see" infrared is an example of a reasonably realistic vision of an enhancement allowing the creation of species-untypical abilities. Even the direct use of computer memory functions by humans appears possible in principle, albeit not feasible in the near future. In any case, it appears realistic to assume that, in the long run, prosthetic applications will be developed that will provide specialised sensory input or mechanical output (JASON 2008), and might thus begin to put traditional, biological human corporeality under competitive pressure, at least in a military context. As the British Medical Association has pointed out, more and more people appear willing to endure risks, including major surgery, to enhance their visual appearance and so the development of a market for implanted HET cannot be entirely ruled out (BMA 2007).

In several sections of the following chapter, we will discuss some HET in more detail, with a special view on their societal and cultural aspects.

# 2. TOWARD AN ENHANCEMENT SOCIETY?

We have seen that there are quite a few instances of the moderate success of non-therapeutic HET, some cases of highly remarkable progress in therapeutic and in particular prosthetic HET, and realistic prospects of a dynamic development in such fields as pharmaceutical cognitive enhancement. On the other hand, human enhancement still constitutes, perhaps more than anything else, a societal and cultural phenomenon. It touches a wide variety of broader societal processes, specific desires and fears of both individuals and society at large, and often deep-seated intellectual traditions in Western and, in particular, European history.

We would like to start the discussion of the cultural and social aspects of human enhancement with a cautionary note. As we have already outlined in previous chapters, the debates on human enhancement are strongly shaped by very visionary perspectives and by transhumanist and other rather contentious worldviews. The debates between optimistic technovisionaries and some of their critics revolve around the very distant future of mankind or "posthumanity", and even extend to eschatological questions such as those concerning death, immortality and the end of the universe. By staging debates on such far-reaching and at times far-fetched visions, the ardent promoters of human enhancement and some of their critics have managed to raise attention for their mundane goals and their ideologies at large (cf. Coenen 2007). This is even true for policy and policy-related activities (cf. Coenen 2009, TAB 2008) and, to a very high degree, in professional ethical reflections on the topic of human enhancement (see for a critique: Nordmann 2007a). The creation of hype thereby serves particular interests and, in particular in a policy context, one should take this fact into account and be alert to which kind of visionaries are acting in what manner in the discourse.

In foresight and technology assessment as in any other reflection on the future of HET, one has to be aware of the fine line between taking a broad look at the future and feeding the hype. As has been shown for nanotechnology (Paschen et al. 2004), the enthusiasm which optimistic futuristic visions can evoke is often deliberately utilised as a means of promoting technology development. Such a strategy of "hype and hope" always appears to be precarious. This strategy can have both positive effects (e.g. incentives for young scientists, or arousing and sustaining political and business interest) adverse effects. Among the latter is the danger that expectations will be set too high, making disappointment inevitable. Second, it may popularise the reverse of the optimistic futurism – a pessimistic futurism involving apocalyptic fears and visions of horror, which itself is being increasingly used to raise attention for nascent fields. Third, the focus on far-reaching visions may hinder a sober discussion of the potentials of technologies.

On the other hand, a critical discussion of such visions appears to be a prerequisite for a rational political and societal discourse on their potential. Ignoring these visions in policy and policy-related activities does not make them disappear from the world, nor are these visions wholly irrelevant for understanding the ever-changing relationships between science, technology and society.

It is commonplace in science and technology studies, economics and the fields of foresight and technology assessment that visions can have an impact such as a significant influence on R&D trajectories, which has led to the development of new fields or methods of inquiry such as vision assessment (e.g. Grin/Grunwald 2000; Grunwald 2007; Lösch 2006; TAB 2008) and the sociology of expectations (e.g. Brown/Michael 2003; Selin 2008). Moreover, in the case of human enhancement as a cultural and social phenomenon, we encounter a tendency, not only on the part of the promoters of extreme positions, to use the discussions on certain technologies and their convergence for staging comprehensive debates about our societies and their political and technoscientific futures.

In the following, we discuss such cultural, societal, and, in a broader sense, political aspects of human enhancement. Based on the results of our attempt to take stock of existing and emerging HET, we engage with the hype as well as with the desires and fears of individuals relating to HET, and with the underlying broader societal tendencies and issues driving and shaping them. We analyse and discuss all of these phenomena and processes with regard to the notion that we might be on a way to an "enhancement society".

Accordingly, in the first section we discuss in some detail some of the lines of the reasoning that shape the rather heated debates on human enhancement, including some of its most visionary aspects (Sect. 2.1). We briefly present and discuss three rather visionary lines of reasoning which appear to feed the hype and confront them with an approach that is more down to earth and that questions the hype. Afterwards, we turn to a number of broader societal tendencies and issues that need to be taken into account in an analysis of the phenomenon of human enhancement, and try to present some fresh approaches to their analysis and to question or corroborate certain widespread assumptions (Sect. 2.2). In the subsequent sections, we draw attention to what might be called "bottom-up" tendencies towards an "enhancement society" and to fields and discourses in which the social and ethical relevance of existing or emerging HET can be exemplified (cf. Van Est et al. 2008). In these sections, we discuss the topics of genetic therapy and doping (Sect. 2.4), the discourse on so-called designer babies (Sect. 2.4), the case of Ritalin™ (Sect. 2.5), and deep brain stimulation (DBS, see Sect. 2.6). Against the background of our analysis of influential lines of reasoning, of the broader societal tendencies and issues, and of these cases, all of which appear to be veering toward an enhancement society, we then take a look at the promotion of human enhancement by some key players in science and technology and by sociocultural movements such as the transhumanists (Sect. 2.7). We then discuss the possible motives of these actors for advancing radically affirmative notions of human enhancement. We relate this to an ideology of extreme progress that has formed out of visions of the technoscientific future of humankind in the nineteenth and twentieth centuries (Sect. 2.8). In the closing section of this chapter, we provide a preliminary discussion of how the discourse on human enhancement, emerging HET may challenge European culture and value systems (Sect. 2.9).

## 2.1 Heated Discussions and Far-Ranging Visions

Recently it has been argued that a further surge of tendencies toward an "enhancement society" would necessitate a re-framing and thematic expansion of the debate on human enhancement (Grunwald 2008): The focus would then have to shift from rather conventional, short- or mid-range ethical questions to the more comprehensive issue of our social system and its implications for the ethics of science, technology, and human corporeality. In the actual debate on human enhancement, such a broader view of the topic is still rare, although one can find at least some lines of reasoning in this direction and also some instances of such a perspective in academic works that are not direct contributions to the current ethicopolitical discourse or accompanying research on HET, but are related to research on topics like "human nature", the historical eugenics movement, or the cultural significance of "cyborgs" and the posthumanist imaginary (see for example Baillie/Casey 2005; Orland 2005; Pual 2005; cf. Coenen 2007).

In the following, we discuss some examples of such socio- and cultural-theoretical lines of reasoning, in order to outline the emerging discursive frame in which the debate on human enhancement may take place in the future. Most lines of reasoning in the debate on human enhancement mix visions, some of which are derived from fictional literature, with perspectives far into the future and strong political claims. We address three such approaches, one pro and two contra radical human enhancement, and a line of reasoning that appears to us to be more instrumental in analysing and discussing the actual challenges raised by HET. However, we also hold that the more visionary approaches raise some important points regarding not only possible long-term developments, but also our present notions of technoscientific and societal progress.

### 2.1.1 The Concerns of Dehumanisation and Moral Decline

One of the most influential reports on the topic of human enhancement (entitled "Beyond Therapy") was published in 2003 by the U.S. President's Council on Bioethics (PCB 2003). The PCB was created by George W. Bush shortly after his first election and can regarded as a central point of reference (not only) in the conservative and religious bioethical discourse in the United States (see Sect. 2.2.3; see for the following in more detail: Coenen 2007). The first major activity of the PCB was on human enhancement, with a focus on genetic and neuropharmaceutical interventions. The PCB included a broad range of scientists, scholars and other professionals in its deliberation of this topic. The Council's working definition of "enhancement" was the directed use of biotechnical power to alter, by direct intervention, not disease processes but the "normal" workings of the human body and psyche, to augment or improve their native capacities and performances. The PCB chose "Beyond Therapy" as the title for its report to expose the non-traditional goals of new uses for biotechnical power, and it hints at the open-ended character of what lies "beyond" the goal of healing. However, in the Council's view, one must ultimately adopt an outlook that is not only "beyond therapy" but also "beyond the distinction between therapy and enhancement". Accordingly, the topic must be seen less in relation to medicine and its purposes, and more in relation to human beings and their purposes, beyond the therapeutic view of life altogether.

The Council, some of its individual members, and President Bush have continually referred to the dystopian vision described in Aldous Huxley's 1932 novel *Brave New World* as a danger for contemporary society if it chooses to pursue certain existing technological options related to enhancement. In his famous novel, which is referred to in numerous publications on human enhancement, Huxley developed the vision of a rationally organised and obligatorily hedonistic future society whose technocratic ruling class uses science and technology to produce individuals who perfectly and obediently fulfil their roles in a naturalised social hierarchy. While promoters of HET see this as a perversion of their ideals of human enhancement, these technologies qualify as second-stage HET in the sense that technoscientific means are used to permanently enhance the performance of individuals beyond what is species-typical. Prenatal manipulations are, for example, used to equip specialist workers of the lower castes with certain enhanced capacities such as a better sense of balance.

The reference to Huxley's nightmarish future society serves the PCB and other conservative critics to denounce certain tendencies in our present society. The PCB has, for example, officially cited the first report of the NBIC initiative on converging technologies in the U.S. as one example of futuristic visions that may lead to a society which might resemble "the humanly diminished world" portrayed by Huxley, "whose technologically enhanced inhabitants live cheerfully, without disappointment or regret, 'enjoying' flat, empty lives devoid of love and longing, filled with only trivial pursuits and shallow attachments" (PCB 2003, p. 7). In advancing their criticism of certain technologies, of technofuturist worldviews, and of our society in general, PCB members and other conservative critics also refer to works by the philosopher Hans Jonas and the Christian writer C.S. Lewis. They admittedly and systematically use references to *Brave New World* as a polemical instrument, recommending it as one of the most valuable historical resources for moral reorientation in the light of recent technological innovations in biotechnology. Their core argument is that tendencies of our assumedly hedonistic, permissive, and culturally self-forgetful society (such as "liberal eugenics" and the widespread use of psychoactive substances) lead us down a slippery slope to a dehumanised world which, at least in the West, will most probably not be ruled by totalitarian regimes, but will nevertheless be fundamentally flawed in a cultural and moral sense. They tend to ignore military interests in HET, and, while they concede that Huxley himself stressed the danger of a totalitarian world-state, they belittle the possible role of states. In their view, old-fashioned "eugenics" only remains a problem in countries like China. The primary targets of the conservatives' criticism are irresponsible parents, politically correct teachers, technophiliac libertarians, liberals and cultural progressives, and some segments of industry. When asked what he deemed the World's most dangerous idea, former PCB member Fukuyama chose transhumanism, stressing that many of its core ideas are implicit in much of the research agenda of temporary biomedicine. Leon Kass, first chairman of the PCB, also sees our societies on a slippery slope to a Brave New World. He writes: "Just give us the technological imperative, liberal democratic society, compassionate humanitarianism, moral pluralism, and free markets, and we can take ourselves to Brave New World all by ourselves" (Kass 2002, p. 52). In his view, only a moral and religious awakening may save us.

Accordingly, the report of the PCB and publications by PCB members have strongly influenced Christian theologians and lay activists who, as individuals or representatives of their organisations, criticise human enhancement or certain HET (see Sect. 2.2.3; cf. Coenen 2007, 2008b).

Obviously, at the heart of the type of critique advanced by the PCB, some of its former members, and many religious cultural conservatives is an anti-permissive and anti-hedonistic line of reasoning. In this view, our societies are in need of clear normative boundaries, and we should live our lives according to traditional values, appreciating our limits, including our mortality, as well as looking for happiness, instead of mere fun and a shallow form of freedom (for a strong case of the latter point, see Tirosh-Samuelson 2007). This appears to them less as a danger of political abuse of HET, but of horrible effects caused by the total sum of individual decisions taken without a solid moral ground.

### 2.1.2 Concerns Regarding the Political Abuse of Enhancement Technologies

However, by referring to Huxley's novel, the conservative and religious critics of human enhancement, *nolens volens*, raise the spectre of an authoritarian, or even totalitarian, rule on the basis of advanced HET. The anti-totalitarian and anti-authoritarian line of reasoning may seem to be alarmist, given the relative stability of our liberal democracies. However, the notion of "enhancing" of humans in favour of propagated future social forms was often used historically to oppress the generation of the time. This means that caution must be exercised whenever there is talk of specifically "enhancing" humans (Grunwald 2008). And today it is rather commonplace in the debate to posit that "China will do it anyway" (see Sect. 2.2.1 and 2.2.3), often combined with remarks such as: "So, we do have to do it too, but in a responsible way."

Moreover, some emerging or soundly envisioned HET appear to have the potential for directly controlling humans or for predetermining their social behaviour and emotions (EGE 2005; Hennen et al. 2008). If we accept the notion of the radically transforming character of second-stage HET, we also have to ask the critical question whether taken together these HET might amount to a tool-kit for a perfect repressive or even totalitarian regime. Some of the blue-sky thinking in publications of the NBIC initiative and by some transhumanists (see Sects. 2.8.1 and 2.8.3) gives additional cause for such concerns, which are most probably not widespread, but have already been the driving force behind militant protests by anarchists against the research centre MINATEC in Grenoble for example (PMO 2006; cf. Joly/Kaufmann 2008).

### 2.1.3 Belief in Technological Fixes

In stark contrast to this, an extremely technophile line of reasoning expects technological fixes for all kind of problems including increasing productivity, environmental problems, poverty etc. The proponents of this line of reasoning tend to disregard the problem that future HET might be abused by repressive regimes and often cling to normative concepts of the "transhuman" which narrow the perspective of human enhancement to those interventions which appear, at least at a first glance, to be wholly beneficial.

The belief in the viability of all kinds of technological fixes can go hand in hand with different, to a certain degree far-fetched, but in any case highly speculative visions of a future society. Relating to the visionary discussions about the Internet, artificial intelligence, and the emergence of a free society in the "virtual worlds" of electronic networks, these societies are often envisioned as stateless, beneficial to total individual freedom, or even as realms in which the liberation of the mind from the biological body can be fully realised (e.g. Bainbridge 2004). A more mundane vision in a similar vein, presents us with a society in which "morphological freedom" and "cognitive liberty" are core values (cf. Bainbridge/Roco 2006b). In such a society, every individual would have the right to treat his or her own body as fully malleable object. While some critics have denounced this as a reduction of the body to a commodity or a fashion accessory (Hayles 1999), the promoters of morphological freedom argue for a new notion of individual freedom which allows for aesthetic self-realisation, overcoming the "genetic lottery", free experimentation with all kinds of mood- and mind-altering drugs and technologies, and transcendence of the merely human. Such ideas have been around for quite a long time now in such fields as media and performance arts (e.g. in the works of the artist Stelarc; cf. www.stelarc.va.com.au/arcx.html) and cyberfeminist or other postmodernist cultural studies. They also fit in with broader tendencies in (cultural) identity politics which veer toward a de-coupling of bodily traits and biologist attributions, on the one hand, and social roles (such as gender roles) and cultural or sexual identities, on the other.

However, in a particular manifestation or application of the extremely technophile approach, the instrumentalist eudaemonic line of reasoning, which is advanced mainly by leading transhumanists, the envisioned future societies often appear to be rather uniform due to an instrumental understanding of emotions and a one-dimensional conception of happiness (cf. Tirosh-Samuelson 2007). This line of reasoning is, albeit often highly speculative as regards technologies, relevant in our context, because it places high hopes in new kinds of mood-altering interventions that are expected not only to help those who suffer emotionally or are looking for conventional pleasures, but to fundamentally change social relationships and individual self-perception by a kind of perfection of social life, and total control of emotions. (see e.g. Bostrom 2008a, 2008b; Sandberg/Savulescu 2008; cf. Sect. 2.8.1 and Coenen 2006).

### 2.1.4 Questioning the Hype and the Trends toward an Enhancement Society

To conclude the present section, we refer to another line of reasoning on human enhancement which relates to more mundane issues such as the structural features of our societies, broader social processes, and current social tendencies or cultural practices related to the appropriation or emergence of HET. This should prepare the ground for the following sections in which such processes, tendencies, and practices are discussed in a little more detail.

In a political-analytical and sociological line of reasoning of this kind, social structures are considered which favour the spread of HET as are new tendencies which may boost their use. The pathologisation and medicalisation of more and more emotional and physical states, the commodification of the human body, its use as an improvable tool for competition, and the prospects of radically changing the human body by means of second-stage HET are only some of the aspects relevant here.

As mentioned above, George Khushf (2005) relates the new tendencies toward second-stage enhancements to the notions of (a) "self-aware evolution", (b) "human–machine hybrids" or "humanity 2.0", and (c) "medical enhancements". We have added to these the (still largely visionary) pharmacological HET which are designed to alter fundamental features of an individual's psychological identity (e.g. drugs to erase memory) and basic human traits (such as empathy or aggressiveness). Khushf argues that even "if we wish to contest the optimistic tone, or argue with the background assumptions or 'transhumanist' goals", everyone should recognise "the kernel of truth in these kinds of claims". In his view, science has brought us to a place where "the radical project of re-engineering ourselves moves out of the realm of science fiction and into the realm of scientific fact". The visions and techno-scientific background of the NBIC initiative in the U.S., which Khushf characterises as a "representative policy initiative", are used by him to illustrate the "new stage of the enhancement debate". The second-stage enhancements are multifunctional, in his view, altering how we approach disability, providing "radically new capacities", enabled by a convergence of multiple kinds of technology, and developing at an accelerating rate. Witnessing the "initial stages of human experimentation, not just in medical arenas, but also in industry and military", we may already notice that these new HET will not just be "like a new gadget, even a highly influential one like computers", but "make possible radically new forms of human interaction". And with this, they may "alter the rules of post-hoc ethical and policy reflection". In Khushf's view, this is the key component to recognise: "Many of the enhancements will be of such a kind that those who control them may have capacities to manipulate directly the rules of social engagement in ways we now might consider unfair." These possible "kinds of radical shifts in power and control" should therefore "be explored in tandem with the development of the technologies."

While we agree with Khushf's view, we would also like to point out that some of the more conventional HET are also highly relevant for understanding current shifts in the rules of social engagement, if only because they are already widespread.

Even where such HET are non-effective, their widespread use changes social interaction, promotes the establishment of new norms, and raises a variety of questions such as those relating to distributive or procedural fairness, to the fabrics of society, to the relationships between the self-image of individuals and their social roles, and to social key concepts such as competition, ability and disability, happiness, self-realisation, and individual freedom.

While the desires expressed in the more far-reaching visions can tell us a lot, not only about the current techno-imaginary but at the same time about competing societal visions and quasi-religious longings for transcendence, we should keep in mind that the actual social (and economic) relevance of established HET differs hugely from that of the emerging second-stage HET.

And we should not ignore that there is hardly any overlap between considerations of how to handle drug consumption to improve brain performance, and questions of the direction a society would take for the discriminability between humans and technology to be largely removed in the future (Grunwald 2008).

One could argue that there is growing evidence for the hypothesis that we are witnessing at the moment a transition from a performance-oriented society, in which the fulfilment of predefined tasks is rewarded, to a performance-enhancing society, in which tasks in work life, and even private life, are ever harder to calculate and foresee, and therefore the most pressing task for individuals is the competitive improvement of bodily preconditions and requirements for successful performance (Coenen 2008a). Such a shift from a performance-oriented society to an enhancement society would also raise questions regarding old and new guiding visions in research policy and beyond.

In a thoughtful, well-informed, but scathing critique of trans- and posthumanist ambitions, Winner (2005) draws attention to another aspect of the interplay of visionary desires for a transgression of natural human boundaries on the one hand, and the growing relevance of HET on the other. Winner sketches three approaches in the conceptualisations of the relationships between humans and technology. Two of them, the notions of humans as "tool-making animals" and of technologies as "extensions of human organs", are well-known and therefore require no detailed explanations here. It suffices to say that both approaches still assume that technologies are distinct from the human organism itself to considerable degree. The third approach, however, which was developed above all in such fields as science and technology studies and cultural studies, is based on the assumption of a pervasive blending of nature and technology. In this view, numerous blended identities such as "hybrids" or "cyborgs" exist today: due to our use of technologies and our conceptualisations of science and technology we already became "cyborgs" or even "posthuman" (Hayles 1999) a long time ago. While some of the most prominent theorists of this line of reasoning, such as Donna Haraway and Katherine Hayles, distance themselves from, or are even shocked by, the ambitions of visionary, transhumanist engineers who lay claim to a practical posthumanism, Winner polemically points out the interrelations of cultural posthumanism and the transhumanist technophile line of reasoning, with its high hopes for all kinds of technological fixes. He questions the claim of many cultural posthumanists that their theories can form the basis of a radical progressive politics, and defends the notion of the "human condition", including mortality and our confinement to the Earth (two limits which transhumanists seek to overcome), and the traditional line of progressive reasoning on society and its future (focussing on the elimination of oppressive institutions and the creation of better ones). In Winner's view, the goal of human liberation must be maintained and should not be given up in favour of overcoming or transcending humanity. He does not shy away from denouncing the adherents to the latter idea as "scientific zealots", social activists and theorists whose worldview is bizarre, self-indulgent, megalomaniac, and an expression of sheer hubris. Winner portrays the social and cultural theorists as a kind of useful idiots with regard to the "technical and corporate realms". And he writes: "Whether they intend it or not, social theorists fascinated with hybrids and cyborgs could end up playing a significant role in upcoming debates about practical initiatives to achieve posthuman dreams in tangible forms. More eloquently than the scientists who have embraced posthumanist projects, they express a weariness about identifying oneself as merely human at all" (Winner 2005, p. 402).

Winner predicts that in the decades ahead, a climate of opinion centring on posthumanism could well emerge to inform debates about crucial points of departure in public policy.

Within this mood, Winner writes that "bio-engineering will be regarded as perfectly normal and endlessly fascinating" and any resistance to it "could appear regressive, reactionary, and outmoded. (…) (T)o deny that any such projects should be launched at all will likely be rejected as an attitude that is simply out of touch with contemporary trends (Winner 2005, p. 408).

In Winner's view, the "one serious consequence of the move to abandon a vital concern for humans and their condition and to search for more exotic, posthuman ways of being is to remove the foundations on which some crucial moral and political agreements can be sought" (Winner 2005, p. 406), namely an appeal to our common humanity. Pointing out the current miserable condition of billions of human beings today, he contrasts a global and ecologically sustainable evening out of the wealth available to human individuals with the idea of breeding exotic posthuman hybrids. Winner polemically argues that, quite on the contrary, "many seem eager to announce to persons living on less than one dollar a day that their bodies, abilities, and identities have been superseded by new products, new hybrids, produced in European and U.S. high-tech labs and social theory seminars" (Winner 2005, pp. 407f.). While many of the social theorists and transhumanists thus denounced would counter this argument by indicating the politically progressive features of their respective worldviews and theories, the huge gap between Western posthumanist visions and the actual global reality is often noted. The "digital metaphysics" (cf. the analyses by Rafael Capurro at www.capurro.de) that culminates in the vision of a libertarian society of disembodied minds in an extraterrestrial cyberspace (see Sect. 2.8) appears to be based on a depreciation of human corporeality and a neglect of human suffering. If transhumanists ponder the issue of suffering, it is most often done with regard to the problems of those who do not live in poverty (e.g., the use of emerging mood-enhancing HET for improving bonding in marriages), or by considering mortality or ageing as diseases and targets of technoscientific interventions. Compared to these concerns, such mundane problems as treating the diseases of poverty often appear minor to enthusiasts of human enhancement, to be solved by rather trivial technological fixes.

Any line of reasoning which confronts the visionary flights of fancy with rather down-to-earth societal issues is instrumental in questioning the hype around human enhancement. If such visionary ideas are taken seriously at all, they are discussed with a focus on their feasibility, as indicators of ideological drivers of the debate on human enhancement, and with a view on how they relate to observable or foreseeable power shifts and changes in the fabric of our societies.

## 2.2 Broader Societal Tendencies and Issues

In the following, we briefly discuss some broader societal tendencies and issues that are relevant in, or for the debate on human enhancement, namely aspects of globalisation (Sect. 2.2.1), the role of religion (Sect. 2.2.2), evidence of the popular view on HET (Sect. 2.2.3), tendencies to medicalise an increasing number of bodily or psychological traits and states and to commercialise medicine (Sect. 2.2.4), and altered concepts of health and disability (Sect. 2.2.5).

All these topics are discussed or mentioned quite frequently in the debate on human enhancement, but often in a rather superficial manner. As a matter of course, we will also not be able to discuss them here in detail. Therefore, we focus on such aspects that are particularly relevant in our context as well as on some contested issues.

### 2.2.1 Globalisation

As mentioned above, it is quite commonplace in the debate on human enhancement to argue that "the Chinese" will use advanced HET anyway, regardless of what stance on second-stage enhancements is taken in the West. Certainly, one could argue that this amounts to a defeatist attitude, and that the reference to China, or to authoritarian states in general, serves rhetorical purposes in a similar way as do references to more deregulated economies or low-wage countries in debates about economic or social policies. The opposite position, namely that new divides within and between societies caused by the spread of second-stage HET can be anticipated and international agreements could be made accordingly (Andler et al. 2008), may appear to be naïve, but the example of human reproductive cloning demonstrates that an international consensus on such questions is not impossible, and at least some progress in customary international law is feasible. Macer (1994) adds that there are already some transnational agreements to protect common interest and innocent parties from future technological advances and refers to the law of the sea, the law against ocean dumping, the conventions against biological and chemical weapons, the laws against militarisation of space and the international atomic energy authority, the declarations of human rights (including guidance on reproductive freedom and discrimination) and conventions aimed at combating ozone depletion, and biodiversity. At the other extreme, Mehlman and Rabe (2002) have expounded in great detail, and often along the lines of the "wars" against terror and drugs, how the U.S. could regulate genetic enhancement and even attempt to enforce a ban on genetic enhancement worldwide, with measures ranging from rather conventional means of domestic regulation and international agreements by quarantining Americans returning from foreign travels to test them for signs of genetic enhancement, or taking away U.S. citizenship from "rogue" physicians who practise genetic enhancement abroad, to economic pressures and even waging war against countries which allow genetic enhancements.

Nevertheless, the consideration that an authoritarian regime, or individual researchers in a completely *laissez-faire* environment, could press ahead with the development of ethically problematic HET is an often hidden, but crucial element of the debate on human enhancement.

As early as 1994, Zbigniew Brzezinski, political scientist and influential policy advisor from the U.S., argued that, far from being resolved, the dilemmas of human rights that relate to the protection of individual liberty and the spread of democracy, pale in complexity against a now-emerging third new dimension of human rights: the rapidly growing potential for the actual alteration of human individuality and for the inequitable social, or even totalitarian exploitation of that potential (Brzezinski/Rosenthal 1994). In an anti-relativistic vein, he argued that, in the West, we have already lost faith in the idea that there exists a shared natural moral law of universal validity. In his view, ethical conflicts over the definition of the human being will increasingly dominate our political life, at least as much as older conflicts about secular utopias.

In that broad connection, Brzezinski foresaw that the most difficult dilemma facing advanced societies would be how to define the boundary between private decisions and public regulations regarding the exploitation of the new powers acquired because of the ongoing scientific revolution.

Brzezinski particularly emphasises the aspect of globalisation. He argues that there will be a debate over whether the individual personal right to reproduce should be socially controlled and refers in this context to Singapore and China. Moreover, Brzezinski writes: "In just one century we have traversed from the coercive utopia of the totalitarians, through the permissive cornucopia of our current consumption-oriented and morally relativistic democracies, to the gates of the scientifically self-perfecting genomia. (…) The interface between ethics and science will hence be the new frontier of politics—the third new dimension of human rights—and that places on the shoulders of democratic leaders, and ultimately on all of us concerned with human rights, the obligation to be at least part-time scientists and philosophers" (Brzezinski/Rosenthal 1994, n.p.).

And ten years later, he adds, in a similar vein to Fukuyama (2002), that "the traditional linkage of political liberty and political equality - a legal concept that is central to the functioning of a democracy - was derived from the idea that 'all men are created equal'. But preferential human enhancement, by selectively manipulating the elemental code that defines the parameters of human possibility, could imperil that idea and all the political and legal constructs based on it. (…) The danger is that some states may be tempted to pursue preferential human enhancement as a national policy. In the past, a self-centered sense of innate superiority on the part of certain peoples provided the justification for colonial exploitation, slavery, and in the extreme case, the monstrous racial doctrines of the Nazis. What if such superiority, rather than being merely a self-serving illusion, should become real? Perceptible differences in intelligence, health, and longevity between people could challenge the very unity of humanity that globalization is said to be advancing, and the very democracy that America seeks to promote" (Brzezinski 2004, p. 209).

Besides the aspect of a possible international "enhancement race", another theme in the debate on human enhancement is the assumption of significant cultural differences between Western and non-Western societies with regard to the modification of human bodies, or even the assumption that certain non-Western or non-Christian cultural traditions are much more conducive to the spread of HET than Christian occidental ones (cf. e.g. Hughes 2008b).

The basic idea in this line of reasoning is that without a notion of limits set by a God, or a secularised highest entity, one has a *carte blanche* for all kinds of radical modifications of human beings. Swedin (2006) predicts that within the next twenty years, we will witness a "genetic human-enhancement race with China", with fears of a "smart-baby gap" driving Western policies. He argues that China is predisposed to adapting genetic engineering to human enhancement, referring to the fact that Confucianism teaches that life begins at birth rather than conception and to the eugenicist Chinese Maternal and Infant Health Law (1995).

These assessments are contested for at least three main reasons: Firstly, some of the evidence that is given for the strong Asian support of HET appears to be shaky. Secondly, it overlooks the fact that the widespread use of certain enhancement technologies, such as cosmetic surgery, appears to be caused, above all, by social pressures that were created by Western influences. Thirdly, the idea that Asian non-theistic cultural traditions give a *carte blanche* for limitless modifications of the human body appears to be a misunderstanding of these traditions. In the following sections, we will also briefly discuss these points.

### 2.2.2 Popular Views of Human Enhancement

As far as we can see, only very few survey results are available that reveal anything about how different nations view the topic of human enhancement, the views on prenatal genetic engineering being a major exception (cf. e.g. Meisenberg 2009). Researchers who take part in the discussions about new second-stage enhancements therefore often switch to polls that addressed technologies with a non-therapeutic human enhancement potential, but did not ask the respondents about their views on human enhancement.

Evidence suggests that the support for non-therapeutic human enhancement uses of prenatal genetic engineering ranged from 20% to 45% in industrialised countries in the first half of the 1990s (Macer et al. 1995): If we exclude the U.S., only between 20% and 30% support such a use of genetic engineering. There appeared to be no significant differences between uses for cognitive enhancement and uses for an improvement of physical characteristics. However, people in poorer countries as well as the generally poorer minorities in the U.S. tended to judge non-therapeutic human enhancement more favourably than the people in richer countries and the whites in the United States.

These findings also provide some evidence regarding the question of cultural differences between the West and other world regions. One of the studies conducted in the 1990s, a major international survey study on public perceptions of genetic enhancement came up with the following results (Macer et al. 1995): In general, there was extremely strong support for the use of gene therapy to cure disease and less support for non-therapeutic enhancement uses. However, in India and Thailand more than 50% of the 900+ total respondents in each country supported enhancement of physical characteristics, intelligence, or making people more ethical, a fact which has been interpreted as possible evidence for the conduciveness of Asian cultural traditions to human enhancement (Hughes 2008b).

However, the very same study shows that in Japan, a non-Western and non-Christian industrialised country, there was less support for human enhancement than in the U.S. and Russia and about the same level of support as in Australia, New Zealand, and Israel, namely between 20% and 30%, with less than 20% of respondents strongly supporting it. While the authors point out that further research into the factors behind people's acceptance or rejection of enhancement is needed (for instance, to what degree culture, education, religion, familiarity with medicine, or living standards, influence the perceptions), they also argue that results such as these might suggest that poor living standards and infectious disease make people more pragmatic about human enhancement and lower education more naïve when it comes to the questions of risk and effectiveness of HET.

Similar to Asian parents who subject their children to surgical interventions with the aim to facilitate their success in a Westernised professional life (see LaFleur 2008), the willingness of poor people to use HET appears to be less a self-conscious choice based on cultural values, but as act of desperation.

In a recently published U.S. study, consumers of genetic testing services were asked by researchers and "genetic counsellors" of the universities who offered these services about their views on different current and possible future uses of this technology (Hathaway 2009). The researchers found that the majority of respondents would elect to have prenatal genetic testing for mental retardation (75%), deafness (54%), blindness (56%), heart disease (52%) and cancer (51%). The consumers, however, were much less interested in testing for traits such as tall stature, superior athletic ability and high intelligence. The leader of the project team stated that the survey, which was conducted between July 2006 and February 2007, had "discovered that although the media portrays a desire for 'designer babies', this does not appear to be true among consumers of genetic testing services" (NYU 2009, n.p.). Only a minority of respondents were interested in genetic testing for enhanced athletic ability (10%) or superior intelligence (13%).

In a U.S. national survey conducted in 2008 on nanotechnology and human enhancement and believed to be the first nationally representative survey of its kind, the researchers used a number of methods to evaluate the potential effects of information on public attitudes to human enhancement (cf. Cobb 2008, NCSU 2008). Overall, they found attitudes to be largely ambivalent and dependent on the information provided in the wording of the question, but also that interest declines as the respondents learn more and that equity is a fairly important concern with regard to the long-term distribution of potential benefits.

Some of the key findings reported by the researchers include the following (Cobb 2008): Support is very high for visionary therapeutic HET such as artificial eyesight (88%) and medical devices to detect changes in human biomarkers to detect diseases early (84%). Conversely, limited support exists for non-health benefits, such as drugs to prevent prisoners escaping (22%), implants to improve the performance of soldiers on the battlefield (30%), and brain implants to permit basic computer-to-brain functions. A total of 84% believe government should guarantee equal access should such enhancements become available. A slim majority (55%) agreed that we should "avoid playing God with new technologies" rather than "embrace new enhancement technologies to improve humankind" (45%).

Interestingly, far fewer people believed human enhancements to be important at the end of the survey after they had been asked more questions about it (55%) than at the beginning before they had heard much about it (81%). The study was conducted between July and October of 2008. The survey included 556 participants, had a 28% response rate, and has a margin of error of ±4.1%.

In 2009, the Deutsche Angestellten Krankenkasse (DAK), a leading health insurance company in Germany, published their annual health report with a special perspective on "brain doping" at the workplace (DAK 2009): the DAK questioned some 3000 employees between the ages of 20 and 50 years and researched a large number of insurance records to find out more about doping in the workplace.

The study made it to the headlines of national quality newspapers, which reported that hundreds of thousands or even millions of Germans resort to doping at the workplace. In fact, 5% were found to have already used drugs to improve their cognitive functioning or emotional well-being without medical indication, which would amount to about 2 million people. However, less than 2% of the respondents (about 800 000 people) take such drugs regularly. And only half of these use them for cognitive enhancement, while the remainder take the drugs to deal with anxiety or depressive moods. The researchers conclude that if the frequency of use and sources of supply are taken into account, only between 1% and 1.9% of the respondents can be classified as dedicated, active "dopers". However, 20% of the respondents reported that the use of drugs for cognitive or mood enhancement has been recommended to them, and in about one-third of these cases this recommendation came from a physician.

According to the analysis of the insurance records whose results may also reflect widespread deficits in the diagnostic records of physicians, drugs such as Piracetam, methylphenidate (Ritalin™), modafinil, and fluoxetin (Prozac™) were often (between 10% and 20% of all cases) prescribed without diagnosis. Interestingly, 20% of those questioned said they considered the benefits of the non-therapeutic use of pharmaceutical cognitive enhancers to outweigh the risks and side effects, and again about 20% of respondents reported knowing at least one person who takes drugs for cognitive or mood enhancement with medical indication.

Moreover, about 45% of all respondents could name at least one justifiable reason why they would take pharmaceutical cognitive enhancers without medical indication. Of the more than 50% of respondents who would never take a drug for cognitive or mood enhancement without medical indication, only about 3% refrain from taking these drugs for the moral reason that this would amount to unfair competitive advantage. In sum, the results of the survey indicate that the non-therapeutic use of cognitive and mood enhancers at the workplace is far from widespread. The researchers contrast this with what in their view constitutes sensationalist and irresponsible media reporting that tends to overrate the efficacy and diffusion rate of such uses.

However, the theoretical willingness of a large number of respondents to take drugs for non-therapeutic enhancement purposes, and the still large number of respondents who reported knowing at least one other person who is taking such drugs at the workplace indicate that the societal potential of pharmacological cognitive and mood enhancers should not be underrated.

As a final example, we would like to mention an informal survey that the prestigious scientific journal *Nature* conducted on its website in the course of its campaign for legalising pharmaceutical cognitive enhancers (for the campaign, see Sect. 3.8.2). More than 1400 people from 60 countries responded to the online poll (Maher 2008). About 20% of the respondents said that they had used drugs for non-medical reasons to stimulate their focus, concentration, or memory, with concentration on the top of the list of goals. About half of all questioned reported taking one or more of these drugs daily or weekly. A high four-fifths thought that healthy adults should be able to take the drugs if they wanted to. About one-third of the respondents said they would feel pressure to give cognition-enhancing drugs to their children if other children at school were taking them.

### 2.2.3 Religion and Cultural Differences

Religion is an important aspect in the debate on human enhancement for several reasons:

- Firstly, the more far-reaching visions of transhumanists and other ardent promoters of human enhancement appear to be quasi-religious, or even as possible elements of a new technoscientistic religion or cult.
- Secondly, and probably also for this reason, theologians and Christian laypeople have been engaged at rather early stages and to a strong degree in discussions about human enhancement (cf. Coenen 2008b).
- Thirdly, to many Christians some second-stage enhancements appear as offensive as certain older biotechnologies.
- Fourthly, mainly in the U.S. but with growing impetus in Europe, there is a debate on Darwinism, biological evolutionary theories, and the competing Christian fundamentalist, "creationist" worldviews.
- Fifthly, we have witnessed in large parts of the world a growing interest in religions which also has an impact on the debate on human enhancement as a matter of course.
- Sixthly, the churches and other religious organisations play an important role in health systems.

We have already mentioned, and questioned one aspect of the religion in the debate on human enhancement, namely the assumption that certain non-Western or non-Christian cultural traditions are much more conducive to the spread of HET than Christian occidental ones, and that Asian religions which do without a notion of limits set by a God, or a secularised highest entity, give a *carte blanche* for all kinds of radical modifications of human beings.

It is useful to discuss these two claims in conjunction with each other, not only because East Asia is an important player in science and technology, but also because the comparison may shed some new light on our Western traditions.

While certain statements by prominent Asians, such as the Dalai Lama and notorious biologist Woo Suk Hwang, are quoted to underline the assumption of a conduciveness of non-theistic Asian worldviews to HET, pertinent research based on the works of Asian bioethicists comes up with different results.

Döring (2002), for example, discusses the relevance of Confucianism in the thought of several Chinese bioethicists and comes to a much more nuanced conclusion, rejecting the ideas that one could make general statements on "the Chinese" or "the Confucians". In his view, bioethics inspired by Confucianism is as diverse as Western bioethics, and can also serve to question eugenicist claims and policies. Scholarly works on Confucianism as well as the above-mentioned survey (Macer et al. 1995) suggest, for example, that in countries that are still heavily influenced by Confucianism, any enhancement for economic reasons, including competitive advantages for individuals, is particularly strongly rejected.

With regard to Buddhism, LaFleur (2008) not only questions whether Asian promoters of human enhancement really do speak for their cultural traditions, but also presents a number of interesting arguments as to why the notion of a particular conduciveness of East Asian cultural tradition to human enhancement stands on shaky ground and may well be primarily caused by the inability of some Westerners to reflect on their own worldview.

In his view, the Christian and secularised Western tradition is shaped by the split into "limitationists", who see hubris and the risk of divine (or Nature's) displeasure in human efforts to surgically or biogenetically "improve" the inherited human body or mind, and "completionists", who see the god of the myth as mandating an enhancing, even a perfecting, of what humans had received as genetically given. In LaFleur's view, Buddhism is strikingly different because, within its own core tradition, speculation about how the universe came into being is irrelevant to humankind's fundamental religious problem. He writes: "Reasons for prudence may have other, even better, bases than assumptions made about limits with a divine origin" (LaFleur 2008, 69). LaFleur emphasises that the central Buddhist notion of an exacerbation of desire, comparable in its relevance for Buddhism to the notion of sin in the biblical traditions, still implicitly or explicitly informs advanced reflections on human enhancement in East Asia. While he concedes that the Japanese are more reluctant than some other East Asian peoples to pursue high-risk research in HET, due to a historical awareness of Japanese war crimes in World War Two, LaFleur emphasis that the analysis of desire is at the heart of all Buddhist reflections on human enhancement. As in Confucianism too, the negative impacts of limitless desires on the society constitute a major ethicopolitical concern. Accordingly, Japanese bioethicists envision both psychological suffering and social confusion as the postulated result of socially sanctioning uncontrolled and promoted enhancement technologies. Quoting a Japanese bioethicist, LaFleur writes that, therefore, "the central problem with which bioethics must deal is where to draw the line between what we will allow and what we will disallow within the continuum of things we desire. He concludes that "God, natural law, and the like may be absent from the Mahayana Buddhist account of things, but human beings and their deeply entrenched ways of making themselves miserable remain very much present. And this means the persistence of easily enflamed desires and, via technology, the mechanisms to produce and pour even more fuel on existing fires within the human mind, psyche, and societies" (LaFleur 2008, 70). In his view, this critical notion of desire is also relevant for other societies, including Western ones. Rhetorically he asks what is driving us to become societies in which being competitive is tolerated so much, even celebrated, that individuals feel compelled to surgically enhance not only their own bodies but even those of their children?

If we consider the evidence that suggests a larger impact of living standards on views of human enhancement than of cultural or religious traditions (see Sect. 2.2.3), and take into account that non-Christian traditions are in no way, in general, more conducive to human enhancement than Christian ones, we can question, and may cautiously deem premature, the positing that cultural globalisation will inevitably lead to a global surge of new HET. Compared to this assumption, the idea that countries with authoritarian or totalitarian regimes, irrespective of their cultural or religious traditions, may be tempted to pursue human enhancement as a national policy appears to be more plausible.

We must also bear in mind that Christian views on human enhancement are far from consistent (for the following and an overview, see Coenen 2008b). Taking up LaFleur's (2008) above-mentioned notions of Western "limitationists" and "completionists", one can say that the mainstream of Western Christianity and its leaders are limitationists. However, there are several U.S. and some European theologians whose completionist views are quite open to a perspective of human enhancement. Within Christian theology, the notion of humanity as God's "Co-Creator" is particularly relevant here. In a particular strand of Protestant theology, this concept is related to the notion that Christians cannot accept the status quo as normative, but have to press on creatively toward a new and better future (Peters 2002). For some of these co-creationist theologians, this includes far-reaching uses of genetic engineering, or even an open stance towards transhumanism (a fact that is appreciated by transhumanist leaders, see Hughes 2008b).

Accordingly, the Vatican, which favours a rather limitationist view of certain technological developments, warned in a high-level document that the idea of man as "co-creator" with God could be used to try "to justify the management of human evolution" by means of "genetic human enhancement", defined in this document as genetic engineering which "aims at improving certain specific characteristics" (International Theological Commission 2002). In the view of those authors, this would imply that man has the full right of disposal over his own biological nature, but changing the genetic identity of man as a human person through the production of superhuman beings is "radically immoral". Moreover, the authors emphasise that the use of genetic modification to yield a superhuman being "with essentially new spiritual faculties is unthinkable, given that the spiritual life principle of man – forming the matter into the body of the human person – is not a product of human hands" and is not subject to genetic engineering. Citing another core concept in this context, namely *imago Dei* (image of God) which implies that human beings are created in God's image and therefore have an exceptional, intrinsic value, the authors argue that "man can only truly improve" by realising more fully the image of God in him by uniting himself to Christ and in imitation of him. Moreover, genetic enhancement would, therefore, in any case violate the freedom of future persons who had no part in decisions that determine their bodily structure and characteristics in a significant and possibly irreversible way. However, the paragraph on genetic enhancement in this document ends with a remark that characterises certain inborn bodily structures and characteristics as a legitimate subject for gene therapy. The authors hold that, if gene therapy were directed towards the alleviation of congenital conditions like Down's syndrome, although this modification would certainly affect the identity of the person involved with regard to his appearance and mental gifts, it would also help him "to give full expression to his real identity which is blocked by a defective gene" (International Theological Commission 2002).

High-ranking leaders of Western Christianity have tackled the issue of human enhancement also with regard to its more visionary aspects, in particular the hope for overcoming death by technoscientific means. Wolfgang Huber, chairman of the council of the Evangelical Church of Germany, sees two main tendencies which call into question the notion of a person as a free and responsible being, created in the image of God: (1) prenatal negative eugenics and (2) the transhumanist visions of a technological immortality and of creating a new species by means of artificial intelligence or genetics; this would, in his view, amount to annihilating the exceptional position of mankind (Huber 2002).

Pope Benedict XVI devoted his second encyclical (*Spe Salvi*) to the issues of Christian hope and of secular hopes for the future. He discusses the nature of the Christian hope for eternal life (*Spe Salvi*, 10-12), raising the question of whether we really want to live eternally. In his view, to live forever without end can only be monotonous and ultimately unbearable, and "to eliminate death or to postpone it more or less indefinitely would place the earth and humanity in an impossible situation", and "even for the individual would bring no benefit". According to the Pope, in some way we want a "blessed life", untouched even by death, yet at the same time we do not know the thing towards which we feel driven. And this unknown "thing" he defines as the true "hope" which drives us, arguing that the very fact that it is unknown is the cause of all forms of despair and also of all efforts, whether positive or destructive, directed towards worldly and human authenticity. Obviously, such an understanding of Christian hope is at odds with the transhumanist visions of cybernetic "immortality" or an endlessly prolonged biological existence. In Benedict's view, Francis Bacon's programmatic vision has determined the trajectory of modern times since hope has acquired a new form in it: faith in progress. According to the Pope, as the ideology of progress developed further, two categories became increasingly central to it: reason and freedom (*Spe Salvi*, 18). In his view, the dominion of reason and freedom were seen purely as promises, in which man becomes more and more fully himself. The Pope identifies two essential stages in the political realisation of this hope, the French Revolution and the Marxist revolutions (*Spe Salvi*, 19-22). Against this historical background, Benedict argues that, if technological progress is not matched by corresponding progress in man's ethical formation and inner growth, then it is not progress at all, but a threat for man and for the world. Man could never be redeemed simply from outside. Bacon and those who followed in the intellectual current of modernity that he inspired were, therefore, wrong to believe that man would be redeemed through science. Benedict emphasises that it is not science that redeems man, but that man is redeemed by love (*Spe Salvi*, 26).

There are several pieces of evidence as well as good reasons for making an educated guess that the debate on religious aspects of human enhancement, that is already rather vivid, will most probably continue to gain impetus (for an overview and more detailed analysis, see Coenen 2008b, Malsch 2007; for a transhumanist view, see Hughes 2008b).

Firstly, some Christian theologians and lay activists interpret the posthuman concepts of evolution and some main tendencies in the discourse on human enhancement as a kind of Darwinism taken to its logical endpoint or extreme. This may draw the topic into the heated debates on Darwinism and Religion which, in particular in the U.S., display features of a "culture war".

In this context, one should, however, note that a recent study on the public perception of nanotechnology in the U.S. and in Europe came to the conclusion that the strong reservations of many rather well-informed people in the U.S. about nanotechnology relate to their religious background which leads them to reject any attempts to "play God" (Scheufele et al. 2008), a background that is in Europe far less widespread.

Secondly, as we have seen above, certain second-stage enhancements, if realised, and even more so the related visionary debate touch on core elements of the Christian message such as the hope of eternal existence for individuals or the godlikeness of human beings.

We must note here, however, that it is not very likely that second-stage enhancements that are used in a clearly therapeutic and postnatal context (or for that matter new brain-computer interfaces for soldiers) will be met with resistance by many Christian conservatives in the U.S. They have often held technoscientific and medical progress in high esteem, in line with U.S. culture in general.

Thirdly, the anti-permissive, anti-relativist, and anti-hedonistic line of reasoning which is characteristic of conservative Christians, ranging from Pope Benedict to U.S. evangelicals, already plays an important role in the debate on human enhancement (see Sect. 2.1.1).

Fourthly, there are already quite a few instances of Christian theologians and lay activists who have engaged in the new debate on human enhancement with a focus on its wider cultural, ideological, and political aspects. Some of these authors see several visions of human enhancement as an important manifestation of modern hubris, and as an attempt to play God by violating laws of a given natural order of society and human existence. This corresponds to the arguments that have long been levelled at the artificial intelligence movement and the mentors of posthumanism by feminist and social progressives such the above-cited Langdon Winner (see Sect. 2.1.4). Christian lay activists and authors, in particular, often offer a reduced version of a thesis that is, at least implicitly, also to be found in the texts of the PCB and its circle (see Sect. 2.1.1.). This states that secular modernity is a morally disastrous aberration from the natural order, and its danger lies above all in its utopian elements and some of the consequences of technoscientific progress. These authors often cite C.S. Lewis, whose essay *The Abolition of Man*, based on a 1942 lecture, excoriates the early transhumanist hopes for a secular and enlightened technocracy. They often interpret this aberration as a kind of heresy with roots in a magical or Gnostic, but in any case decidedly anti-Christian revival in the times of the Renaissance. Moreover, they argue that the radical promoters of human enhancement as the "new utopians" intend to use science and technology for realising "the perfect society of perfect people on a perfect earth" with "eternal life and freedom from pain, suffering, and the burden of a frail body" (Mitchell/Kilner 2003), and they often characterise transhumanism as a rival to Christianity, promising what is, in their view, already available to Christians (such as eternal life).

Finally, such Christian authors often tend to affirm the self-perception of posthumanism as the legitimate heir of the Age of Enlightenment, of modernity, and of secular humanism. The Enlightenment is reduced to its high esteem for science and technology. This age of reason is portrayed as an era of technophilia and of shallow notions of progress. If the authors refer to any Enlightenment thinkers at all, they often use the Marquis de Condorcet and Julien Offray de La Mettrie as strawmen (e.g. Hook 2004).

The assumption of a religious confrontation is affirmed by some leading transhumanists, such as William Bainbridge of the U.S. National Science Foundation, one of the key players of the NBIC initiative (see Sect. 2.8.3). He not only dreams of a renaissance of the Renaissance and has argued for a "space religion" to culturally prepare the extraterrestrial expansion of (post)humanity, but also sees the NBIC "convergenists" (his term) and the transhumanists as allied movements which challenge traditional Western religions and churches and are thus at risk of similar persecution by traditional powers as heretical or magical movements of the past (Bainbridge 2005).

However, several leading figures of transhumanism concede or even emphasise similarities between their visions and religious ideas, and some ponder how to strengthen existing syntheses of posthumanism and religious thought or develop new ones (Hughes 2008b; cf. Coenen 2008b). All this relates to endeavours by the forerunners of today's transhumanism, a number of leading natural scientists and technovisionaries in the 1920s to 1950s (such as the biologist and first UNESCO director Julian Huxley, brother of Aldous) who have more or less seriously considered the promotion of a new, technoscientistic religion.

Below, we will briefly come back to such questions which appear to touch on core elements of European cultural value systems (see Sects. 2.8.6 and 2.9), but now turn to, in the literal sense, more mundane issues.

### 2.2.4 Changes in Concepts and Systems of Health Care

The previous sections in Chapter 3 have contrasted alarmist or enthusiastic visionary contributions to the debate, as well as the rather rough contours of the debate itself, with more nuanced and down-to-earth contributions and discussions of what is at stake with regard to human enhancement. In this and the following sections, we will corroborate our belief that the heated and rather visionary controversies about human enhancement at large need to be complemented by a closer look at the actual social relevance of human enhancement and by a discussion of the practices related to and lay peoples' perceptions of the development and use of specific HETs.

The obvious starting point for this is the field of health care, if only because most of the ethical debates about human enhancement revolve around its relevance for this field and because most of the existing HET are exclusively or mainly used in a therapeutic context. Other important starting points are competing conceptions of disability and the underlying notions of ability and normalcy. This is related to the fact that actual and supposed demands of disabled people are used as important points of reference in the debates on HET, and in particular that second-stage HET are often targeted at impaired or disabled people (see Sect. 2.2.5).

The notion of human enhancement shifts the focus from the medical practitioners to lay people and their choices and goals. As far as discussions about enhancement centre on reproductive medicine, these individuals are adults who want children. In the debate about "designer babies" (see Sect. 2.4) and related issues, strong criticism of human enhancement (e.g. Habermas 2001), with warnings about a loss of children's autonomy and the long-term dangers for humanity, are pitted against the ideas of proponents of liberal eugenics (Agar 2004) in which the latter is conceived in terms of reproductive freedom.

However, there are medical and non-medical HET which can be subject to informed consent by those persons who are the only or main target of the interventions. A well-established example of such an enhancement technology is cosmetic surgery. To a certain degree, neuropharmaceutical and neurotechnological interventions can also be subject to informed consent. Viewing such developments only from a perspective of individual decisions for or against the use of HET risks overlooking broader societal tendencies that are the context of such decisions, and of the issue of human enhancement in general.

One such tendency is that of the medicalisation of society. Medicalisation "occurs when previously nonmedical problems are defined and treated as medical problems, usually in terms of illnesses or disorders" (Conrad and Leiter 2004). This tendency, in turn, has to be seen against the background of even broader changes in medicine (Conrad 2007; cf. Wolbring 2005), such as (i) the widespread questioning of medical authority by patients and advocacy group, a trend that is arguably reinforced by the rise of the World Wide Web with its countless websites on medical issues, (ii) the new focus on cost control of health care (instead of on access to it), (iii) the commercialisation of medicine (including, for example, the rise of direct-to-consumer marketing, of corporate medicine, and of cosmetic surgery, the shift from the notion of "patient" to that of "consumer", and the emergence of medical markets), and (iv) the rise of modern biotechnology and neurotechnology, which have not only added new approaches to therapy but also changed widespread views of illnesses and disorders and of the human body and mind in general.

Social scientists involved in studies of medicalisation hold that there has been a marked increase in the medicalisation of society over the past three decades. Conrad and Leiter (2004) argue that there are numerous broad social factors that have encouraged or abetted medicalisation, including the decline of religion; an abiding faith in science, rationality, and progress; an increased reliance on experts; and a general humanitarian trend in Western societies. Foremost among the factors directly influencing the tendency toward medicalisation on the "supply" side is the prestige and power of the medical profession. On the "demand" side of medicalisation, there has been a growth in consumer demand for medical solutions. Some more or less successful cases of medicalisation are attention deficit hyperactivity disorder (ADHD; see Sect. 2.5), obesity, post-traumatic stress disorder, new addictions (sexual addiction, computer addiction etc.), and the chronic fatigue and premenstrual syndromes. In most of these cases, there are disagreements and in some instances heated debates about whether the new diseases or disorders actually constitute a condition requiring therapy. Critics usually argue that these conditions relate to social pressures, norms and the like and could largely be solved by social change instead of by medical or technological fixes.

On the other hand, more and more conditions or bodily traits are being related to genetic or neurological components, often in a speculative manner. Conrad and Leiter (2004, 159) emphasise "that new biomedical knowledge or interventions alone cannot engender medicalization. Etiology or treatment may be a central component of a claim to medicalization, but those claims must be championed by supporters or promoters of a diagnosis, be they physicians, patients, lay advocates, or commercial entities such as drug companies."

This applies to HET, too, which is increasingly being made a topic in medicalisation studies (cf. Wolbring 2005). Conrad (2007) sees human enhancement as one of the relatively new drivers of the tendency toward medicalisation. Conrad and Leiter (2004) discuss, for example, inter alia the cases of Viagra, human growth hormone, and in vitro fertilisation as illustrations for their contention that — in the climate of increased corporatisation of health care and diminished public regulation — the creation or expansion of new medical markets is a significant force toward medicalisation.

Drugs developed for neurological or psychological treatment clearly bear a potential for "dual use" beyond the more or less well-defined clinical problem they originally may have been developed for. Enhancement in this case may come about as a clearly non-medical use (or abuse) of a drug developed for a medical objective. A HET, however, may find its way into society by benefiting from the above outlined tendencies toward medicalisation (see Sect. 3.2.4). There is a broad scope of bodily features, physical states (or deficiencies) and behavioural particularities that until now would not have been regarded as a disease or abnormality but simply as a variety of human nature (e.g., variations in body height, a person's sociability, stress resistance, self-confidence). Such variations can easily become an object of medicalisation as soon as medical or technical means are available to intervene, alter or alleviate. What is going to happen then is a redefinition or shifting of existing concepts of health and disease. What was formerly regarded as being "unfavourable", a "weakness", a "bad habit" is redefined as being a disease or disability when an effective (or allegedly effective) medical treatment seems to be at hand.

The redefinition of clinical patterns or disorders is an ongoing and normal process in health care as clinical knowledge grows. New symptoms may be subsumed under existing patterns that are already well described. On the other hand, symptoms that had been related to one disease or clinical pattern may be regarded as a separate new clinical pattern in the light of new clinical studies. Medicalisation, however, entails an expansion of what is covered by the medical sector as such, i.e. bodily or mental features or idiosyncrasies come to be viewed from a medical perspective where this was previously not the case. Apart from ADHD (see section 2.5, cf. e.g. Malacrida 2004), processes of medicalisation that touch at the margin between therapy and enhancement have recently been shown for shyness, for example, which is on the way to being perceived (and treated) as a medical syndrome in the course of the expanding scope of medical applications of new anti-depressives beyond what can be diagnosed as a severe depressive disorder (Wehling 2008).

Another case in point is the development of the medical use of human growth hormone (see for the following Conrad and Leiter 2004). A human growth hormone synthetically produced by the U.S. biotech company Genentech originally had been approved by the U.S. Federal Drug Agency only for treatment of a well-defined class of people suffering from growth hormone deficiency.

Strict guidelines had been developed for the medical profession in order to define the syndrome and discern it from what has been called "idiopathic short stature" (i.e. children with normal growth hormone who are short). Based on statistics, short stature is defined as the lower 3 percentiles for age and sex, which is roughly two standard deviations below the sex-age mean. There are estimates that 1.8 million children in the U.S. have a short stature, but only 5% of them suffer from growth hormone deficiency. For the others, the cause is unknown or short stature is simply a characteristic trait in their families. Within a period of ten years and after co-operation between the company producing the synthetic hormone and patient organisations promoting research on "healthy" children with short stature (i.e. not suffering from growth hormone deficiency), a private market for off-label use of the hormone had evolved.

Despite the fact that insurance companies only cover treatment costs for hormone deficiency and that the treatment costs about $20,000 (over a period of at least three years), the majority of prescriptions of human growth hormone were for children who are of short stature but are not suffering from hormone deficit disorder (94% of prescriptions according to a national survey from 1996).

The example of the growth hormone is one of several that show that a trend toward medicalisation, accompanied by a tendency for the differences between therapy and enhancement to be blurred, can be expected as soon as there is a (new) drug or treatment available that bears potential to establish a private market for off-label use. This will usually be driven by, on the one hand, consumers who experience themselves as in some sense suffering from or being disadvantaged by a personal physical or mental deviation from the average, and on the other hand by companies with an economic interested in expanding and propagating the applicability of a drug or treatment beyond rather restricted medical descriptions and establish it as a "cure" for (potentially) "everybody". It is not at all unlikely that this mechanism will also work for medical drugs or treatments that might help to enhance human capacities beyond what is defined as being normal or "average" – e.g. for capacities to concentrate and focus, resist stress, and suppress normal anxieties. Gaining a competitive advantage in a market society that is driven by the dynamics of competition will not be regarded as being "unfair" or ethically doubtful by many, and even doctors may not hesitate to "help" when patients/customers ask them for support in "keeping pace" in their professional lives. A consequence of medicalisation and the expansion of what is regarded to be subject to medical treatment might well be that the ethical expectations on some professions (for example on pilots or lorry drivers) will demand that cognitive capacities be expanded beyond the "normal".

### 2.2.5 Disability, Human Enhancement, and Environmental Challenges

Disabled people are often highlighted as the beneficiaries of the products and processes of science and technology, and, particularly of second-stage enhancements that are still visionary or just emerging (for the following, see Wolbring 2005, 2008b; cf. Anderson 2008).

We distinguish the following categories of science and technology products and processes targeting the disabled: (i) medical solutions (preventive or therapeutic, including adaptations to social norms), (ii) non-medical solutions (including second-stage and species-atypical enhancements of the human body), and (iii) environmental solutions which, above all, relate to public infrastructure and assistive technologies.

Many applications and products of new and emerging sciences and technologies (see Sect. 2.2), some of them as yet only envisioned or under development, belong to the first category, but may also fit the second. Therefore, many ardent promoters of human enhancement see disabled people as trail blazers for HET which pave the way for transhumanist philosophies and developments.

A leading transhumanist, for example, claimed that "(a)lthough few disabled people and transhumanists realize it yet, we are allies in fighting for technological empowerment" (Hughes 2004).

Another transhumanist displays a kind of "Promethean shame" (which was philosopher Günter Anders' notion of an inferiority complex about our own bodies in relation to machines) when looking at a new artificial arm: "No, this particular prosthetic barely resembled a human arm, looking more like something out of a Terminator movie. It was robotic, sleek and very high tech. In fact, I think I was jealous. (…) (J)ust looking at it made me realize that it won't be long before future prostheses, for all intents and purposes, will be better than my biological appendages. And what's more, the disabled will in all likelihood be encouraged to try out the latest models, to experiment with the latest in prosthetic neural interfacing and advanced cybernetics. (…) For the handicapped, the impetus toward 'human normalization' is as irrelevant and useless a notion as it is offensive. Indeed, the disabled are no longer accepting the limitations of the 'normal' human body. They are truly bridging the gap between the biological and the mechanical, the human and the posthuman" (Dvorsky 2003). And he goes on: "Interestingly, many in the disabled community will choose to be willing test subjects; many have nothing to lose and are eager to try out the latest innovations – if not for themselves, certainly for those in the disabled community who will follow after them" (Dvorsky 2003).

Against this background and that of the large amount of resources that are used for R&D that fits our first two categories, one can ask why comparatively few applications or products of new and emerging sciences and technologies are linked to our third category, namely products and applications that target the environment in which disabled people and not their bodies to increase their well-being. Furthermore, as many disabled people are poor and live in low-income countries, they will very likely not have any access to new HET. Many argue that HET will eventually "trickle down". However, most disabled people today still do not even have access to clean water and sanitation and basic essentials such as work, education, and health services (Elwan 1999; Wolfensohn 2002). Moreover, many technological developments have led to new groups of marginalised people and to new inequalities.

There is no reason in today's political realities why this would be different if the human body became the newest frontier of commodification. As much as HET will become an enabling technology for the few, it will become a disabling technology for the many. As more powerful, less invasive and more sophisticated enhancements become available, the market share and acceptance of enhancement products will grow in high-income countries.

This will very likely develop into a situation where those who do not have or do not want certain enhancements, a future group of people we may call the "techno poor impaired and disabled" (Wolbring 2008a, 2008b), will be discriminated against, given negative labels, and suffer difficult consequences in tune with how the "traditional disabled" are treated today.

Analogous technology-related situations are already with us today, if we think of access to new information and communication technologies ("digital divide"). There is a high-probability risk that if effective HET are developed on a large scale, an "ability divide" will develop between the poor and rich within every country. A far-reaching consequence of this would be that billions of people who today are regarded as healthy and non-disabled very likely will be labelled as impaired and experience disablement, not because their bodies have changed, but because they have not changed their bodies in accordance with a new, transhumanist norm.

One could argue that there are tendencies which veer towards a significant change in concepts of health, ability and disability. Up until now a non-impaired person is considered to be someone whose body functioning performs within species-typical, acceptable parameters. Within a "transhumanised model of health", a person is no longer considered to be healthy and non-impaired if the person biologically functions within species-typical, normative frameworks. Rather, in this model all human bodies – no matter how conventionally "medically healthy" – are seen as limited and defective. This is related to the possibly crypto-gnostic view, widespread in transhumanism and in some corners of biotechnology and artificial intelligence research, that our human bodies are rather fragile and partly inefficient machines, or even prisons of our minds (for a short discussion of these ideas, see Coenen 2006, 2008b).

In such a model of health, that fits into other developments in the direction of an "enhancement society" such as the rise of highly competitive entertainment shows or of cosmetic surgery (Grunwald 2008), human beings are seen to be in need of constant improvements that are made possible by new technologies appearing on the horizon (similar to the constant software upgrades we perform on our computers).

This also fits well with the existing dynamic of the medicalisation of the human body, where more and more variations of human body structure and functioning are labelled as deviations or diseases and with the phenomenon that more and more healthy people feel unhappy with their bodily structure and functioning. The transhumanised model of health elevates the medicalisation dynamic to its ultimate endpoint, namely, to see the enhancement beyond species-typical body structures and functioning as a therapeutic intervention.

Here we have to go back to the concept of "ableism", the notion that certain abilities, such as productivity and competitiveness, are cherished and promoted over others such as empathy, compassion and kindness. It is a set of beliefs, processes and practices that, based on abilities, produce a particular kind of understanding of the self, the body and the relationship with others of the same species, of other species and the current environment, and includes being judged by others (Wolbring 2008b). In the course of the "transhumanisation" of ableism the improvement of functioning of biological structures beyond species-typical boundaries is seen as essential, the new ableism, therefore, exhibits the favouritism of species-atypical abilities.

In sum, one can argue that the triangle of medicine, disability and human enhancement appears to undergo radical changes (Wolbring 2005):

- On the one hand, as the line between disabled and non-disabled is often rather blurred, the so-called non-disabled are impacted by the situation and treatment of the disabled.
- On the other hand, a range of new or emerging HET as well as the rise of the new discourse on HET threatens to change the freedom of choice and the cultures of disabled people (such as the widely discussed deaf culture), and to marginalise those concepts of disability that focus on the social and normative aspects of disability and not on medical categories or technological fixes.

Given the rapid progress in robotics, information and communication technologies, and other relevant fields of R&D, the trend to technological fixes by means of HET appears to be in no way technologically determined. Instead of focusing on the development of tools that would diagnose or eliminate that portion of disabled people's biological reality seen by others as deficient, defect, impaired and "disabled", the construction of an intelligent, barrier-free public infrastructure and R&D in new assistive technologies could be more strongly funded to allow disabled people to adapt the environment in which they live to their needs, and to give them the tools to deal with environmental challenges without changing their identity and biological reality. Given that the decision which approach should be chosen is a political one, there is a need to critically reflect on the roles of targets, or "poster boys" that are assigned to disabled people in many science and technology endeavours, and to empirically find out their demands and wishes.

A particular case of changing the parameters of individual human performance which challenges the view that there is a general standard for human capabilities concerns deafness (see also Sect. 2.4.2). The European Group on Ethics in Science and New Technologies (EGE) points out that the technological drive to promote cochlear implants raises ethical questions concerned with how this drive impacts on the individual and on the deaf community (and of the signing community in particular), and that (i) this drive leaves unquestioned the social integration of the deaf person with the deaf community, (ii) does not pay sufficient attention to psychological, linguistic and sociological issues, and (iii), above all, promotes a particular view of "normality" (EGE 2005). In the view of the EGE, these cultural and social impacts of cochlear implants needs further study.

In the following sections, we discuss visions of HET, some of them quite far-reaching, in close connection with actual technologies, social practices and related debates and discourses. The four selected technologies are (i) enhancing the body and physical performance by gene doping, (ii) prenatal genetic enhancement (by selecting embryos that match certain genetic characteristics as a possible precursor of the rise of genetic perfectibility to a new societal guiding vision), (iii) cognitive enhancement through drugs, and (iv) the possibility of mood control by deep brain stimulation. The research for these case studies was carried out by the Rathenau Institute in 2008, and has also been reported in their essay *Future man, no future man* (Van Est et al. 2008). We do not focus only on the technologies and their risks, but also on social concerns regarding these technologies, their cultural relevance, and the discursive settings in which they are applied or envisioned. In a separate section, we pick out the common themes that run through all four cases (see Sect. 3.7). These themes will clarify why the technologies and practices that are seemingly very different are all in fact part of an overarching phenomenon, namely the trend towards an enhancement society. In all four cases, as it will be explained, the border between treatment and enhancement appears to be shifting. This leads to non-therapeutic enhancement practices, sometimes introduced as medical practices, that affect more than just the people using the technology. We also discuss the challenges to existing regulations raised by these practices and by the discourses on them.

## 2.3 Pushing Boundaries with Genetic Therapies and Doping?

This section will focus on genetic enhancement in sports, one of the most controversial human enhancement technologies in the academic debate. First, some basics of gene therapy for genetic enhancement in sports are explained, and how the existing anti-doping policies and institutions try to regulate the practice of sports. Then, some of the risks, possible consequences of gene doping, and questions related to it, for the athletes, sports and the society are described. Finally, the questions or themes that merit further scientific research or another kind of attention will be listed.

### 2.3.1. Gene Therapy, Genetic Enhancement and Gene Doping

Gene therapy entails "the transfer of genetic material to human cells for the treatment or prevention of a disease or disorder" (Haisma/De Hon 2006: 259; *italics ours*). Gene therapy, however, may also enhance someone's natural endowments. In that case, one speaks of genetic enhancement. Given the continuous strong, and increasing social and economic pressure on athletes to improve their performance, sports might be one of the first social practices to widely use second-stage, non-therapeutic enhancement technologies. This section explores the potential use of genetic enhancement in sports, or in short: gene doping.

***Gene Therapy: Experimental Treatment for Severe Illnesses***

Gene therapy is still in the experimental stage. In gene therapy, in the case of insertion of additional genetic material into the cell nucleus or cytoplasm, a gene, which can compensate for a missing or abnormal gene, is delivered to a cell nucleus by a so-called vector, usually a non-pathogenic virus. The new genetic material encodes for the production of a certain relevant protein. By means of gene therapy scientists try to cure, or prevent, genetic diseases as severe anaemia, muscular dystrophy, or immunodeficiency. So far few diseases have been cured or prevented through gene therapy (Reynolds 2007).

The use of gene therapy is regulated on the level of the Member States as well as on the European level. In the Netherlands, for example, permission of the Central Committee on Research involving Human Subjects (CCMO) and the Committee on Genetic Modification (COGEM) is mandatory to start a clinical trial of a gene therapy (Haisma/De Hon 2005, 123).

The European Council has adopted directives to ensure the containment of genetically modified organisms and to protect the health of those working with biological agents. Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP) are also mandatory.

In the EU, marketing authorisation is covered by the European Medicines Evaluation Agency (Haisma/De Hon 2006, 259), but the exchange – and therefore the availability - of genetic materials is only limited by the EC Regulation Nr. 3381/94. This limits the import and export of strategic goods, including genetic materials (ibid., 264).

***Genetic Enhancement of Healthy People***

It is expected by scientists and the World Anti-Doping Agency that gene therapy, when used on healthy people, will, at least in some cases, enhance their production of the related protein.

Therefore, gene therapy might enhance the performance of athletes in specific ways. Professor Hidde Haisma of the department of Therapeutic Gene Modulation of Groningen University and Olivier de Hon of the Netherlands Centre for Doping Affairs list the following enhancement options: By inserting the gene that is responsible for the creation of red blood cells, erythropoietin, better known as EPO, the aerobic capacity of the muscles could be improved. Muscles could also be strengthened locally by injecting the gene coding for the creation of insulin-like growth factor-1. By blocking the growth-inhibitor myostatin gene muscle growth could be stimulated. A better blood supply of tissues by newly formed new vessels could delay exhaustion.

The gene encoding for vascular endothelial growth factor could be used for this. By genetically enhancing their pain relief system (endorphins, enkephalins), athletes would experience less pain and could perform at their maximum longer at a time (Haisma/De Hon 2006, 261-262). It is important to notice here that all these enhancement options are currently being developed to treat diseases, like severe anemia or muscular dystrophy.

Of course changing nature does not mean that one can go without nurture (Blitz 2005, 90). Being in great shape, having a perfect technique or strategic insight, etc. cannot be realised through genetic enhancement. To reach the top, years of hard work under the supervision of a good coach are required, which in turn requires character, determination and motivation. Nevertheless, athletes can think that gene doping might provide just that little something extra that may mean the difference between winning and losing.

***The Fight against (Gene) Doping***

The world of sports has its own values, habits and rules. The International Olympic Committee (IOC) and the World Anti-Doping Agency (WADA) guard those values and habits of sports, by seeing to it that the rules are complied with. Other organisations fighting doping are national anti-doping agencies, or international governing bodies of sports such as FINA (swimming) or FIFA (soccer) and in some countries there exist laws concerning sports. WADA, however, is the most influential anti-doping agency. The WADA was created in 1999 by the IOC, governments and other authorities to promote and coordinate the international fight against doping.

According to WADA's World Anti-Doping Code, the values of sports include ethics, fair play and honesty; health; and respect for self and other participants, amongst other things. Since the coming into being of competitive sports, there have been attempts to enhance performance. Some of these attempts involved generally accepted methods or substances, like training or eating healthy, but illegal substances and practices are also used. Using performance enhancing drugs is an example of an illegal practice. To promote the ideal of fair and clean sports, WADA regularly tests athletes to see if they have used prohibited substances, and tries to educate the athletic community about the "spirit of sport", and the dangers of doping.

Every year, WADA updates a list of substances and methods banned from sports. A substance or method can be included on The Prohibited List, if it satisfies at least two of the following criteria:

- the substance or method is (potentially) performance enhancing or a masking agent for a prohibited substance or method;

- it might be dangerous for the athletes' health;
- it violates the spirit of sports.

This definition of performance enhancing substances and methods has received criticism for being contradictory: Any kind of training that is potentially dangerous for the athletes' health should be banned, yet some sports are intrinsically dangerous, sometimes even more dangerous than the (medically supervised) use of illegal steroids or Epo (Blitz 2005, 86-87). Ethicists Bennett Foddy and Julian Savulescu (2007, 511-512) point to the fact that caffeine is not listed on the Prohibited List, although it is performance enhancing. WADA apparently does not consider it to be harmful or contrary to the spirit of sports. Cannabinoids as THC, however, are banned, although they have no known enhancing effects. Obviously, the rather vague notion of the "spirit of sports" is problematic in this context.

The WADA included gene doping on the prohibited list since 2003, years before scientists thought it would be possible for athletes to use the technology. WADA defines gene doping as "[t]he transfer of cells or genetic elements or the use of cells, genetic elements or pharmacological agents to modulating expression of endogenous genes having the capacity to enhance athletic performance".

WADA is not the only organisation that tries to implement an anti-doping policy. National (or European) leagues adhere to WADA's policy or their own. Seeing sports as a part of the European culture that should be healthy, accessible, and fair, the EU supports WADA's anti-doping policies financially, and has drafted a treaty designed at harmonizing the anti-doping policies of the member states. The treaty aims, amongst other things, to discourage access to enhancing substances, to assist in the funding of anti-doping tests and to impose more and stricter tests on athletes. Individual Member States, however, can use sports legislation to set up a framework for the sports community, or can actually interfere with the organisation of the sports community. In Italy, for example, a medical passport for athletes was introduced by law (KPMG et al. 2002, 44-49). The fight against doping is fought in every member state, but they all organise it differently.

### 2.3.2 Introduction of Gene Doping: Concerns and Consequences

Gene doping is an example of a new technical phenomenon that does not fit automatically in present social and cultural categories. It is an uneasy phenomenon, which can potentially change the way we think about the world (of sports). It raises new and difficult questions and concerns amongst divergent actors. A first question leaping the eye is: Can the existing anti-doping policies deal with this new enhancement technology? Or is it necessary to rethink the fight against doping? The answers depend on visions about what is valuable in sport and harmful in (gene) doping.

Besides the principled question into the nature of sports and doping, there are questions relating to the future of the world of sports, questions about the implications the use of gene doping has for the athletes' health, and concerns about the impact of gene doping and genetic enhancement on the society, of which sports is a part.

There are two major concerns regarding gene doping in the athletic community (for a detailed discussion, see Gerlinger et al. 2008). The first is about the possibility of detecting gene doping, and behind that, what it is that an anti-doping policy tries to protect. The second is about the distinction of enhancement and treatment. After those, the concerns about health and society will be discussed.

***Concern about Sports (I): Can Gene Doping be Detected?***

Starting from the very first discussions about the use of genetic enhancement in sports, one of the major questions was: is it possible to detect gene doping, and, if so, how? And what if it is not possible to develop a test for gene doping? Is there another way to prove athletes, suspected of using gene doping or other illegal enhancement products, guilty beyond reasonable doubt, or is the fight against doping a lost cause? Bioethicist Andy Miah (2002, 196-207) reviewed some of the early debates about genetic enhancement in sports, and found the following quote by genetic researcher Peter Scherling: "gene doping can be arranged so that detection, in practice, will be impossible... Artificial genes can, and most likely will, be abused by athletes as a means of doping…

Detection is extremely difficult since the artificial genes will produce proteins that are identical to those in the human body" (Miah, 2002, 203). Scherling also said that perhaps the only way to detect the use of gene doping would be to take a biopsy of the enhanced tissue, but that "[a] doping test based on taking pieces of the athlete's muscle is not likely to be ethically accepted" (2002, 203). Or, as neurosurgeon Peter Hamlyn, quoted by Miah on the same page, put it: "peeing in a pot is one thing, but having your legs cut open is another". Since 2002, WADA has requested scientists to develop tests for gene doping and funded their research.

There might be another way to infer, but not positively prove, that someone has used gene doping, or another illegal performance enhancement substance that WADA does not know of and, therefore, has not developed a test for. An identity card could be implemented, which can be used to assess and monitor biological, chemical and physical conditions of athletes. In professional cycling this kind of monitoring has been started. For each cyclist a so-called bio-passport is used. All kinds of physical parameters of the athlete could be measured regularly. Any changes that cannot be explained by training or diet could be reason for further investigation. This might be seen as an alternative way to infer the use of gene doping by the athlete, without actually physically proving it (Austen 2004). However, this task might be at least as challenging and complex as a traditional testing system.

Whether athletes are already experimenting with gene doping is unclear. There is no test ready yet, the bio-passport is not widely used, and athletes using gene doping are not likely to unveil the reason for their (improved) performances especially if it involves illegal practices.

***Concern about Sports (II): Treatment or Enhancement?***

The second set of questions is related to the distinction between "enhancement" and "therapy" (see Sect. 1.1.1). In gene doping, again, the line between therapeutic and non-therapeutic use is not clear. Gene therapy could be used to treat sport injuries by stimulating tissue to re-grow.

If gene therapy could be used to heal injuries faster, or even allows injuries that these days will end a career to heal, should this treatment be withheld from athletes? Or will such treatment be regarded just as twenty-first century sports medicine, building on the already permitted exceptions to the rules in case of certain injuries and diseases of athletes?

From an anti-doping perspective an important question is whether, if the results of gene therapy are long-term, any athlete who has received gene therapy for an illness in the past, which could also have enhanced his performance beyond the athletes' natural ability, is excluded from competition for life? Is there a point in which "therapeutic" becomes "non-therapeutic", and if there is, how can an anti-doping policy deal with that? Reflecting on these issues, Theodore Friedmann, a leading expert in genetic research, argues that therapy and enhancement are "part of a continuum in which a genetic treatment to heal a short-term injury could also lead to the long-term enhancement of the athlete's genetic make-up" (quoted in Sandomir 2002). Nevertheless, the demarcation is important for the implementation of an anti-gene-doping policy.

The reaction to both problems (the possibility of an undetectable form of doping, and the problems in demarcating treatment and enhancement) can be different, depending on the values one emphasises regarding both sports and enhancement. This relates to two other sets of questions, namely the consequences for the athletes' health and for society.

***Concerns about Health***

Gene doping could endanger the athletes' health. While it is true that practicing many sports is intrinsically dangerous, there is no need to increase the risks with unsafe genetic enhancement techniques, according to the U.S. President's Council on Bioethics (PCB, 2003, 137-138). Gene therapy, of which gene doping is derived, is still in an experimental stage. There are various risks involved. There is the possibility of auto-immune reactions to the treatment. Up till now three patients developed leukaemia-like symptoms. Also flu-like symptoms have been reported as side-effects (Haisma/De Hon 2006, 263).

Administering gene doping to athletes illegally adds further risks. The genetic material or the virus used in the treatment could be of inferior quality to that used in a controlled laboratory. The virus could be pathogenic and infect the athlete – and possibly other people. At the moment, it is also unclear if and how the genetically enhanced production of muscle or red blood cells can be slowed down again. Unnaturally high levels of red blood cells thicken the blood, which may result in a heart attack or stroke (ibid.).

Furthermore, little is understood or known about the interaction between genes and between genes and the environment. It is possible that altering the genetic make-up of somebody could (sooner or later) lead to unpleasant surprises because of this interaction.

Especially if the capability to be enhanced is polygenetic (that is, more than one gene is responsible for it, as is the case with a lot of traits) these interactions could be problematic: "… the relationships and interactions among these genes (and between one's genes and the environment) are certain to be enormous complex. […] Growing recognition of the complexity of gene interactions, the importance of epigenetic and other environmental influences on gene expression, and the impact of stochastic events is producing a strong challenge to strict genetic determinism. Straightforward genetic engineering of children [and athletes] may prove impossible, not only in practice but even in principle" (PCB, 2003, 38).

The PCB also addresses the issue of side effects. They write: "One of the central concerns about the biotechnical agents themselves is the risk and reality of adverse and undesirable "side effects", in the first instance, on bodily health and safety. The unintended cost of seeking stronger muscles and superior performance through drugs or genetic engineering could well be bodily (or mental) harm. […] With looming biotechnical powers like genetic muscle enhancement, the side effects are for now uncertain. […] Moreover, targeted interventions aimed at enhancing normally functioning capacities, not repairing broken parts, could produce lopsided "improvements" that throw whole systems out of kilter: monster muscles could threaten unenhanced bones and ligaments" (2003, 137). Whereas Haisma and De Hon (2006) pointed to physical risks only, the PCB also mentions the possibility of side effects that endanger the bodily as well as mental health.

So, since gene therapy is relatively new, the long and short term effects need to be studied in order to assess the safety of the technology. Nevertheless, for athletes the potential benefits could outweigh the risks involved in gene doping.

Athletes willing to consider the use of gene doping have to consider some of the above mentioned risks associated with gene therapy without knowing whether the procedure will produce the desired results. In 2007, Hidde Haisma, professor of therapeutic gene modulation, claimed that manufacturing gene doping is relatively easy and cheap (Van Lare 2007). He stated that any student who has completed an internship at his laboratory can make gene doping. Implementing the technology into humans, however, still is a very complex and risky task. As Theodore Friedmann, a leading authority on human gene therapy, argues that the bottom line is that everything gets complicated when you move from the laboratory into a human being. Accordingly, we do not have the technology yet in hand to ensure a predictable and adequate level of safety to feel comfortable using gene transfer technology in anyone other than a patient with a serious or untreatable disease.

Many forms of athletic activity, such as cycling or skiing, are intrinsically dangerous. It is the nature of sports that athletes always strive to improve their last performance and become better than all the other competitors, and establishing an anti-doping policy has not reduced the temptation of improving by means of illegal methods and substances. Should, then, all extra, not strictly necessary risks in the (genetic) enhancement process be banned by banning gene doping, or should they be controlled? This is one question to be taken into account thinking about gene doping and also with regard to doping in general, but there are more concerns about gene doping to be considered. Several concerns about the influence of gene doping on society will be presented next.

***Society: Concerns about Gene Doping Outside the Athletic Community***

Sports play an important role in society. People entertain themselves by going to matches or watching sports on television, or by doing something athletic themselves. The best athletes can be idolised and can become (influential) role models. The huge (financial and other) rewards at stake for athletes (contracts with teams, sponsors, promised bonuses for extraordinary achievements such as Olympic gold) as well as their immense personal drive and motivation to be the best can lead an athletes to take gene doping. But not only professional athletes will be tempted to use genetic enhancement to boost their athletic performances. Semi-professional or even amateurs could use gene doping just as well, if they can find and afford it.

Steroids that help the body grow more muscular are not only used by professional athletes, but also by amateurs or even by people who would like to look very muscular with

relatively little exercise (PCB 2003, 121). Those amateurs will, if they use gene doping, expose themselves to the risks mentioned above, and they might not be in as good a physical shape as professional athletes are and probably lack the medical guidance that athletes (generally speaking) do have. Who should be responsible for the implementation of a policy to discourage and control this?

Another aspect that will have to be kept in mind when forming an opinion about gene doping are the broader societal processes and other uses of HET which lead in the direction of an enhancement society.

It can be expected that, in case gene therapy will prove to be safe and efficient, and enough will be understood about the function and interaction of genes, it will be widely used for non-therapeutic, non-athletic enhancements. By contrast, in the sports world, where improving your performance, and in order to do that enhancing your capabilities, is the goal of the activity, enhancing yourself with anything other than traditional methods like training, dieting or using the right equipment is not allowed. If the public, in their quest towards better bodies and minds, is allowed to use these technologies, but athletes are not allowed to use the same technologies a strange friction could arise in society. The athletic community is, after all, a part of society.

One has to decide whether these themes (amateurs using genetic doping, and severing the regulations of sports from the practices in society) should be taken into account when formulating an anti-doping policy. After all, they could lead to different opinions on genetic enhancements in athletics and anti-doping policies.

### 2.3.3 Obstinate Questions and Issues

The development of gene therapy and genetic enhancements could challenge the world of sports. The possibility of genetically enhanced athletes raises concerns about their health, about the world of sports, and about the relation between gene doping and society. However, if gene doping will become a reality and if the current anti-doping policy is still operative, it would be probably wise to focus the debate on some fundamental, awkward questions.

The first set of such questions is on the long- and short-term benefits, side-effects and risks for both the bodily and mental health.

Do these effects vary for different kinds of genetic enhancements? Can the risks be controlled and the unwanted side-effects be treated? Are genetic enhancements reversible, or not? Many effects of 'normal' doping like Epo or steroids gradually wear off when someone stops taking them, but does the production of a protein, which is switched on genetically, wear off as well? In the thinkable case a black market for illegal genetic enhancements will form, which further, unwanted side-effects or risks can be expected, beside those inherent in the technology itself? Can genetic enhancement under such black market conditions be safe? Is there any way to prevent the coming into being of such an illegal circuit and protect the professional and amateur athletes' health? These last questions will be the more urgent if the introduction of gene doping is going ahead with serious health complications.

Another set of obstinate questions concerns the essence of sports and the relation between sports and society. The introduction of gene doping puts it under further pressure. Will a new relation between the world of sports and the society, of which it is a part, arise? Are

athletes the pioneers on the path towards an enhancement society? Or will sports lag behind the development due to its particular ethics?

The overarching question, behind the ones related to the risks of gene doping, the relation between sports and society and the possibility to detect gene doping, comes as no surprise: Do we have to rethink the essence of sports and the ends and means of an anti-doping policy, and revise the current anti-doping policy or create a new one?

In the light of the last question, there is one last theme which should be studied further. The possibility of effective, alternative anti-doping strategies should be investigated. The proposal to implement an identity card is one option, as well as the idea to focus anti-doping efforts on the health of the athletes. Perhaps there are more alternatives.

## 2.4 The Case of Designer Babies

However drastically cosmetic surgery or even a brain implant may interfere with the body, they still stand for a change that seems exterior to the given material, and that can be reversed to some extent. This is no longer true for genetic interventions in humans.

The ideal of genetic perfectibility is already very much present in discussions on reproductive technologies. Even when it comes to the widespread practice of selecting an embryo with or without a specific gene that codes for a specific disease or property, by pre-implantation genetic diagnosis (PGD), the idea of the "designer baby" is often lurking in the background. While PGD is not an enhancement technology, it could prepare the ground for the spread of genetic enhancement technologies (cf. e.g. Selgelid 2007). Not only because it is occasionally counted among the HET, but, above all, due to its societal and political topicality, we discuss PGD as one important element of the discourse on genetic enhancement.

However, PGD and, for that matter, somatic gene modification using viral vectors (as in gene therapy and gene doping; see Sect. 2.3.) relate to rather conservative notions of genetic perfectibility: With PGD, there is no active mutation of genetic material at all. In gene therapy there is, but this only affects the genetic material of one individual.

Another method is human germline engineering (or human germline genetic modification, HGGM), which promises to alter the reproductive cells as well, so that the engineered DNA could become a permanent part of the human genetic legacy. From a species perspective, this form of genetic enhancement could be seen as the most extreme case of human enhancement, as it would irreversibly interfere with human bodies.

Often the designer baby is presented as a future artefact. At the same time it seems to be a non-artefact: it stands for a cultural icon, the age-old dream of the perfect child, made by recipe. In this section on the designer baby, our questions are: What are new moral and politically relevant issues coming to the fore when considering new reproductive technologies that are linked to the promise or threat of designer babies?

Will current regulative institutions do in order to weigh and address these important new questions and uncertainties? Or do we possibly need other, or extra regulative mechanisms and institutions?

These questions are extensive ones and answering them goes beyond the limits of this study. The case study does not pretend to give exhaustive answers, instead, it is a first exploration of new issues to reflect on.

### 2.4.1 It's a Fantasy: the Dream of the Perfect Child

What is a 'designer baby', technically spoken? There is no simple answer. A brief look inside the history of the designer baby shows it is a shifting target. It might be more precise to ask, what is the latest fantasy about the designer baby?

For centuries now, we know the designer baby as a cultural phantasm, a myth, coming into our imagination as a long cherished dream as well as a nightmare. The ambivalent dream of the Perfect Child is at least as old as the tale of the Monster of Frankenstein – to make a human in the lab and be in control over his traits, breaking away from destiny and the roulette of biological evolution. The cultural dream is renewed time over time, every time suggesting its coming closer within reach, fuelled by new technological developments and by extrapolation of current abilities in the field of genetics, cloning and reproductive technology.

Whilst in the 1980s the test tube child was identified with this dream of the perfect child (Kalden/Beker 1993), and in the 1990s the human clone, in the last years it was PGD and the genetically enhanced embryo, produced by gene therapy or by germline engineering, that took over the role of the true appearance of the 'perfect child'.

The genetically enhanced 'Designer Baby' was only invented in the newspapers a decade ago, in 1998, after the French physician Anderson in the U.S. asked for permission to try gene therapy on foetuses suffering from a condition called adenosine deaminase deficiency (ADA), a fatal childhood disease. Anderson acknowledged that the technique was likely to modify the developing germ cells of the foetuses, so it was a step further than gene therapy. Anderson's plan - to insert new genes into babies in the womb - has never been practiced.

The popular media though immediately recognised the significance of his proposal. Shortly after, both Newsweek and Time magazines released articles titled 'Designer babies'. On top, on the cover of the Guardian Weekend a foetus reading a volume of Proust was figured, suggesting that the design of human beings according to our cultural preferences is within reach.

This image brings us closer to a definition of a designer baby. It is not so much the baby procreated with the help of a new reproductive technology that is used for medical reasons. It is the extrapolation of this possibility, bringing the use of the new reproductive technique outside the medical domain of cure and care to a new domain, where it is not so much the medical need, but the desire for positive traits that steers making babies.

Thus the Designer Baby was not only coined by scientists propagating 'techno-eugenics', but particularly by journalists seeking popular platforms. In those public places the Designer Baby appears to be a source of fanciful and dark reflections.

Influential geneticists and intellectuals, transhumanist thinkers and culture critics seeking popular platforms, such as Gregory Stock, Lee Silver, James Watson and Francis

Fukuyama, are convinced that designer-baby technology will be available within a few decades. Genetic interventions in the embryo will increase resistance to diseases, optimise height and weight, limit aggression and boost intelligence.

Even attractive traits of other species could become within reach: some geneticists predict children with the "night vision from an owl" and "supersensitive hearing cloned from a dog" (Darnovsky 2001). Stock states in sweeping words that "[g]enetic enhancement technology promises […] eventually to transform our very beings as ever more significant genetic changes are introduced into our genomes. This technology will force us to re-examine even the very notion of what it means to be human [as] we become subject to the same process of conscious design that has so dramatically altered the world around us" (Stock, 1999).

It is precisely the unbridled confidence and enthusiasm of the proponents that triggers the sceptics to turn the message upside down. The waving future of posthumanity is turned into the end of our common humanity, in the words of spokesmen such as Francis Fukuyama or of Richard Hayes, director of the U.S. Centre for Genetics and Society. One of the outspoken critics on this side is journalist Bill McKibben, drawing attention with his book *Enough. Staying human in an engineered age* (McKibben 2003). In *Enough*, McKibben argues that "improving" humans through genetic engineering risks turns them into humanoid robots. We will rob our descendants of freedom of choice and may even extinguish our own species, he declares.

So while the proponents of a posthuman future embrace it, amongst other things, for broadening our freedom of choice, particularly the freedom of parents to have their offspring according to their own preferences, the opponents precisely fear the same phenomenon for the loss of freedom they project on it. The example gives a glimpse of the ideological character of the discussion on designer babies. Quick styles of reasoning dominate, such as the determinist argument that designer babies will enhance, or limit human freedom. It suggests that when public discussion is dominated by these styles of reasoning, the gap in between will probably remain unabridged.

### 2.4.2 It is a Reality: the Saviour Baby, Cosmetic Baby and Disability Baby

With Stock and McKibben we meet the Designer Baby in its utopian and dystopian shape. Remarkably, both of them depart from the outdated paradigm of genetic determinism that assumes that desirable capacities such as intelligence or a healthy immune system are a direct result of our genetic makeup.

This reductionist paradigm however has almost entirely lost its attraction in scientific circles. Its decline accelerated after the Human Genome Project was finished in 2000 and has now been generally replaced by the multifactorial approach. In this scientific paradigm of complexity most human properties and diseases are the outcome of a complex interplay of countless genes and their environment. Reasoning from this complexity paradigm, both McKibben's and Stock's fantasies are put aside as nonsense. At the moment, geneticists can only select for a few, rare, monogenetic properties, but most desired properties cannot be programmed by just altering some of our genes.

This insight puts a huge obstacle to the realisation of any utopian and dystopian dream on breeding designer babies by genetic enhancement: Controlling the complex interaction of multiple genes and environment to produce traits such as 'intelligence' or for 'eternal youth' will be far more difficult than changing a single gene, and today's concepts for germline engineering will not suffice for this.

Moreover, very little research has been done by now on genes that concern positive traits, such as intelligence. One of the scarce examples is the research done by Robert Plomin on the genetic causes of high intelligence. (Plomin 1998)

At the same time designer babies appear as a palpable reality. At least in the language of the newspapers, typical uses of PGD are named "designer babies", for the method allows for controlling genetic properties of an embryo. These types of designer babies are no longer a future promise, but they seem to be alive and kicking.

***The Saviour Baby***

In 2000, at August 29, the first saviour baby was born in Colorado (USA). Adam Nash was procreated to save his sister Molly who suffered from Fanconi anemia, a deadly genetic disease that often leads to leukemia. Adam was conceived by IVF in combination with Pre-Implantation Genetic Diagnosis (PGD) (and making use of histocompatibility typing which identifies suitable donors for stem cell transplants) that enabled the selection of his embryo out of 30 sibling-embryos. With PGD it was determined he was free of Fanconi anemia. As soon as he was born, stem cells extracted from his umbilical cord blood provided a perfect match for his sister's transplant. Adam is a so-called saviour baby, a baby that is not only procreated for its own sake, but also for that of a severely ill sibling in order to treat it with gene therapy. Since Adam, many more saviour babies serving their siblings needs have been born. This form of PGD is allowed in many countries nowadays. Saviour babies however are a source of concern as well: what will for example be the psychological effects on the designer baby, knowing that it was chosen because of its genetic properties? Or what is the effect on the saved sibling and its relation to his or her saviour sibling?

***The Cosmetic Baby***

Other variants of actual designer babies, whose embryos were selected by PGD, are reported as well. While the saviour baby is procreated serving a severely ill sibling, there are embryos that are selected because of a monogenetic disorder of their parents, a disorder that is generally not perceived as life-threatening and not even as a sickness, like squint. So here we meet the cosmetic designer baby.

In 2007 the Bridge Clinic in London has been granted a license to treat a couple who wanted to prevent their child inheriting a severe genetic squint. Mr. Grudzinkas, director of the clinic, commented that the use of embryos screening for cosmetic conditions such as squint will increase in the near future. He thinks the admissibility of these interventions is dependent on the level of family distress, which should be assessed by a physician. In early 2009, a Californian clinic offered couples (who need PGD to select a healthy embryo) the option of choosing embryos with genes for a certain appearance as well. However, they cannot guarantee that the baby will look like the specified profile. This broadening of the practice from purely medical to cosmetic enhancement caused some stir in newspapers (see below).

### *The Disability Baby*

Another case is that of the baby with the made-to-order anomalies, also paraphrased ironically the 'disability baby' or 'deformer baby'. The embryo of a disability baby is chosen for a specific, monogenetic characteristic that in daily life is perceived as an undesirable deviation by most people, such as deafness or dwarfism. As an example, in 2002 two female deaf mental health professionals used 'genetic manipulation' by employing a male deaf gentleman friend as a sperm donor, in order to procure a deaf baby (Barclay 2002). In this case, the baby was not conceived with the use of PGD, but it illustrates the wish for a baby with a specific deviation.

Another case reports the attempt to select a dwarf baby for two dwarf parents. A few clinics in the U.S. and in the UK provide the costly procedure to help disabled parents create 'disabled' progeny. Only a handful of these cases are reported, so the practice is not widespread at the moment and it is quite controversial.

The option of the disability baby causes sharp reactions by the public and by bioethicists. Critics call it "the deliberate crippling of children." (Saletan 2006a). The parents however appeal to their unwritten right to have a child that resembles its parents. "You cannot tell me that I cannot have a child who's going to look like me," Cara Reynolds, a dwarf mother said (New York Post 2006). Reynolds and her husband started a PGD procedure to have a dwarf baby, but they stopped it because the insurance did not cover it and because her age (39) limited her chances on a successful treatment.

The 'disability baby' shows a surprising application of PGD: whilst dystopian critics of genetic enhancement fear for a child on recipe, fed by the thought that we would create super humans, the same technique is used in an opposite direction as well: to reproduce specific properties that are usually perceived as a disability and therefore as an undesirable trait, but by some others as a mark of a cultural identity.

### *PGD Babies and Designer Babies*

These designer babies reported during the last couple of years are bred by the help of Pre-Implantation Genetic Diagnosis (PGD) combined with In Vitro Fertilisation (IVF). In the years after 2000, PGD treatment became current practice in Europe and the US, a practice that encouraged regulative and restricting policies in a lot of countries. (TAB 2004; Franklin 2006, Baruch et al. 2004, 2005).

How can the genetically enhanced designer baby be a fiction and a reality at the same time? Here of course rules a confusion of tongues. Some authors contest that these babies conceived by the help of PGD are indeed pre-fixed and engineered designer babies. PGD and designer babies are too easily identified, says Sarah Franklin (2006), a British Professor on Social Studies of Biomedicine. The ability to select embryos by PGD leads cultural critics such as Fukuyama to assuming that PGD will enable to control the genetic make-up of children, suggesting it would only involve a small step from the "actual" designer baby to a designer baby in the utopian sense. But this would be too big a step according to Franklin: Technically, PGD is just a variation on the established technology of IVF. With IVF, the selection of the embryos to be implanted was based on morphology, and with PGD the selection is extended to a selection on genetic information. Thus Franklin states that as much as an IVF baby is not a designer-baby, a PGD baby is not one as well.

Still, it turns out with the examples of saviour, cosmetic and disability babies in mind, that in current PGD practice its application is slowly widened and shifting beyond a strict medical use for treating severe, life endangering diseases. As in other cases, the line between enhancing and mere treating appears to be vulnerable and negotiable.

### 2.4.3 Status Quo of PGD: the Technique and its Demand

Amongst the technologies constitutive for both PGD and germline engineering, In Vitro Fertilisation (IVF) is by far the most important, for both technologies can only be applied in combination with IVF. Some (like Franklin 2006) consider PGD as a close variant of IVF, others see it as a radical step towards engineering the genetic make-up of humans. IVF is indeed considered to be "the core technology upon which all of these new and controversial reproductive and genetic technologies are based" (Throsby 2004). IVF was recognised by bio-ethicists as the first technology transgressing the traditional goals of medicine, exchanging the treatment of diseases and the cure of medical conditions for a treatment of desires. Thus they opened the road for a medicine "by desire". (Hellegers/Mc Cormick 1978)

Though the fantasy of the designer baby as expressed by transhumanist proponents and culture critics is steered by the thought of enhancing human faculties, the techniques that underlie IVF and PGD are mainly being developed in medical practice and under the regime of medical regulations.

An important driving force behind developing these techniques results from doctors and scientists emphasising its use for medical problems, for example to prevent the birth of severely handicapped children due to inheritance. The peculiar mechanism here is that the development of medical possibilities goes hand in hand with an extension of medical needs, the typical pattern of medicalisation (see Sect. 2.2.4).

IVF was no exception on this pattern. Though traditionally infertility was not seen as a sign of a lack of health, the shift from being mainly defined as a social problem to a medical problem took place in discussions on IVF in the 1980s. The distinction between social and medical problems was relevant (and finally blurred) in the discussion, whether IVF should be admitted. With a positive decision in this direction by policy makers in the 1980s, the conceptual shift of infertility from a social problem to a medical problem was underlined by law.

PGD was first introduced in the United Kingdom in 1989. It was presented as a diagnostic technique in medicine that in some cases was a desirable alternative for the existing practice of prenatal diagnostics (PND). With PND an embryo is screened in its mother's womb for monogenetic diseases such as Huntington or cystic fibrosis. PND however is necessarily linked with the undesirable option for an abortion: In case a deviation is found in the embryo, the parents are placed for a choice whether to abort the embryo or not. PGD enables to avoid this choice, because the screening and selection of the embryo takes place outside the womb. Meanwhile PGD is necessarily connected with the burden of an IVF treatment. So both techniques have a burdensome disadvantage: either a possible abortion, or a necessary IVF.

In a rather short term, since about 2000, PGD has developed into a common practice in developed countries. Within Europe and the US, the use of PGD expands rapidly. In principle, diagnosis can be done on more than thousand monogenetic traits, but there are only a dozen genetic properties on which it is tested (Baruch et al. 2004). Users travel within Europe for PGD, mostly for legal and financial reasons but also because of (non-) availability of the test at home.

The main receiving countries are Spain, Belgium and the Czech Republic, treating parents that come from other EU countries, but also from the United States, Lebanon and Israel.

The demand for PGD is slowly increasing: For example, in the Netherlands two new clinics were permitted to offer PGD treatments in 2007, which brought the total amount of treatment locations at 3. In 2006, about 100 treatments a year were given, but the total demand for that year was estimated three times higher by the Dutch National Health Council (Gezondheidsraad 2006).

### 2.4.4 Main Social and Ethical Worries on PGD

Few current medical subjects are as much discussed by ethicists and policy makers as PGD. Though PGD rapidly became an established technology and a standard medical procedure in developed countries, it is still surrounded by manifold perspectives and concerns on its actual use and its future impact for individuals and society. These issues often stay within circles of medical scientists and bioethicists. Their largely incompatible arguments stem from different positions on the newness of PGD and its long-term impacts in the respect of morality and policy, as compared to IVF and prenatal screening.

Some researchers and practitioners declare that there is "nothing new under the sun" and PGD is business as usual – an example is Franklin's position on PGD as just a logical variation on IVF. Therefore, in her view, its social consequences and its moral status are not really different from those of the IVF technology it compares to. (Franklin 2006)

This argumentation style is characterised as arguments from precedent; means or ends of the technology at stake are treated as morally the same (Parens 1998b, 7). Indeed a familiar concern is the increasing costs of healthcare and the equal (financial) accessibility for parents. And PGD also re-opens the returning question of the moral status of the pre-implanted embryo and on how the rest-embryos should be dealt with.

In contrast to this position, others tell that PGD might also disclose new moral issues, different from the ones that rose in the wake of IVF. In contrast to the other positions sketched, representatives of this position are willing to put current values into question. Typical new questions are about to what purposes PGD should be limited - only in case of serious health problems or also for enhancing desired traits? Should society allow selecting embryos lacking a gene that codes for obesity, or squint, or dyslexia?

A recent controversy on the indication limits for PGD is on the prevention of familiar breast cancer. This case might be illustrative for the dynamics of the legal limits on the use of PGD. In Australia, the US and the UK (since 2007) PGD for embryos of women bearing a genetic mutation of the 'breast cancer gene' BRCA 1 or 2 is a current treatment.

In other countries policymakers refuse to widen the indication for PGD. They argue that in this case PGD is not preventing a severe and lethal disease that will certainly appear. Instead there is a heightened risk for the bearer of the gene, and in most cases there will be an average life expectation of about 50 years. Does this warrant selecting and discarding embryos? (Green 2008)

Proponents however point out the inconsistency raised by the prohibition: for prenatal screening in combination with abortion is allowed in this case, whereas PGD (avoiding abortion) is not. In the Netherlands, after two years of debate and lobbying by patient organisations, the Parliamentary Undersecretary Bussemaker for Public Health Policy just decided that PGD will be allowed for this specific group of bearers of the breast cancer gene BRCA 1 or 2. (Staatssecretaris VWS 2006; De Volkskrant 2008).

Even more recently, there was a short, but vehement moral debate in the UK about turning babies into commodities that you buy off the shelf. The LA Fertility Institutes had offered a new service for its clients (that already are having genetic screening for genetic conditions): besides selecting the sex of the future child, but also could try to select traits like hair- or eye- colour (although in contrasts to the babies' sex the clinic could not guarantee the baby will actually look like the specified preferences). Besides the fear of commodification, critics also pointed to the slippery slope following the selection of hair- and eye-colour. Another concern is that many more embryos will have to be produced than necessary to conceive of a child, since many that do not have the preferred genetic make-up will be discarded in the process. The negative feedback made the clinic decide to suspend this programme: "Though well intended, we remain sensitive to public perception and feel that any benefit the diagnostic studies may offer are far outweighed by the apparent negative societal impacts involved" (see www.fertility-docs.com).

Another group of new questions is concerned with themes on effects for society at large and in the long term, such as the commodification of the child by way of these techniques, and the future implications for society caused by the assumed shift from genetics becoming a choice instead of a chance.

Will there be a loss of solidarity with the weak and handicapped that might become regarded as the result of individual choices?

### 2.4.5 Regulatory Arrangements on PGD

Do current regulatory arrangements cover the scope of these new issues on expected long term implications for society?

On PGD a well organised regulatory practice has been developed. In most countries, institutions and laws have risen to regulate reproductive technologies such as IVF and PGD. PGD usually is permitted within legal restrictions. In a large overview study the Office of Technology Assessment (TAB) in Germany concludes that in all countries (Belgium, Denmark, France, Great Britain, Italy, Norway, USA) political discussions took place on the legitimacy of PGD and the limits of the indications for its use.

These discussions resulted in divergent political regulations (TAB 2004).

Particularly the United Kingdom excels in public debate and regulation (Franklin 2006). In the UK, the birth of the first IVF child in 1978 encouraged a long-term deliberation on regulation. Sarah Franklin notes for the UK: "[W]hat emerges from a quick scan of PGD and its future is the extent to which PGD in the UK, like stem cells in the US, is associated with public debate and regulation, *not their absence*." (Franklin 2006, 93). Twelve years later, in 1990, this resulted in the Human Fertilisation and Embryology Act that has become "the global standard for governance of the post-IVF reproductive 'revolution'" (Franklin 2006, 92). Franklin holds that "[t]he Act remains the most extensive, substantial and detailed legal framework ever created to regulate and govern what had previously been the legally uncharted territory of 'human fertilisation and embryology" (Franklin 2006, 92). Britain's formal agency, the Human Fertilisation and Embryology Authority (HFEA), must approve all requests for PGD. At EU level, the most significant legislation affecting the use of PGD is the Human Tissue and Cells Directive which introduces a wide range of quality and safety requirements that clinics have to implement. (TAB 2004) In the Netherlands, PGD is permitted within strict limits, although they were recently expanded a little: only when a very severe disease can be prevented, which has a high chance of manifesting itself in life. Severe restrictions are put on the practice of saviour babies such as the absence of alternative therapies and the absence of a donor. In the U.S. however more PGD tests are offered, such as for preventing haemophilia gene or the cancer-related genes such as TP53, BRCA1 and BRCA2.

Since no final societal closure on the uses of PGD is nearing, existing restrictions and regulations are subject to continuous discussion. This tendency disquietens the German TAB. The researchers hold that it appears that without strong juridical or other regulative barriers, the praxis of PGD will be quickly extended shortly after its introduction (TAB 2004). A driving force for this pressure is the use of PGD to optimise the results of IVF treatments, in order to select the most vital embryos for a higher success rate. This kind of use is not steered by a medical necessity like an indication for a genetic disease.

The examples of saviour, cosmetic and disability babies form another sign of the widening tendency of PGD practice beyond a strict medical use for treating severe, life endangering diseases. As we have mentioned above, there is however a surprising application of PGD.

### 2.4.6 Conclusion

What is the "state of the art" of the Designer Baby? The baby fabricated by germline engineering still appears to be science fiction, and there are strong doubts – both for scientific reasons and for reasons of harmfulness – if babies fashioned by germline interventions will ever show up at all in the way they are imagined by proponents such as Stock and Silver. The "designer babies" bred by PGD techniques however has become a standardised and regulated practice in developed countries.

As a consequence of policy regulations created in the wake of IVF, European institutions seem to be fairly equipped to serve policy issues on PGD, such as efficiency and safety issues of the persons involved in PGD treatment. Issues of informed consent and family relationships get attention as well. Other typical concerns on the long term impacts for society might be harder to address within current regulative arrangements, such as the fear for a growing "commodification" of children.

A remarkable feature of current regulative dynamics is the persistent pressure on widening the indications for PGD, leading to a further medicalisation of society. Current laws even seem to trigger this tendency; for every formulation of a limit remains arbitrary to some extent, challenging groups to debate it. This happened in the case of the breast cancer gene in the Netherlands, where patient organisations successfully assailed the restrictive measures. So whereas the law intends to strictly limit the use of PGD to the prevention of severe diseases, the unintended effect seems to be a shift towards a further enhancement that is hardly indistinguishable from a process of medicalisation.

With IVF infertility was changed from a social to a medical problem. In this case the parents became patients. With PGD the focus has shifted towards the embryo; the next generation, and the type of genetic disorders that parents want to prevent their children from having. Here the moral entry point of the debate and ensuing laws was to strictly limit the use of PGD to the prevention of severe diseases. The ongoing discovery of monogenetic disorders, however, unleashes a constant political struggle about where to draw the next line. The closure of this process of medicalisation of negative genetic traits is not yet in view. As long as that, there will not be closure on the fears of, and hopes for a Designer Baby either.

Another remarkable feature of the PGD developments sketched is its surprising application in the 'disability baby'. Whilst dystopian critics of genetic enhancement feared for a child on recipe, the same technique is used here in an opposite direction as well: to reproduce specific properties that are usually perceived as a disability and therefore as an undesirable trait, but by some others as a mark of a cultural identity. The development indicates a pressure to broaden the extent of parental autonomy in liberal society, from their right to rear their own children, to a right to choose what kind of children they want. The question where the parental right is in tension with the social, collective interest, and how this tension should be resolved, might be one of the important future policy issues.

## 2.5 Better Performing Students and Employees with Ritalin?

The drug methylphenidate, better known by its commercial name Ritalin™, is a dual-use drug: a drug that is used both for therapeutic ends and for non-therapeutic ends.

Non-therapeutic use of Ritalin™ can serve either the purpose of enhancement or that of recreation. Ritalin™ owes its recreational value to its chemical resemblance to cocaine: if it is snorted or taken intravenously, Ritalin™ has similar effects as cocaine. Taken orally in the form of a pill, the drug is either used therapeutically for the treatment of people diagnosed with Attention Deficit / Hyperactivity Disorder (ADHD) or used for the enhancement of attention in normal subjects. Eighty percent of therapeutic users is male, most of which are boys. In recent years the number of patients diagnosed as having ADHD has increased strongly. The diagnosis has also widened to girls and adults.

Because of Ritalin™'s alleged potential to promote concentration it is often earmarked as a "universal performance enhancer". Namely, improved concentration is taken to enhance performance on all tasks that critically imply cognitive function. This makes Ritalin™ a candidate for cognitive enhancement. The usage of Ritalin™ among American students to enhance their learning capabilities (as well as to get high) is widely reported.

This case study will investigate what kind of controversial issues the Ritalin™ gives rise to from the perspective of human enhancement. First a picture is drawn of its history and of its current uncertainties about therapeutic treatment with Ritalin™ and the diagnostics of ADHD. In the second part, the most protruding issues in the ongoing controversies on Ritalin™ are sketched.

### 2.5.1 The Success Story of Ritalin

Ritalin™ and ADHD provide fascinating histories, which are illustrative for the history of psychopharmacology and psychiatry in general. The latter shows an interesting dynamics, moving from a biological orientation at the beginning of the 20th century, to a psycho-dynamical orientation and back to a biological orientation during the last decades of the 20th century. The success of a number of psycho-pharmaceuticals, like chlorpromazine (for schizophrenia and psychotic disorders), Ritalin™ and fluoxetine hydrochloride (i.e., Prozac™, for depression), played a key role in the come-back and current victory of the biological orientation. More specifically, the availability of a psycho-pharmaceutical that was able to alleviate concentration seems to have played a major role in the medicalisation of lack of concentration and hyperactive behaviour of children.

The following logic lies behind this medicalisation: if a drug can restore "normal behaviour", then the pre-medicated behaviour must have been not merely deviating, but pathological and must have been caused by some neurochemical imbalance. Psychiatry's history proves such reasoning to be enormously powerful, also where it comes to ADHD and Ritalin™ (cf. Shorter 1997). Hence medicalisation and somatisation (the localisation of a behavioural deviation in some bodily substrate) of inattentive and hyperactive behaviours have taken place, despite the fact that the physiological causes of ADHD are still unknown and "[n]o validated diagnostic test exists to confirm the clinical diagnosis" (Zwi et al. 2000, 975).

The expert opinions on the causes of the behaviour indicative of ADHD differ enormously. They range from neurological dysfunction to hearing impairments and from lack of sleep to psychologically disturbing events such as the death of parents or siblings (cf. Bailly 2005; O'Brien et al. 2003; Van den Berg/Marcoen 2004; Bennet/Haggard 1999). Because so many different causes are associated with ADHD some people question whether its symptomatic behaviours are really indicative of one discrete disorder. Some have put forward the possibility that ADHD is not one disorder, but rather a catch-all diagnosis that covers several disparate psychological deficits, that might each have their own neurological cause (cf. e.g. Zwi et al. 2000: 975; Reason 1999).

Also where it comes to ADHD's treatment with Ritalin™ uncertainty exists amongst experts, as the exact neurological workings of Ritalin™ are unknown. Nevertheless, ADHD is now commonly considered to be a neurodevelopmental disorder, and the prescriptions of Ritalin™ for the treatment of ADHD have been rising ever since its launch at the beginning of the 1980s. In many European countries today around five percent of children are diagnosed with ADHD, but epidemiological studies have produced prevalence estimates ranging from one-half to twenty-six percent (Timimi 2004). In the United States seven percent of all children between three and seventeen years are diagnosed with ADHD (Bloom et al. 2006), whereas in Italy hardly any psychiatrist recognises the diagnosis as valid (Brancaccio 2001).

Around the time Ritalin™ hit the market, the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) was introduced. The DSM-III (1980) dramatically changed the way psychiatric disorders are classified, and gave credibility to the above logic.

The objective of DSM-III was to turn psychiatry into a rigorous science. It wanted to leave behind psychiatry's associations with vague and speculative psycho-dynamical ideas. As a result, DSM's third edition removed any reference to psychiatric disorder's alleged "causes". Diagnosis had to be based on readily perceivable phenomena only, leaving out entirely (unconscious) motivations, drives and emotional forces. For example, diagnosis of ADHD is based on three symptomatic behaviours: inattention, hyperactivity and impulsiveness. Ritalin™ or similar psycho-stimulants are its commonest treatments.

The DSM-III introduced ADHD's direct predecessor Attention Deficit Disorder, only to make place for (the less restricted) ADHD in its 1994 issue IV. During the 1970s, it had been common practice to refer to this disorder as either "Hyperkinetic Reaction of Childhood" (if one was psycho-dynamically-minded) or "Minimal Brain Dysfunction" (MBD) (if one was biologically-minded). Since from DSM-III onwards diagnosis had to be based on outwardly observable phenomena only, there was neither place for "Hyperkinetic Reaction of Childhood" nor for MBD in the DSM's psychiatric classification (cf. Brancaccio 2001, Rafalovich 2001, Singh 2006).

### 2.5.2 Ongoing Controversies

Despite the commercial success of Ritalin™, its prescription has remained controversial throughout the years. In the turbulent discussions on Ritalin™, three sets of issues catch the eye in particular.

Firstly, there is disagreement about whether or not these behaviours should be treated pharmacologically and whether they belong to the psychiatric realm altogether. Proponents see Ritalin™ as a miracle drug and argue that ADHD is under-diagnosed and under-treated (e.g. Barkley 1997). Opponents argue that ADHD is over-diagnosed and over-treated, that it is not clear how Ritalin™ works and that it is associated with serious adverse side effects.

The second set of controversies concerns the worries that Ritalin™ may disrupt normal child development and the worries about the consequences for society as a whole.

These lead to a third set of questions, concerning the enhancement use of Ritalin™ and the issue of social equality.

*Concerns on Health Effects*

Proponents and opponents of treating children diagnosed with ADHD with psychostimulants agree that it is as yet unknown precisely how stimulants help decrease symptomatic behaviours (see e.g. Bailly 2005, Coghill 2005). The dopamine system is likely to be involved but, remarkably, it has also been suggested that psychostimulants work through their effect on the serotonin system (Marx 1999).

In addition to this lack of certainty, proponents and opponents are divided upon the severity of the adverse effects of psychostimulants.

Box 1 sums up the side effects of today's most often used drug for the treatment of children with ADHD, viz. AdderallXR.

**Box 1: Important Safety Information for AdderallXR**

Safety:

children – decreased appetite, difficulty falling asleep, stomachache, and emotional lability; adolescents – loss of appetite, difficulty falling asleep, stomachache, and weight loss; adults – dry mouth, loss of appetite, difficulty falling asleep, headache, and weight loss. Agression, new abnormal thoughts/behaviours, mania, growth suppression, worsening of motion or verbal tics and Tourette's syndrome have been associated with use of drugs of this type. (AdderallXR 2007)

Defenders of drug treatment point out that use of stimulants has not been associated with serious adverse events and that the side effects mentioned are neither very serious, nor occur very often (e.g. Baldwin/Cooper 2000, Barkley 1997, Coghill 2005, Taylor 2004).

Opponents declare the exact opposite, including addictiveness and associations with sudden death under the possible adverse effects of psycho-stimulants (Bailly 2005, Baldwin/Cooper 2000, Breggin 1998, Timimi & 33 Co-Authors 2004, Timimi 2004).

The warning on the US Food and Drug Administration's patient information sheet on Adderall and AdderallXR—reproduced in Box 2—sides with the sceptics (U.S. Food and Drug Administration 2005).

**Box 2: FDA patient information on Adderall and AdderallXR**

Patient information:

WARNING: ABUSE POTENTIAL

Amphetamines have a high potential for abuse. Taking amphetamines for long periods of time may lead to drug addiction. Particular attention should be paid to the possibility of people obtaining amphetamines for non-therapeutic use of distribution to others.

Misuse of amphetamine may cause sudden death and serious cardiovascular adverse events.

Many people take psycho-stimulants for many years (see e.g. Breggin 1998), and there is an additional controversy on the long-term positive and adverse effects of psycho-stimulants. Opponents of long-term prescription say that efficacy has not been proven beyond four weeks (e.g. Timimi & 33 Co-Authors 2004). It has, however, also been defended — although some defenders readily admit that "no long-term efficacy trials have yet been reported" (Nutt et al. 2007, 22). Such disagreement also exists regarding long-term adverse effects: some argue that the increases in blood pressure, pulse and weight associated with long-term use of psycho-stimulants do not pose a problem (e.g. Nutt et al. 2007, 22) whereas others urge that these effects seriously harm the cardiovascular system (Timimi & 33 Co-Authors 2004).

Although little systematic research has been done on the experience of users of psychostimulants, it is noteworthy that many users seem to stop taking these drugs when given the choice at eighteen years of age (Kendall/Klaassen 2007).

Lastly, in the UK a growing number of children are being prescribed strong tranquilisers next to psycho-stimulants, to deal with the side-effect of the latter that the children cannot fall asleep. However, the effects of these tranquilisers on (neuro-) development are wholly unknown.

***Concerns on the ADHD Diagnosis and its Impact on Society***

The critics emphasise that the diagnosis of ADHD requires difficult normative judgments throughout and hence is ambiguous: what one person might consider being inattentive, hyperactive or impulsive behaviour symptomatic of a psychiatric disorder, another might perceive as healthy boyishness.

This makes Singh state that ADHD, more than any other diagnosis on the medical market today, "problematises the assumption of an objective measure of 'normal' functioning, and points to the distinctly social task of judging normative behaviours, assigning diagnostic labels and deciding on, and responding to, medical treatments" (Singh 2006, 439).

The complex issue of whether ADHD is really a viable, medical diagnosis, directly leads to the question of whether this disorder is caused by a neurological defect, by other phenomena (such as social problems) or the interaction of a variety of things. The controversy over ADHD's causes brings up the issue of whether a pill is the right way to treat ADHD.

Critics claim that the use of Ritalin™ prevents modern society to address the real social problems at stake. For example, some see Ritalin™ as a dangerous drug, which offers bad teachers and parents an easy way to discipline their unruly boys (e.g. Breggin 1998). Neuroscientist Steven Rose worries about the long-term social implications and fears that modern society is opting for quick technological fixes. According to Rose (2006): "The growing belief in a 'pill for every ill' ignores the ways that a child's discontent at school might be caused by a poor home environment, inadequate teachers, rigid syllabuses or even endemic racism. We seem to be heading towards a pharmacologically defined future". Here we find a more general criticism of prescribing psycho-stimulants, maintaining that treating small children with (powerful) drugs like psycho-stimulants helps them — and possibly their parents too — to internalise an idea of "a pill for life's problems" (Timimi 2004, 8). According to Timimi, "[w]e create unnecessary dependence on doctors, discouraging children and their families from engaging their own abilities to solve problems" (Timimi 2004, 8-9)

To put it in terminology borrowed from Nikolas Rose — who has no quibbles about this development per se — this helps create "neurochemical selves", i.e. people for whom it is more natural to think of themselves "molecularly", in terms of brain dynamics (Rose 2007), than in terms of membership of and functioning in a social body.

***Concerns on Non-Therapeutic Enhancement Use and Social Equality***

A famous study by Rapoport et al. in 1978 - which today to all likelihood would not pass medical-ethical boards - showed that methylphenidate-like agents do not merely alleviate attention and composure in subjects who suffer from ADHD, but also, and even to a larger extent, in subjects who do not suffer from such complaints.

This makes Ritalin™ (and comparable substances) a likely candidate for being considered a non-therapeutic human enhancement technology, although evidence of its use does not exclusively show improvements. Anyway, its use by American college students, writing papers or learning exams is widely reported, as is use by academics more generally (Sahakian/Morein-Zamir 2007, Maher 2008; cf. Sect. 2.8.2).

The enhancement use of Ritalin™ by college students has raised the issue of fairness: in a world in which competitive advantage is very much dependent on scholarly results, those with access to Ritalin™ to enhance their concentration when doing exams seem to have unfair benefits relative to those without access to Ritalin™. This gives rise to several questions, two of which Turner and Sahakian (2006: 84) formulate as follows: "Is it possible that these drugs could be used to reduce social inequality and injustice in society? Or is it more likely that their use will fuel further disparity based on a lack of affordability?"

Following this line of thought, Turner and Sahakian speculate about the future prospect of drug-testing regimes in schools, similar to those common in sports, in order to deal with this issue. Other people do not think that using "smart drugs" is problematic per se. In December 2008, Henry Greely and several other, well-known scientists and ethicists advocated the vision that society must respond to the growing demand for cognitive enhancement by making voluntary use of cognitive enhancing drugs possible (Greely et al. 2008; cf. Sect. 2.8.2).

They "call for enforceable policies concerning the use of cognitive-enhancing drugs to support fairness, protect individuals from coercion and minimize enhancement-related socio-economic disparities" (Greely et al. 2008, 704). This plead inspired many reactions, both supportive and opposing Greely and his co-authors.

The case of Ritalin™ shows that one pill or technology can be used for a variety of purposes: therapeutic and non-therapeutic, where the latter category can be refined in the two subcategories of enhancement use and recreational use.

Focussing on enhancement these different usages lead to partially overlapping and partially distinct moral, social and regulatory issues. From a judicial point of view the therapeutic use of Ritalin™ is legal, the non-therapeutic is not. Nevertheless, the broad availability of Ritalin™, because of its widespread therapeutic use, has unquestionably led to an (illegal) market for its enhancement and recreational use. As POST (2007), the British office for parliamentary technology assessment puts it: "Increased availability of cognitive enhancers could lead to greater pressure on individuals to use them. In the first instance, this could arise through pressure to compete with peers at school or in work. Indeed, legislation has already been introduced in the US to prevent school personnel promoting the use of cognitive enhancers. There are also ethical questions as to whether employers would be within their rights to require employees in certain professions to use cognition enhancers in the workplace."

The legal therapeutic use of Ritalin™, however, is also much debated from an enhancement point of view (Smits/Schuijff 2009). Because of the fine lines involved in the diagnosis of ADHD, which require normative judgments that are highly sensitive for diverging opinions, it is often hard to judge whether Ritalin™ is used as a therapeutic or an enhancing agent.

Furthermore, it should be recognised that (moral) decision making with regard to psycho-stimulant treatments does not primarily take place on the (academic) plane where scientists and ethicists exchange empirical details and moral arguments. Instead, today this decision making is primarily a task for parents, in particular mothers of children diagnosed with ADHD — and the basis upon which they commonly have to decide this issue hardly resembles that of either ethicists or prescribing doctors (Singh 2005). Culturally embedded beliefs on good mothering, normal boyhood and authenticity are co-productive of mothers' decisions, which simultaneously tend to re-produce these beliefs (Singh 2002a, 2004, 2005).

### 2.5.3 Remaining Issues of Concern

The three sets of issues of concern above have proven to be persistent and will probably not be settled easily in the near future. But even without having settled the issues of side-effects, addictiveness, or treatment vs. enhancement, differences of opinion are bound to emerge over whether "psycho-altering" drugs like psycho-stimulants can justifiably be prescribed to children. One need not be of the opinion that there is a categorical difference between treatment and enhancement — a distinction that according to some would have to be based on an "appeal to human nature, human dignity, or a rejection of artificiality" (Rose 2007, 104) that might ultimately be unjustifiable — to think that the positive effect of psycho-stimulants on children's behaviour does not warrant their prescription.

Ideas on the drugs impinging on children's "authenticity" can play a role here. Inequality in access to the drugs — resulting in inequality in behaviour, response to behaviour and, possibly, academic achievement — is another reason why one might oppose the use of psycho-stimulants in children.

## 2.6 Deep Brain Stimulation: Push-Button Mood Control?

In the 1980s a new neurosurgical technique has been developed to target Parkinson's disease, Essential Tremor, and other tremor-inducing disorders: Deep brain stimulation (DBS). In DBS a lead with two to four contacts for electrical stimulation is implanted in the brain, connected to a programmable and implantable pulse generator. This "pacemaker for the brain" fires electrical pulses at specific brain areas, which are thought to be implicated in the targeted neurological (or psychiatric) disorder. The DBS's electrodes are connected to wires that run down to a battery-powered pack, which is placed under the clavicle, and can be controlled by the patient. The precise activity of the DBS needs to be worked out. This fine-tuning can take weeks, and even months.

In this section the evolving issues and concerns on DBS and its enhancing qualities are explored. First, we shortly describe the supporting technology and its current applications. Secondly, a sketch of present and past images of DBS and its predecessors is given. Thirdly, we made an inventory of the main moral concerns on DBS caused by its. Finally, we draw some conclusions on the challenges DBS might pose for current health policy.

### 2.6.1. Deep Brain Stimulation and its Applications: State-of-the-Art

A critical success factor for the expansion of the area of application of DBS is the modern brain-imaging technology that has been developed during the last decades. These technologies have helped establish correlations between various (symptoms of) neurological and psychiatric disorders on the one hand, and (dys)functioning of specific brain areas on the other (cf. Kopell et.al. 2004). Following the identification of relevant brain areas, these areas can be targeted with DBS to treat the correlated disorders, or better: to fight specific symptoms of those disorders.

Imaging techniques also play a crucial role in the surgical intervention itself, since they are used to make sure where precisely in the particular patient at hand the DBS should be placed and similarly to ensure that there are no big arteries running through the brain area the electrode has to pass through.

Today DBS is mainly placed in the sub thalamic nucleus and used for the treatment of Parkinson's and other diseases that cause tremor. Currently, around 40.000 people worldwide have a DBS. For Parkinson's fairly good results have been recorded: on average Parkinson's patients report some fifty percent improvement in basic activities such as walking and keeping balance. DBS does not cure Parkinson's, but it offers a therapy for some of its symptoms (mostly motor-function symptoms).

Other symptoms of Parkinson's, such as memory loss, depression or anxiety are not or only sometimes negatively affected by DBS (cf. Hintum 2009).

According to neurosurgeon and DBS champion Ali Rezai, successful use of DBS for neurological afflictions such as Parkinson's should be regarded as "the tip of the iceberg". Today experiments are conducted with applications of DBS in patients suffering from Gilles de la Tourette (a neurological disorder often associated with psychiatric symptoms) and in psychiatric patients suffering from, for example, major depression or Obsessive Compulsive Disorder (OCD). However, use of DBS for other disorders than Parkinson's and similar neurological causes of tremor are all still in a (very) experimental phase. To illustrate: as of 2004, no more than a handful of people had been given DBS for Gilles de la Tourette or Obsessive Compulsive Disorder (OCD) (Van 't Hoog 2004). Psychiatrist Damian Denys and neurosurgeon Rick Schuurmans recently presented the results of one of the largest studies of the efficacy of DBS for psychiatric disorders (cf. Hintum 2009). Denys and Schuurman treated and followed up 16 OCD patients, whose nucleus accumbens was stimulated by DBS. Of the 16 patients, six experienced an improvement of 80% fewer symptoms, three reported about 50% fewer symptoms, and the others 10%-20% improvement (most likely because another neural circuit is also responsible for the OCD).

### 2.6.2. Promises of the Present and Images of the Past

#### *Scientific Hope and Uncertainties*

Interestingly, the success of DBS seems to run out of track with the available knowledge on the mechanisms through which it works. That is to say, there exists controversy about the causal mechanism to which DBS owes its efficacy. It is clear that the electrical activity of DBS changes the local neurochemistry and activity, but precisely how it works remains unclear.

DBS is often regarded as the successor of lobotomy, because it is likely that also this intervention owes its efficacy to a lesioning effect. In other words, it seems that it works through locally blocking neural activity. But whereas lobotomy involved permanently damaging or removing brain tissue, DBS is reversible. This leads to clear optimism among specialists: "With this technique, we have for the first time in psychosurgery the chance to help patients without damaging their brain in an irreversible way" (Berkelbach van der Sprenkel 2004: 61).

Being relatively benign, however, seems not the sole reason for trying this still risky surgical operation. DBS entails the promise of putting psychiatry on a truly scientific trail, by directly connecting psychiatric illnesses with neurological knowledge, rather than with outward symptoms only. This promise of a thoroughly biologised, evidence-based psychiatry invites the expansion of the (experimental) use of DBS.

***Lobotomy: DBS's Infamous Predecessor***

Despite its promises, DBS, being a neurosurgical technique with psycho-surgical potential, has a tough stigma to fight against. DBS's predecessor lobotomy has almost generally been abandoned, often enforced by law (Kopell et al. 2004). Although this is not the place to unfold the full tale of lobotomy (cf. Diefenbach et al.1999, and El-Haj 2005), some of its strands are helpful for thinking about DBS.

Lobotomy was first practiced by the Portuguese Antonio Moniz, but was made famous by the American neurologist Walter Freeman, who has performed thousands of lobotomies. Freeman infamously tended to use an ice-pick for the surgical procedure. Rather than the eccentric work of a bunch of mad men, lobotomy at the time was considered state-of-the-art science. The fact that in 1949 Moniz received a Nobel price for his work in lobotomy illustrates this.

This does not entail, however, that when measured against today's standards, lobotomy was grounded in rigorous scientific work. Evidence-based medicine did not exist in those days. Moniz, for example, did not present test results of the patients before and after the surgical procedure.

But more reasons can be found for why there is such a bad sound to lobotomy today. For one thing, it appears often to have been used as a cheap and fast solution to difficult and expensive social problems: "For state hospital physicians working in overcrowded and understaffed institutions, lobotomy provided a scientifically based means by which to treat their most psychotic and uncontrollable patients." (Braslow 1999: 236-7; cf. Lerner 2005)

After lobotomy, namely, many patients were much calmer than they were before and could therefore be cared for much easier, or could even be released from the overcrowded psychiatric wards. Sometimes it was practiced by doctors without surgical training, or even by non-medical hospital personnel (Van't Hoog 2004: 105). When the first psycho-pharmaceuticals (such as chlorpromazine) became available in the 1950s, many practitioners stopped performing lobotomy.

### 2.6.3 Concerns and Consequences

Partly in reaction to such aforementioned abuses, regulatory systems, like ethical boards and procedures of informed consent, have been put in place. In the Netherlands, for example, there exist strict conditions for the use of DBS. The patient needs to suffer from the disease for more than five years, while not responding to existing therapies such as psycho-pharmaceuticals. Moreover, there needs to be severe suffering from the side of the patient, with little hope of cure. Additionally, approval for the use of DBS is needed from both the patient and the family. And finally, the whole procedure is tested by a medical ethical commission (Van 't Hoog 2005: 106).

***Concerns on Risks and Enhancement***

Like any other (neuro)surgical intervention, DBS is not without risks. Risks common to neurosurgery are haemorrhage and infection, possibly resulting in death (Deuschl et.al. 2006). A variety of side effects of DBS have been reported, ranging from the agreeable — e.g. enhanced mood and uncontrollable bouts of laughter — to the uncongenial — e.g. mania and psychosis. Suicide also seems to be a possible "adverse effect": in a cohort of 140 patients treated for Parkinson's with DBS, 4.3% committed suicide (Burkhard et.al. 2004). However, a more recent study (cf. Arehart-Treichel 2008), which included more than 5000 patients, still found the suicide rate to be significantly higher than in the general population, but to a lesser degree (completed suicide percentage 0.45%; attempted suicide percentage 0.90%). Moreover, there is some evidence that the suicide risk is largely due to postoperative depression, which in most cases is unlikely to have been due to the stimulation, but rather to an existing depression prior to surgery.

One coincidental case is reported of dramatically increased memory: in a subject who got DBS for an experimental trial for the treatment of obesity, memory was, allegedly, significantly enhanced. Thus we find that enhancement of one or other human trait can sometimes be an unforeseen and unintentional side-effect of the DBS therapy. This shows that with the widespread use of DSB also a new experimental terrain is being developed, which by coincidence might lead to insights on how to enhance various cognitive functions.

As many historical cases bare witness to, such serendipity can be a major component of scientific discoveries and progress.

***Concerns on the Manipulation of the Mind***

Technologies such as these have the power to instantly trigger all kinds of (rush) reactions, both from enthusiasts and from critics. This is especially the case where we witness the move of DBS from neurological disorders (such as Parkinson's), through intermediary cases (such as Tourette) to psychiatric disorders, in other words: where neurosurgery turns into psychosurgery.

The optimists here see either a potential route for psychiatry finally to become truly scientific, or a highly precise means to enhance all kinds of cognitive functions, or both. For others, DBS constitutes a problematic instance of an imperialist drive characteristic of much technology:

"There is nothing particularly sublime or marvellous about this. Instead of liberation and transcendence it invokes the idea of technical dependency and even the scenario of remote-controlled humans – of which we would hardly say that they are enhanced or that they possess extended powers of self-determination, even if we placed the remote-control in their own hands" (Nordmann n.d.).

According to some this does not pose all too difficult a problem — no matter how philosophically weighty DBS may be: "Volunteers who receive the treatment for depression smile on the operating table as the voltage is turned up and frown as it's turned down, raising questions about just whose mind it is anyway. Advocates argue that when your life has come to ruin as a result of disability, you're concerned less with such philosophical questions than with simply feeling better" (Time, August 30, 2007).

For the critics it is crucial that such developments allegedly show that our cognition, emotion, perception — our selves — have been materialised and mechanised. That is to say, a presupposition underlying much of the debates on the societal and ethical implications of technologies such as DBS is that they manifest that medicine has come to grips with something that was until recently considered to be out of reach of direct medical intervention: the mind. Accordingly, so the reasoning goes, the mind has obviously (and finally) become part of nature in much the same way as anything else we encounter in our daily lives. The history of at least the last four hundred years has shown that once known, nature can be manipulated at will. The capacity of turning on and off emotions, moods, motor control and what have we, simply by switching on or off one's DBS, appears to powerfully illustrate this enlarged power of science and technology.

Following this line of thought, the idea of a pacemaker for the brain is easily associated with "emotions on demand" and "cosmetic mental surgery". It is imagined that what belongs to our cognitive, emotional and perceptive possibilities becomes something that we can choose in a way analogous to how we choose which shoes we wear.

Mention is being made of remote-controlled humans, fully dependent on technology, as it is envisioned that by switching one's DBS on and off at will — at different locations in the brain, in different ways and at different moments — one can control not only tremors, but mood and emotions as well.

The sound of contempt that can be heard in Nordmann's voice in the above quotation speaks from such worries about "instant self-techniques". What remains of any authentic self, if one's emotions and moods can be altered by pushing a button?

***Practical Concerns – Questions of Responsibility***

More practical worries arise when one considers who is responsible for one's actions, if these can be incited by technology-induced affective responses. Although there seems to quite a huge gap between such worries and the scientific state of affairs, there are clearly moral worries along these lines that are already topical. The aforementioned adverse side-effect of mania, for example, can have severe consequences.

Leentjens et al. (2004) describe a Parkinson's patient who after (successful) treatment with DBS became euphoric and manifested manic behaviours to a very problematic extent. His condition of Parkinson's was alleviated significantly, but additionally he started an affair with a married woman, bought several houses and several cars – with money he did not in fact have – and ended up with judicial and financial troubles. While his DBS was turned on, he was completely unaware of his manic behaviour. But when it was turned off, he showed awareness and regret. In light of such case description, also the issue of misuse of technologies by powerful actors to control people pops up here.

The medical standard of informed consent becomes a very difficult notion here as does moral responsibility for one's actions. Who must be held accountable for the damage done while his DBS was turned on: the patient, the DBS device, or the doctors who implanted it and turned it on? When his DBS is turned off, the patient will likely have his choice on whether to use his DBS or not be informed by his (very bad) Parkinson's condition. In this case, the patient did indeed choose to have his DBS turned on again.

### 2.6.4 Conclusion

In this latter case, we find that DBS succeeds to create a new moral dilemma and that this technology likely impacts on the outcome of the moral deliberation it puts into working (cf. Verbeek 2008). Will DBS for example urge for a revision of the informed consent notion? These and similar questions, so the above description of state of affairs suggests, should be discussed and, more urgently, should find their way into policy-making with regard to the use and abuse of DBS. Common ethical and judicial frames of thought do not seem to have much to offer for thinking about an issue like this, where technology becomes a (moral) player in its own right.

At this moment Deep Brain Stimulation is not being used to enhance performance of the brain. It is being used for the treatment of Parkinson's and other diseases that cause tremor. This treatment is strongly regulated. Lessons learned in the past – amongst others the abuses related to the practice of DBS's predecessor lobotomy – have lead to the current regulatory practices, like the need for informed consent and the institutionalisation of ethical boards.

DBS is only used in extreme circumstances: severe suffering of the patient, no alternatives and hope for improvement available. Also the risks of DBS are severe; think of classical risks like infection. DBS regularly involves rather unpredictable changes: from suicidal behaviour to enhanced moods and enhanced memory.

This coincidental deterioration and enhancement illustrates the experimental stage DBS is in right now. Nothing much is known as yet about what we can realistically expect from DBS in the future — not with respect to the range of disorders that will be treated with it, nor with respect to its potential in enhancing memory and moods.

Nevertheless, the experimentation in the field of DBS is guided by the hope to make psychiatry science-based. This is being legitimated through the hope to offer release and treatment for very serious neurological and mental disorders. Part of the experiment and the endeavour to create a science-based psychiatry, however, is the expectation that DBS will also be able to alleviate mood and happiness.

Accordingly, in the case of DBS there is no clear borderline between science for treatment and science for non-therapeutic enhancement.

It is exactly that idea that both attracts and frightens many. It is associated with the loss of the much heralded notion of authenticity, for example, and immediately elicits generic fears concerning equity. Neurophilosophers, neuroethicists, neurosociologists and neurojurists are presented with a challenging case to direct their attention to. What to think of "the self" if its essential attributes of mood and emotions can be manipulated at will, by everyone who happens to hold on to the joystick connected to your DBS? Is such manipulation morally permissible? And what conclusions does this entail when it comes to law—who is to be held responsible for behaviour conducted while the mood of the agent at issue was being altered by DBS?

## 2.7 One Trend Instead of Four Separate Cases

At first glance, the four described cases (gene doping, designer babies, Ritalin™, and DBS) might not seem to have much in common. However, they all share certain characteristics, namely that they involve actual or potential HET rather than just any technology. In this section, we will explain the characteristics that make these four cases and the technologies in question relevant for the EU.

### 2.7.1 New Practices Arise from Cutting-Edge Science

All four cases relate to ideas that push back the boundaries of medical, scientific research. The idea, and the possible practice of gene doping benefit from research into curing the severely sick with gene therapies. The Designer Baby fiction is born from an adaptation of a novel technology to prevent inheritable diseases. The widespread use of drugs like Ritalin™ to enhance concentration would not have been possible without the discovery, or invention of ADHD and its treatment. And, finally, mood enhancement by DBS was first discovered as a side effect of a Parkinson's treatment. All the research on which these technologies are based stretches the known limitations of the scientific disciplines.

And after that, novel applications for new technologies can be developed for other (derivative) purposes than the technology was originally designed for.

Note that in all four cases the original research or technology was aimed at alleviating or curing a medical condition, but that the medical context of discovery slowly shifts towards a broader context of application – one that includes non-therapeutic enhancement.

The research into ADHD and the prescription of drugs like Ritalin™ have led to an illegal practice, in which the drugs are sold, traded, or stolen for non-therapeutic enhancement and recreational purposes. This illegal practice around the drugs means that the technologies affect many more people than intended, not only the diagnosed patients, but also the illegal users and people who could be negatively affected by enhanced results of their peers at work or school.

Research to prevent genetic diseases from being passed on to future generations might lead to selection of embryos on non-health related genetic characteristics.

This will put pressure on the selected children to live up to their parents' expectations, but might also cause resentment amongst children who have not been selected – for they could be jealous of the genetically better endowed other children or ask their parents why they did not use the possibility to select the best available embryo.

Gene therapies are being experimented with to cure dreadful deadly diseases. But if they can boost muscle growth, a relatively easily attainable toned body might be of interest of not only (semi-)professional or even amateur athletes, but also of anyone who wants that look without the exercise. And an improved endurance might interest not only athletes, but anyone who sometimes has to run for the train or is out of breath after climbing a flight of stairs.

Finally, the now still experimental technology DBS could conceivably be used to stimulate a good mood. Right now, this is a future scenario rather than a description of an existing practice. This future scenario could, however, have consequences for the larger community than just the users. For example, will a bright mood become a new social standard?

More worryingly, however, are concerns regarding the costs of the technology, unintended side-effects, the desirability of the social changes they will precede, and the acceptability of medical tourism to benefit from highly specialised medical or enhancement tourism. (Note, however, that some of these concerns are important questions for many technologies.)

### 2.7.2 Sufficiently Regulated New Practices?

Developing new, boundary-pushing knowledge or technologies and new medical practices is most often accompanied by debate amongst the scientific peers as well as the larger community. However, the world of science and technology has become an international one, which means that scientists not only discuss their results with their fellow countrymen (scientists as well as others), but also with people in other countries (via peer reviewed journals, conferences etc.). Furthermore, many international research projects exist.

Not only the scientific community has become an international one. People can travel easily to another place or even another country to see a specific doctor, undergo a procedure, or by (earlier available or cheaper) technology.

Mass media and especially the internet have created information platforms in which people exchange information about therapies for diseases they see themselves suffering from, the latest gadgets in technology, and all kinds of experiences with technologies.

Technologies that are available in other countries or regions of the world often come to the Member States in one form or the other. Many enhancement technologies derive from medical technologies.

The introduction of enhancement technologies via the medical domain can not only lead to medical tourism, but can also have the consequence that health care systems are pressured to treat people for more and more conditions (and to give people access to the same treatments that are available elsewhere). Whether people will be treated in their own country or whether they will travel to another country, they want to be reimbursed. This can in turn pressure the health care insurances to pay for all these treatments. Otherwise this could lead to a social divide between rich, enhanced people and poor, natural people. Such a divide could both arise within a Member State and within European regions.

The development of human enhancement technologies needs to be seen in this international perspective; but not only the development, since the use of and the way people think about the technologies will be influenced by the practices abroad.

Just a little over a decade ago, almost everybody thought that cosmetic surgery was morally condemnable, but more and more people now are embracing it to shape their bodies (and selves). The public opinion can change under influence of growing practices. Yet, the practices that arise around human enhancement are sometimes international (couples travelling to Belgium to undergo PGD, for example), sometimes national, and in other cases confined to certain sections of society (doping use in sports or the consumption of smart drugs as a study aid by students).

National debates about the technologies and regulation on the level of European Member States do not always do justice to human enhancement practices. If Germany for example outlaws PGD and people start to travel to Brussels, as they can under EU regulations, the national regulation does not seem to be effective enough to reach the goal. National regulation might thus even contribute to the processes at work in the cases, by opening up space or "forcing" people to seek a more liberal medical climate abroad or to resort to importing illegal cognitive enhancing drugs from a country with less strict regulation on trade or production of, possibly even ineffective or unsafe cognitive enhancement drugs.

Among the most important regulatory challenges raised by the practices discussed are unwanted (side-)effects, the purpose of Member States' or EU-funded research, and the costs and sustainability of - or solidarity behind - health care systems.

## 2.8 The Promotion of Human Enhancement

In the preceding sections of Chapter 3, we have discussed how the perspective of human enhancement sheds new light on broader social processes and how actual and potential HET are perceived and culturally appropriated in society.

We have found that there are important societal tendencies, above all in the medical context, and strong bottom-up processes (including individual desires, fears, and needs) that are moving toward an enhancement society. In various parts of the study, we have also mentioned that the transhumanist movement is interested in HET and promotes a strongly affirmative perspective of human enhancement.

However, in particular in a policy context, one needs to counter the impression, which is widespread in ethical debates and the emerging broader public discourse on human enhancement, that organised transhumanists, with a few close allies and like-minded individuals in science and technology, are the only ones that are out to promote the massive use of all kinds of HET, the development and application of radical, second-stage HET, or far-reaching visions of an enhancement society and a posthumanist future.

In this section, we will point out some evidence that organised transhumanists are but the most vocal and activist element of a cluster of wider networks promoting an – often extremely – affirmative perspective of human enhancement.

They share, or at least tactically endorse, all or the key elements of a worldview whose core was concisely expressed in the first article of *The Transhumanist Declaration* of the World Transhumanist Association (WTA). The article says, "Humanity will be radically changed by technology in the future. We foresee the feasibility of redesigning the human condition, including such parameters as the inevitability of aging, limitations on human and artificial intellects, unchosen psychology, suffering, and our confinement to the planet earth."

Evidently, the transhumanist notion of our future is

- deterministic ("Humanity *will be* radically changed", *our italics*)
- fixed on technology (with humanity figuring as an object, not as an actor of change)
- radical and interventionist with regard to the world as we know it ("redesigning the human condition")
- tied to the hopes for eternal youth or individual immortality, cognitive enhancement, the rise of a powerful artificial intelligence, and a revolution in emotional life
- oriented towards an expansion into outer space
- generally focused on overcoming limits ("limitations", "confinement")

Below, we will discuss the features of this ideology of extreme progress in a little more detail and with a view on larger historical aspects (see Sects. 2.8.6 and 2.9).

In the following, we will first provide an exemplary overview of the networks and players promoting human enhancement and this ideology.

### 2.8.1 Organised Transhumanists, Their Mentors and Milieus

The transhumanist movement in the strict sense (cf. for the following e.g. Regis 1990), i.e. its organisational core, was largely shaped at an early point in time by the so-called "extropians", led by Max More (which is a self-chosen and self-documenting extropian name). This British, California-based consultant, who was trained as a sociologist, and transhumanist artist Natasha Vita-More (self-chosen name) have been a rather prominent couple in the American, largely Californian, milieu of visionary techno-enthusiasts since the 1980s (cf. Alexander 2003).

An important figure in the pre-organisational phase of the transhumanist movement was another technofuturistic sociologist, the Perso-American Fereidoun M. Esfandiary (self-chosen name: FM-2030) who envisioned that we are "(o)n our way beyond animal, beyond human, beyond transhuman – to a post-human dimension – FREE FOREVER IN THE UNIVERSE" (Esfandiary 1974, 298; the unusual and rhapsodic style is characteristic for many of his writings).

The U.S. technofuturist milieu of the 1970s also included the space flight and colonisation enthusiasts around the L5 Society, which later merged with the National Space Institute, founded by Wernher von Braun, to form the present-day National Space Society, the most important of a number of U.S. space advocacy groups.

The L5 Society included, for example, the famous and, to some, notorious psychologist, psychedelics activist, and late-life technofuturist Timothy Leary ("Turn on, tune in, drop out"), the influential nanotechnology visionary Eric Drexler, and the roboticist and artificial intelligence researcher Hans Moravec.

Drexler (1986), Moravec (1994, 1999), and the artificial intelligence research pioneer Marvin Minsky (1994) can be deemed the most important direct mentors or "father figures" of the transhumanist movement. Drexler and Minsky have also shown some support for the "cryonicists", another element of the U.S. technofuturist milieu which continues to exist until today. By taking care that after their death, their corpses or only their heads are frozen, they hope to have the chance to be revived by the means of a future medicine and technology. One far-reaching vision of Moravec and many other organised or non-organised transhumanists is that it will be possible in the future to download someone's personality or mind onto a computer, a vision that is shared by some members of the NBIC initiative on converging technologies (see Sect. 2.8.3). Drexler, supported by Minsky and Moravec, played a crucial role in the prehistory and early history of the promotion and political foundation of nanotechnology as a key technology field. The discourse on nanotechnology enabled the reintroduction of the ideology of extreme progress into the mainstream discourse on science and technology, and the rise of organised transhumanism to some prominence in it.

Recently, the notion of a "singularity", developed in the 1990s by the science fiction author and mathematician Vernor Vinge, appears to have emerged as the focus of large parts of transhumanist and allied networks that have evolved in the U.S. technofuturist milieu. The singularity is imagined as the result of an extremely rapid development of science and technology after which a powerful artificial intelligence and, possibly, a massively transformed human species will shape a world utterly different from our own.

However, the glimpses into this future taken by Ray Kurzweil (2005) and by proponents of the transhumanist branch of "singularitarians" seldom reveal another kind of society with regard to the socio-economic order or the non-material culture (Coenen 2007). Their other society is limited to material culture and, in particular, to high-tech artefacts.

The World Transhumanist Association (WTA) today appears to be the most vital and publicly visible transhumanist organisation, with several thousands members worldwide. Its leaders, such as the above-mentioned philosopher Nick Bostrom and the sociologist and ethicist James Hughes, have been highly active in the new ethicopolitical discourse on human enhancement and on converging technologies (see e.g. Hughes 2006), some of them gaining a reputation in the academic world.

They appear to take a more pragmatic and less visionary approach to human enhancement, favouring a political strategy which is more in line with the political mainstream in Europe than the often economically ultraliberal and rather anti-statist positions of leading extropians. Nevertheless, the WTA leaders still adhere to some of the most far-reaching posthumanist visions (cf. e.g. Coenen 2007).

WTA leaders and other organised transhumanists display a strong interest in technoscientific means to achieve happiness, a total control of emotions, and an improvement of human character, arguing, for example for a use of HET

- to manipulate lust, attraction and attachment in love and marriage, a "neuroenhancement of love" (Sandberg/Savulescu 2008)
- to "edit and augment our desires, to eliminate our vices and enhance our virtues", a "virtue engineering" (cf. Coenen 2007)
- to "become managers of the mixing console of our brains", "turning the buttons like a disc jockey" to "control our emotions ourselves" (cf. Nebbeling 2008),
- to enable a "paradise-engineering",
- or even to create a posthuman future utopia of eternal bliss, happiness and pleasure (Bostrom 2008a).

For a broader public, the trans- or posthumanist worldview became most visible during the international debate on the essay "Why the future doesn't need us" by the computer scientist, IT entrepreneur, and venture capitalist Bill Joy. In this essay, Joy (2000) launched an attack against Kurzweil's, Moravec's and Drexler's visions and the posthumanist worldview at large. It mainly became famous, however, because Joy, with his renown as a leading computer expert, proposed that severe restrictions be considered for several established, new or emerging key technologies such as nanotechnology, robotics, and artificial intelligence.

As previously stated, the promotion of human enhancement and of the ideology of extreme progress is in no way to be solely attributed to the rather small, close-knit networks of organised transhumanists and their immediate allies and mentors. Moreover, one should take into account, particularly in a research and technology policy context (cf. TAB 2008), that the influence of these networks and their ideas is also in no way restricted to isolated flare-ups in the mass media and some degree of interest in certain, rather detached academic fields, such as media and cultural theory.

In the following, we will briefly try to point this out with regard to science communication and the ethics of technology (see Sect. 2.8.2), political activities on nanotechnology and converging technologies (see Sect. 2.8.3), the biotech, and IT industries (see Sect. 2.8.4), and military and space research (see Sect. 2.8.5). Most of the impact is largely or entirely strongly felt in the U.S. and the United Kingdom.

### 2.8.2 Science Communication and the Ethics of Technology

It appears that the worldview of organised transhumanists and their mentors and close allies is at least partly shared or supported by a significant number of ethicists and of influential popularisers of science as well as by some key players in science communication in general.

Regarding the popularisers of science, some academically well-respected researchers in the fields of theoretical physics, astrophysics, astronomy, or cosmology should be mentioned such as Freeman Dyson, Michio Kaku, and the British Royal Astronomer Martin Rees. The latter has recently argued that we should take the "posthuman" era seriously and that we need to keep our minds open — or at least ajar — to the possibility that humans could change drastically within a few centuries (see http://www.edge.org/q2008/q08_13.html).

Rees writes that these thoughts might seem irrelevant to practical discussions and best left to speculative academics and cosmologists, but emphasises that he personally no longer thinks this is true. He argues that humans, individually and collectively, are now so greatly empowered by rapidly changing technology that we can by design or as unintended consequences engender global changes that resonate for centuries and that policy-makers should indeed think that far ahead. In such planning, we should be mindful that it may not be people like us who confront the consequences of our actions today. In his view, we therefore are custodians of a "posthuman" future — here on Earth and perhaps beyond — that cannot just be left to writers of science fiction. His colleagues Dyson and Kaku have provided quite detailed, extremely long-term visions of how such a posthuman future could come into being and what it could look like (see e.g. Kaku 1997).

To remain for a moment with these very visionary perspectives, we would like to draw attention to the fact that they are also having an impact on the public understanding of science through a range of journalistic and editorial marketing efforts.

A number of popular journals, some of them only online and all of them widely read by IT professionals and other technically savvy people, have for quite a long time now provided, a space for radical posthumanist thinking, and also for some of its criticisms. The US journal Wired in which the above-mentioned essay by Bill Joy was first published is one example and, in Europe, the online magazine Telepolis has, for example, been instrumental in popularising the visions of Moravec and transhumanism in Germany (cf. Paschen et al. 2004). To take another example from Germany, the debate on Joy's pessimistic visions has also been conducted in quality newspapers. It was, for example, used by the *Frankfurter Allgemeine Zeitung (FAZ)*, a leading newspaper, to present the views of Kurzweil, Minsky and other posthumanists to the public as instances of the forward-looking, pro-technology character of the U.S. as opposed to the presumed backwardness of Europe and, in particular, European intellectuals (who would still cling to outdated Marxist or Freudian and, in any case, technophobe notions of our present society).

The context of this was a more comprehensive attempt by the *FAZ* to promote natural science and technology issues in its culture and arts section. The *FAZ* cooperated here with literary agent John Brockman and his Edge Foundation which promotes an elitist notion of a new avant-garde of scientists, engineers, and technophile scholars (the "Third Culture") who, through their work and expository writing, are posited to be taking the place of the traditional intellectual in rendering visible the deeper meanings of our lives, redefining who and what we are (see www.edge.org). One of the most visible activities of the Edge Foundation is the *World Question Center* (in existence since 1998) which is a series of annual publications for which a larger number of scientists and writers are asked to answer one big question such as "What do you believe is true even though you cannot prove it?", "What are the pressing scientific issues for the nation and the world, and what is your advice on how I can begin to deal with them?" (a fictive question by the U.S. president), or "What have you changed your mind about? Why?".

Martin Rees' answer to this last question was that we should take the "posthuman" era seriously. Another answer brings us back to more mundane and short-term aspects of human enhancement and to a key player in science and science communication.

Philip Campbell, editor-in-chief of the extremely prestigious and influential scientific journal *Nature*, confesses in his answer that he has changed his mind about the use of enhancement drugs by healthy people. He argues that the ultimate test of such a change of mind is how he would feel if his offspring (both adults) went down that road, and his answer is that, with tolerable risks of side effects and zero risk of addiction, he would approve of it if it had an appropriate purpose. Such a purpose would be, for example, gaining a better return on an investment of study or of developing a skill, not be confused with gaining an unfair advantage, and excluding unwillingly following the demands of others.

Campbell characterises cognitive enhancement as one example of debates about human enhancement that can only become more vigorous in the future, and as an example of a topic in which both natural and social sciences can contribute to better regulation. He reports that thinking about the issues and looking at the evidence-based literatures has made him realise how shallow his own instinctive aversion was to the use of such drugs by healthy people, and that this also led to an article that triggered many blog discussions (Sahakian/Morein-Zamir 2007). Campbell acknowledges that there are only anecdotal accounts and experimental small-scale trials showing that such drugs do indeed improve performance to a modest degree under particular circumstances, but points out that there is no doubt that pharmaceutical cognitive enhancers are used by academic faculties or people in other non-military walks of life. And he emphasises that manufacturers will not turn away the significant revenues from the illegal use of these substances by healthy people.

In his view, the illegality of an off-label use of such drugs to enhance performance reflects an official drug culture that is highly questionable, because it is wrongly founded in the idea that drugs used by healthy people are by definition a Bad Thing. Campbell argues that this in turn reflects instinctive attitudes bound up with "naturalness" and "cheating on yourself" that do not stand up to rational consideration or behavioural consideration.

He concludes that research and societal discussions are necessary before cognitive enhancement drugs should be made legally available for the healthy, but that he now believes that this is the right direction to take.

Recently, *Nature*'s campaign in favour of cognitive enhancement has been continued by an article in the journal which was co-authored by several scientists and scholars, and by Campbell himself (Greely et al. 2009). In this article, the authors sharpen the points that were already made in the above-mentioned article in *Nature* (Sahakian/Morein-Zamir 2007), namely that pharmacological cognitive enhancers are effective to a certain degree if used by "healthy normal people, improving their abilities to focus their attention, manipulate information in working memory and flexibly control their responses" (Greely et al. 2009). As we have shown above (see Sect. 1.2.1), the evidence for these claims is still scarce, a fact which is conceded by the authors. They again emphasise that the demand for and the use of such cognitive enhancers is already widespread, relying on the same limited evidence as the first article.

Although we do not know much about the use of such drugs by healthy people and their effects on them, the authors nevertheless forcefully argue for a legalisation of such uses.

The authors call for a presumption that mentally competent adults should be able to engage in cognitive enhancement using drugs. They call for an evidence-based approach to the evaluation of the risks and benefits of cognitive enhancement, emphasising that such an approach should not lead to an insistence on higher thresholds than those applied to medications. They argue that there should be a freedom from coercion to enhance, but name as actual or possible examples military personnel, children, and an extremely safe drug that enabled surgeons to save more patients. In their view, appropriate policy should prohibit coercion, except in specific circumstances for specific occupations, justified by substantial gains in safety, and it should also discourage indirect coercion insofar as employers, schools or governments should not generally require the use of cognitive enhancements. However, if particular enhancements are shown to be sufficiently safe and effective, this position might be revisited for those interventions.

In other words, *Nature*'s campaign veers towards an equal treatment of enhancement and medication and towards the promotion of even a use of effective and safe cognitive enhancers, in some cases even a mandatory one. Moreover, the authors dismiss in passing the criticism of such a stance on human enhancement by the President's Council on Bioethics as "persuasively rejected" by one of the co-authors of the article, namely the controversial, but influential British ethicist John Harris.

In their attempt to substantiate this claim, the authors rely on the rhetorical strategies that are outlined here in section 1.1.2: They equate new HET with such practices as education, use of tools (such as computers), and the consumption of coffee, offering an anthropological notion of human enhancement. Accordingly, pharmacological cognitive enhancers along with newer technologies such as brain stimulation and prosthetic brain chips should be viewed in the same general category as education, good health habits, and information technology — "ways that our uniquely innovative species tries to improve itself."

If provided with the appropriate caution regarding certain ethical, societal and risk aspects (such as fairness, social disparities, safeness, and individual freedom), we should "welcome new methods of improving our brain function", in a "world in which human workspans and lifespans are increasing".

The article has spawned several comments and criticisms, in the journal itself and elsewhere. The main points of critique were that the article largely neglected the addictive potential of many existing drugs used for human enhancement, and that the authors tend to overrate the evidence for the effectiveness of pharmaceutical cognitive enhancers. Transhumanists such as the philosopher Nick Bostrom welcomed the authors' approach.

Interestingly, *Nature* recently also provided transhumanists and other ardent promoters of human enhancement with a forum, namely the *Nature Debate* on "Enhancing the Body" in London in November 2008, in which they could address a public audience. The panel consisted of the above-mentioned Kevin Warwick, a professor of cybernetics who self-experiments with implants to become the first cyborg, Andy Miah who advocates a liberal approach to human enhancement, and Aubrey de Grey who advocates research to rejuvenate the human body and thereby allow an indefinite lifespan. In its activities in science communication, *Nature* therefore obviously also supports the far-reaching transhumanist visions of human enhancement.

*Nature*'s campaign appears to be just another example of speculative ethics which prematurely jumps from the "if" to the "then" (Nordmann 2007a), by taking some rather scarce evidence for the existence of moderately effective HET to promote a radically new approach to the governance of human enhancement, and even transhumanist visions and other instances of the ideology of extreme progress.

Controversial, but influential ethicists such as John Harris, co-author of the second article in *Nature*, and the above-mentioned Julian Savulescu, who appear to only tactically distance themselves form organised transhumanism, add a further dimension to the promotion of human enhancement: They sharpen the points made by the more moderate defenders of human enhancement by arguing for a "duty to enhance" in certain, rather widely defined circumstances. For quite some time now, some of these ethicists have also advanced elements of a negative eugenics, for example with regard to people with "intellectual disabilities" (cf. e.g. Savulescu 2001).

The ethicists who promote human enhancement can make their points in a professional ethical discourse which generally leans towards very visionary perspectives (cf. e.g. the criticisms Grunwald 2007; Nordmann 2007a, 2007b). Here, we encounter some moderate defenders or opponents of human enhancement and many, particularly religious, strong critics of HET and transhumanism who both tend to take the claims of transhumanists, the NBIC initiative or other promoters of human enhancement at face value, in the sense that they do not question the feasibility of some, and sometimes even the most extreme, visions of progress in HET. In this context, such critics and the transhumanists have been characterised as two camps waging "symbolic crusades", the former by trying to instigate "moral panic" without having cogent ethical arguments, the latter "selling morally uplifting beliefs" that neatly fit into the "current entrepreneurial culture" (Mauron 2005).

While this critique is too harsh, there is evidence that the strategic use of transhumanist and other technofuturist visions is central to the debates on human enhancement (cf. Coenen 2007, 2009): In terms of policy issues and basic assumptions of human corporeality, their conflict resembles a show fight between hostile brothers who are rivals, but work together to get as much public attention as possible. On a more general level, one should take into account instances of the use of speculative ethics as a kind or marketing instrument in a policy context: by claiming very early on actual or probable future ethical (and for this matter societal) implications for new or emerging technologies, interest can be raised for the relevant R&D fields. Paradoxically only at first glance can even extremely frightening, catastrophic and apocalyptic perspectives on such technologies be used in a combination with a strategy of "hype and hope". This aggravates the danger of a vicious circle in research, science and technology policy in which all the players involved (scientists, policy-makers, business representatives, NGOs, and social scientists and scholars engaged in accompanying research) compete to advance the most spectacular visions of future progress in science and technology and its impacts.

There are a number of further instances of the promotion of human enhancement by important players in the field of science communication and scientific policy consultancy which had to deal with the fine line between taking a broad look to the future and feeding the hype surrounding certain technologies.

Activities of the American Association for the Advancement of Science (AAAS) can serve as one example of an approach to the topic which integrates transhumanist and other highly visionary and biased technofuturist views in a way that amounts to restructuring discussions on science and technology from a specific, radical perspective of human enhancement (see http://www.aaas.org/spp/sfrl/projects/HE). Another example is a workshop held in 2006 in the U.S. on policy implications of technologies for cognitive enhancement (CSPO/ACG 2006). Both activities closely relate to or were directly inspired by the NBIC initiative on converging technologies in the U.S. (see Sect. 2.8.3), and they were strongly shaped by prominent transhumanist and other members of the NBIC initiative.

In our view, the problematic aspect of such endeavours is not that the transhumanist approach is taken into account at all, although a less prominent role for a representative of such a visionary and contentious movement appears to be advisable. The problem is that, at least for the sake of a lively discussion, the often overrated appraisals of the state-of-the-art in HET by the technovisionaries are taken at face value, and the normative assumptions of the transhumanists are not, or only superficially discussed against the background of a broad spectrum of normative stances towards the interrelations of science, technology, and society and their future.

As our final example of how even the most extreme transhumanist visions are picked up by well-respected players in science communication, we take a recent special issue of *IEEE Spectrum*, the flagship publication of the Institute of Electrical and Electronics Engineers (IEEE). This is an important U.S.-based professional organisation of engineers, with more than 365000 members in around 150 countries. The special issue was devoted to the above-mentioned vision and concept of a "singularity".

In his editorial, *IEEE Spectrum*'s executive editor Glenn Zorpette makes fun of today's transhumanists and singularitarians and their hope of becoming immortal themselves by preserving their minds in some sort of digitally created Eden. Invited critical comments by Alfred Nordmann and John Horgan, for example, relate the hype about the singularity to the above-mentioned vicious circle in research, science and technology policy which appears to set incentives for overrating, if not the prospects of one's own scientific work, at least the works of researchers in other fields with whom one cooperates in interdisciplinary projects. The thought of the believers in the singularity is characterised as sloppy reasoning, wishful thinking, an invitation to irresponsibility, a yearning for transcendence, and as escapist, pseudoscientific fantasies.

So, why does *IEEE Spectrum* open its pages to some ardent promoters of this idea? And why did *Nature* start its campaign for legalising all kinds of cognitive enhancers and invite transhumanists and other champions of radical human enhancement to preach to the public in an event organised by the journal? What are the drivers in research and technology policy and the related ethical debates that have made the transhumanists appear to many to be a significant voice in the discussions on science and technology?

In the next sections, we would like to present some evidence that the rise of radical notions of human enhancement, and of transhumanism, is related to interests in research policy (see Sect. 2.8.3), some segments of industry (see Sect. 2.8.4), and military and space research (see Sect. 2.8.5), and that this rise should be analysed against the background of a long-term ideological development which challenges value systems, in particular European and Western ones (see Sects. 2.8.6 and 2.9).

### 2.8.3 Policy Activities on Converging Technologies

In the following, we add some analysis results and further information on the above-mentioned NBIC initiative on converging technologies in the U.S. (Roco/Bainbridge 2002; Roco/Montemagno 2004; Bainbridge/Roco 2006a, 2006b). This initiative has been instrumental in advancing the debate on second-stage HET and has brought the topic of human enhancement to the attention of a wide range of players in the ethicopolitical discourse on nanotechnology and other fields of research and development (Coenen 2009).

"Converging Technologies" (CT), not to be confused with the notion of converging technologies in the media and IT industries, originally refers to the convergence of nano-, bio-, info-, and neurotechnologies (including the relevant research fields). We will not go into any detail here on the concept of technological convergence, or the very wide-ranging discussions on it and the initiative; for this, the reader is referred to some pertinent European reports on the topic which provide further references (Andler et al. 2008; Coenen et al. 2004; EU HLEG FNTW 2004; Paschen et al. 2004; STOA 2006; for an overview and detailed account, see TAB 2008).

Our main points here are the following: The NBIC initiative can be deemed the admission of a set of closely interrelated technofuturist visions into the research and technology policy discourse (cf. Coenen 2009). This set of visions resulted from a convergence of visionary traditions stemming from different fields of R&D, such as nanotechnology, artificial intelligence, and neuroscience, and focused on the topic of human enhancement.

The initiative also represents the convergence of interests of several institutional and private interests in the promotion of HET, and epitomises a new phase in the discourse on human enhancement which centres on second-stage HET. The NBIC initiative appears to have been inactive since 2006, and did not achieve its original explicit goals such as setting up a major new funding initiative under the label of CT. However, it certainly was instrumental in starting a debate on new and emerging technologies with a clear focus on second-stage HET. Moreover, some of the initiative's key players continue to advance their agenda in various contexts (cf. Andler et al. 2008; TAB 2008)

Key members of the initiative, which was led by the National Science Foundation (NSF), were the NSF's Mihail Roco, a science manager, engineer, and arguably the most important promoter of nanotechnology since the second half of the 1990s, and the above-mentioned William Bainbridge, also from the NSF, a sociologist of religion who adheres to a rather extreme version of the transhumanist worldview; he imagines our descendants, or even younger people alive today, as patterns of information, roaming in changing technobodies in outer space. Besides the NSF, the Department of Commerce (DoC) sponsored the workshops of the initiative.

Other institutions that participated included the Defense Advanced Research Project Agency (DARPA), other military research agencies, and NASA. Corporate participants came, for example, from the IT industry. Bainbridge has acted as the link between the initiative and the transhumanist movement at least since 2003, and has himself published far-flung visions of an extraterrestrial posthuman civilisation and an overcoming of death (e.g. Bainbridge 2004b). The intellectual and personal interconnections between the NBIC initiative and posthumanism are mainly represented by Bainbridge and his ideas on convergence, but there are also organised transhumanists who have contributed to its publications (e.g. James Hughes and Nick Bostrom).

The initiative's programme (Roco/Bainbridge 2002, 1, 5f. and 18-20) includes the vision that "the human body will be more durable, healthy, energetic, easier to repair, and resistant to many kinds of stress, biological threats, and aging processes" and a view of a transformed civilisation looming on the horizon, in which advances in nanoconvergence will enhance sensory and cognitive capabilities (also "for defense purposes") and enable "brain to brain inter-action". This might then lead to "wholly new ethical principles" that will govern "areas of radical technological advance, such as the acceptance of brain implants, the role of robots in human society, and the ambiguity of death in an era of increasing experimentation with cloning".

Moreover, the editors hope that technological convergence will go hand in hand with "human convergence", leading to a "golden age" characterised by "world peace, universal prosperity, and evolution to a higher level of compassion and accomplishment". Humanity might then become something "like a single, distributed and interconnected 'brain'" or a "networked society of billions of human beings" – possibly regulated with the help of "a predictive science of society", by applying "advanced corrective actions, based on the convergence ideas of NBIC" and an "engineering" (Bainbridge 2004a) of culture, with the aim of securing the U.S. hegemony.

Some participants were impressed by the long-term potential for "uploading" aspects of individual personality to computers and robots, thereby expanding the scope of human experience and longevity (Roco/Bainbridge 2002, 86).

In the most recent publications of the NBIC initiative (Bainbridge/Roco 2006a, 2006b), highly optimistic authors, some of them organised transhumanists, have been invited to contribute articles. Moreover, on several occasions Bainbridge has conjured up massive future conflicts over CT between optimistic technofuturists and religion and (his words) "other reactionary forces".

The initiative's focus on human enhancement (e.g. Canton 2004) was facilitated by the fact that other institutions were interested in a deliberation on this theme with regard to CT (cf. Coenen 2009): DARPA used the opportunity to promote some of its pertinent, cutting-edge research projects; the foresight think tank of Sandia National Laboratories introduced its ideas on the future role of the NBIC fields in a global security context; and the DoC included transhumanist ideas in its strategy of "hype and hope".

Without ever realising its goal to be transformed into a major R&D funding initiative, the initiative remained a kind of mix of accompanying research and high-level promotion activity. It had already passed its peak of (still moderate) political influence in 2003 and 2004.

Important participating institutions withdrew, such as those from military research, and well-respected scientists and scholars were largely replaced as authors of contributions to the conference reports by pro-HET activists and transhumanist ethicists and social scientists.

However, the institutional constellation and the participation of high-level politicians, scientists, and representatives of government institutions and private corporations created the impression that the "NBIC initiative" is an official US activity, which, in turn, triggered initiatives on CT in Europe (HLEG FTNW 2004; cf. Coenen et al. 2004) and elsewhere (see for an overview: Andler et al. 2008 and TAB 2008).

Well into the second half of the present decade, the discourse on CT was mainly restricted to experts concerned with research and technology policy, to a few NGOs, to some active journalists, and a few concerned ethicists, other scholars, and Christian lay activists. However, recently the topic has as it were matured, in two respects.

Firstly, the EU has now become the primary global actor with regard to activities in research policy that are explicitly related to processes of technoscientific convergence (cf. Andler et al. 2008; TAB 2008). During this expansion, the EU made itself largely independent of the content particularities of the American NBIC initiative, especially with regard to the emphasis on human enhancement. In the EU's Seventh Framework Program, the idea of convergence has developed into a key element in the support of nanoscience and nanotechnology and gained in significance in other areas, especially emerging information and communication technologies. At the same time, the EU has apparently become the most active party with regard to funding research on convergence that takes place outside the natural sciences, so-called accompanying research.

Secondly, the topic of CT, and with it some of the more visionary ideas, has become an issue in innovation studies, philosophy, science and technology studies (STS) and other fields, with several special issues and contributions to well-respected journals and a number of conferences, thereby becoming more academic.

However, the prospects of enhancing or augmenting human cognitive and physical capabilities and the significance of the "technoimaginary" (including futurism and science fiction) are still central issues of the debate on CT, mainly due to the original initiative in the US.

The NBIC initiative's program and cultural context reflect processes which can be deemed a convergence of visions from popular culture and various fields of S&T, above all the NBIC fields, including "strong" artificial intelligence (AI), robotics and brain science. Many of these visions are technofuturistic in the sense that they portray a future in which the human condition (and, in particular, human corporeality) and some features of societies are fundamentally transformed by technology.

While technofuturism, and, for that matter, transhumanism are certainly not new phenomena, they have apparently been experiencing a kind of revival since the 1980s, leading to a convergence of visions which reconstituted in a new form and with some new features the ideology of extreme progress of the 1920s and 1930s (see Sect. 2.8.6). The NBIC initiative epitomised and boosted these processes in the political sphere.

The NBIC initiative and the remarkable number of discussions and activities triggered by it can largely be attributed to a convergence of interests on the part of institutions and players in research and technology policy, including the NSF, DoC, DARPA, NASA, and a number of firms and research centres and group. It did, however, also significantly contribute to the new rise of attention for the ideology of extreme progress and, in particular, transhumanism.

In the following, we will briefly present some further evidence that the NBIC initiative cannot be deemed an isolated activity, driven or hijacked by a small number of transhumanists.

### 2.8.4 Industry and Investors

Scoffers may point out that an attractive transhumanist vision of the future may serve as a great marketing tool for companies and research institutions in biotechnology and information and communication technology: In a world where computers are intelligent and have been merged with their users— who live genetically enhanced, in perfect health and happily ever after— in such a world the products and services of these industries will be highly cherished. In fact, the activities of companies and influential leaders in these fields let this sarcasm appear plausible.

According to journalistic accounts, as early as the 1990s some influential biotechnologists engaged with the fringe parts of the anti-ageing movement in the U.S. reassured these "life-extensionists", who are closely connected with transhumanist organisations, that the goal of their work and companies was practical immortality, i.e. to keep people alive forever (cf. Alexander 2003).

Today, it appears mainly to be IT millionaires who are funding such research and also the work of advocacy groups that conceive of ageing as a treatable or even curable disease.

While research with the relatively conservative goal of increasing the maximum human lifespan by a couple of decades is funded, for example, by the Ellison Medical Foundation, founded by IT billionaire Larry Ellison (in 2009 ranked #4 in the Forbes global list of billionaires), there are also IT millionaires who sponsor research into and advocacy of the more ambitious goal of overcoming ageing, epitomised by the British researcher Aubrey de Grey. Some funding of this kind of research is anonymous, but German-born U.S. billionaire Peter Thiel (ranked #377 in the Forbes list of the richest Americans), for example, who has made his fortune with Internet services, openly supports and funds de Grey, recently donating 3.5 million U.S. dollars.

While one could argue that the rich and powerful have always tended to support endeavours that would enable them to stay young, healthy or live forever, the degree to which the IT industry has embraced far-reaching transhumanist visions still remains remarkable. To give but a few more examples: Thiel is also engaged with the singularitarians and has been instrumental in starting a series of annual conferences organised by the Singularity Institute for Artificial Intelligence, at which he himself gave a lecture.

Recently, these conferences, which are sponsored inter alia by an investment company owned by Thiel, and by Google, have attracted the attention of several high-ranking IT industry executives, such as Google's director of research, Intel's vice president and chief technology officer, and a member of the small group of IBM's so-called "master inventors". The leading figure of the singularitarians, the inventor and entrepreneur Ray Kurzweil, is advising Microsoft's Bill Gates on future issues and has been hailed by him as the best person at predicting the future. In the summer of 2008, a video featuring his visions and ideas on singularity was prominently shown at Intel's International Developer Forum during the speech by Justin Rattner, Intel's vice president and chief technology officer, who predicted that humans and machines are indeed starting to cross the chasm between them and move closer together, to ultimately reach that point where machine intelligence exceeds human intelligence, i.e. the Singularity.

### 2.8.5 Military and Space Research

Military research and space research in the U.S., the country on which HET discussions are focused, share a long-standing interest in radical notions of an interventionist, or man-machine symbiosis-oriented enhancement of human performance. It suffices here to mention the well-known concept of a cyborg ("cybernetic organism") which was developed in a space research context, and the important contributions by DARPA to the fields of man-machine interaction, and to concepts of a "co-evolution" of humanity and technology (e.g. Engelbart 1962).

There appears to be, however, a significant difference between military and space research in this context: While both are looking for practical solutions, the very notion of outer space evokes big and even eschatological questions. Moreover, the goal of enabling humans to live for a time beyond the Earth, and, even more so, the highly visionary, but nevertheless still latent dream of space colonisation (see Sect. 2.8.1), both provide points of departure for the development of far-reaching technofuturist visions. One could argue that large parts of the ideology of extreme progress and, in particular, of transhumanism adhere to an anthropology which bases its main concepts on speculations of how transformed humans could dwell and spread in outer space.

Military research, on the other hand, is interested in space as a new strategic core area, but will always focus on the rather mundane goal of winning wars on Earth. Moreover, the military in democratic countries tends to be very cautious with becoming ideally associated with issues that might impede its public image. Therefore, the indeed widespread visions of creating an invincible soldier are normally not related to any larger ideological schemes.

Nevertheless, in addition to the involvement of military research institutions in the NBIC initiative (see above), there are some instances of their interest in core elements of the idea of ideology of extreme progress and its prophets.

In December 2008, Kurzweil was a speaker at the 26th U.S. Army Science Conference and presented his ideas, including his visions of coming epochs. According to him, technology will first master the methods of biology, including human intelligence, and lead to a merger of technology and human intelligence.

This would enable, in the next, apparently final epoch, the spread of a vastly expanded, largely non-biological human intelligence through the universe, which in turn would "wake up", by a process of a saturation of its patterns of matter and energy with intellectual processes and knowledge.

Besides such isolated examples of the interest of military research institutions in the broader ideological aspects of human enhancement, one can also mention that, in interviews and public presentations, staff members of DARPA have emphasised the notion of a directed evolution, based on science and technology, which is a core element of the ideology of extreme progress, but extends, e.g. under the labels "self-directed" or "participant" evolution, to larger parts of technoscientific discourse (Mauron 2005). One former DARPA programme director, an experimental psychologist now at the U.S. Naval Research Office, put it this way in a presentation on its programme on "augmented cognition":

"We are entering an era of unprecedented human advancement in which Darwinian principles of evolution may begin to show signs of artificial self-acceleration. Cutting edge, state-of-the-art scientific domains such as genetics, biomedical informatics, and cognitive psychology could, in fact, reduce today's accepted timeline of phylogeny from a few million years to a single human lifetime. Granted, this requires revolutionary scientific leaps, but we should no longer consider ourselves in a position to discount these possibilities as mere science fiction. (…) Augmenting cognitive functions such as perception, comprehension, insight, and memory overtly transcend the traditional boundaries of the slowly evolving human mind and body" (Schmorrow 2002, n.p.).

Furthermore, ideas developed in projects funded by DARPA in the 1960s have not only been instrumental to the rise of the Internet and computer technology in general, but still influence far-ranging visions of a co-evolution of humans and technology (for the role of such ideas in the activities of the NBIC initiative, see Roco/Montemagno 2004).

More importantly, however, the practical, development-directed visions of DARPA and other military research institutions, as well as their funding of a relatively large number of R&D projects in very diverse fields from the perspective of non-therapeutic enhancement (cf. TAB 2008), are among the most important and persuasive reference points for ardent promoters of HET who argue that their visions have already started to materialise.

Space research arguably is one of the R&D fields most prone to highly visionary thinking (for a philosophical and ethicopolitical analysis, see Grunwald 2008, 198ff.). This comes as no surprise given its target of exploration; we already pointed out above (see Sect. 2.8.1) that the visionary edge of U.S. space research and advocacy played an important role in the continuation of the ideology of extreme progress in the technology-sceptic 1970s, thereby preparing the ground for the rise of nanofuturism and for the persistence of highly visionary thinking on artificial intelligence in the 1990s and the present decade. In section 2.2.3, we furthermore referred to the goal of one key player of the NBIC initiative, and of some important forerunners of today's transhumanism, namely to create a new religion designed expressly for extraterrestrial expansion of humanity transformed by technoscientific means.

It thus suffices here to mention just one recent instance of the affinity of space research for far-reaching ideological elements of the spectrum of promoters of HET: at the NASA website, on 3 February 2009, the NASA Ames Research Center announced an Enhanced Use Lease Agreement with Singularity University (SU) to house a new academic programme at Ames' NASA Research Park. The SU, co-founded by Kurzweil, is dedicated to studying the implications of the expected Singularity (see Sect. 2.8.1). The NASA Ames Research Center defined the goal of the agreement as follows: "(t) echnology experts and entrepreneurs with a passion for solving humanity's grand challenges, will soon have a new place to exchange ideas and facilitate the use of rapidly developing technologies." The university will open its doors in June 2009 and begin offering a nine-week graduate studies programme, as well as three-day chief executive officer-level and ten-day management-level programmes for a small number of potential future leaders. The curriculum will provide broad, interdisciplinary exposure to ten fields of study, including "neuroscience and human enhancement", and to a wide range of other fields that are relevant from the perspective of human enhancement.

While a clarification statement was published on the same web page shortly after the announcement, explaining that NASA Ames "would like to eliminate confusion that might have arisen concerning NASA personnel as 'Founders' of Singularity University" and emphasising that NASA employees are not engaged in the University's operation, this is another example of how even some of the most speculative ideological aspects of the debate on human enhancement have become respectable in research policy and related contexts.

### 2.8.6 The Ideology of Extreme Progress

One crux of the ethicopolitical debate on human enhancement is the fact that its mainstream proponents tends to treat the visions of second-stage enhancements as entirely new ideas resulting from recent advances in science and technology (cf. Coenen 2006, 2007, 2008b): It is only the transhumanist organisations, in their search for historical forerunners of their movement and ideas, some conservative critics with their interest in the criticism of human enhancement expressed by Aldous Huxley and C.S. Lewis, and a limited number of the humanists and social scientists active in the debate who take into account that the new perspective of human enhancement and the ongoing debate do indeed have a history and a pre-history.

On the other hand, there is a body of academic and journalistic literature on these historical aspects of the topic of human enhancement (and, in particular, eugenics) which may help to put the debate on more solid ground.

Basically, there are three reasons why one should be aware of the antecedents of the ongoing debate:

- Firstly, many of our discussions of ethical, political, and societal implications of HET today apparently merely repeat debates of the 1920s and 1930s, if only because the extreme positions in the ongoing debate (transhumanist and conservative) are often directly related to ideas of authors who wrote about human enhancement in these decades.
- Secondly, many of the technological visions which are at the focus of the ongoing debate on human enhancement were already developed about 80 or 90 years ago.
- Thirdly, a close analysis of the history of visions relating to second-stage HET reveals that these visions are a core element of a worldview which is often elusive, but nevertheless constitutes a major, future-oriented line of thought on the interrelationships of science, technology, and society in Europe.

This ideology of extreme progress not only informs the thinking of transhumanist organisations and its close allies, but also appears to permeate the technovisionary thinking and inform the political stances towards science and technology of those wider networks that were outlined above.

But why should these historical aspects be relevant for European policy makers? We have identified two main reasons:

- Firstly, such a historical perspective provides us with evidence for the important role of visionary thinking in the development of science and technology, and therefore demonstrates that the handling of visions is by no means a merely academic or marketing-related activity.

- Secondly, by pointing out the specific role played by the ideology of extreme progress, it puts into perspective the polemical or sensationalist claims that posit a gap between the natural and engineering sciences on the one hand and traditional culture, religion, humanities, and some social sciences on the other. By identifying and analysing the impact of this particular ideology on the discourse on human enhancement, one can more precisely understand the challenges this discourse holds for European cultural values and value systems.

The context of this study limits us to a superficial discussion of this topic here. However, a brief outline may serve our purpose to point out the relevance of these historical aspects (for the following, cf. e.g Andler et al. 2008; Coenen 2007; Euchner 2005; Hughes 2008a, Slusser 2009).

With regard to the last sentence of the declaration that was mentioned at the beginning of section 2.8., namely that transhumanists "foresee the feasibility of redesigning the human condition, including such parameters as the inevitability of aging, limitations on human and artificial intellects, unchosen psychology, suffering, and our confinement to the planet earth" (WTA 2002), we would like to point out that all these visions had already been developed, even in great technical detail, more than eighty years ago.

Starting in the 1870s with the author and Africa explorer Winwood Reade, who had fairly close contact with Charles Darwin, a number of mainly British but also some Russian or Soviet authors developed a world view of extreme progress aimed at the progressive overcoming of all the limits mentioned in the transhumanist declaration.

While Reade's vision of a colonisation of outer space by virtuous men, endowed with new, technoscientifically produced bodies, lacked scientific imagination, a number of science-savvy authors such as H.G. Wells and leading scientists such as J.B.S. (John Burdon Sanderson) Haldane (e.g. 1995), Julian Huxley and, in particular, J.D. (John Desmond) Bernal (e.g. 1970) developed in the first third of the twentieth century many of those visions of second-stage and highly visionary human enhancement technologies which still shape the current debates. Worthy of mention here are (i) neuroelectric visions of cyborgs, which at the time obviously had to be imagined without reference to computer technology, (ii) ectogenesis, (iii) perfect control of emotions, (iv) significant life-extension, (v) immortality of individual minds in a man-machine-symbiotic superstructure resembling an organism, (vi) the conquest of outer space, and (vii) saturation of the universe with earth-based intelligence.

Arguably, all the major concepts and core elements of the current transhumanist movement's ideology, with the exception of some far-reaching visions of artificial intelligence, computer technology and, possibly, nanotechnology, can thus be found in works of these authors; even the notion of transhumanism was coined by one of them, namely by Julian Huxley in the 1950s. Science fiction and the visionary discourse on space research are among the most important vehicles that have helped to maintain this ideology of extreme progress in the decades after World War Two. Transhumanists and some of their conservative critics have themselves referred to these antecedents, though mostly in a cursory and strongly biased manner.

This is not the place for a detailed discussion of this ideology of extreme progress. However, we would like to point out three of its main aspects:

- Firstly, due to its extraterrestrial orientation, this visionary world view conceives human beings only as forerunners of future posthumans which, to be able to live in outer space, must necessarily be "mechanical" men (Bernal 1970).
- Secondly, the ideology of extreme progress, now firmly anchored in the popular genre of science fiction, triggered strong anti-utopian and religious reactions as long ago as the first half of the twentieth century. These reactions, such as the novel *Brave New World*, still shape the positions and imaginations of current critics of HET.
- Thirdly, from such a historical point of view it becomes obvious that this ideology must be seen as a technological, and indeed often technocratic eschatology. What might be interpreted as a techno-imaginary and to some degree specifically British reaction to the crises in the first third of the twentieth century, related to the Darwinian challenge to traditional world views, has thus become an important element of our (Western) discourse on science, technology and the future.

These historical perspectives are essential if one is to understand the features of the new discourse on second-stage enhancements, as they reveal that the current social and political shaping of new and emerging technologies often relies on visions that were developed in a highly specific historical context and might not be appropriate for our times.

## 2.9 Enhancement, Progress, and European Cultural Values

In the current debates on the technologies which are addressed in the present study, new light is shed on the interrelations of individual desires and competitive needs for enhancement of performance, of social and technoscientific progress, and of various European cultural values, such as solidarity and individual freedom (cf. Brom/Schuijff 2009). Moreover, new, cutting-edge, visionary, and even merely fantastic technologies are at the core of a discourse in which age-old themes, dreams and fears abound.

It is not accidental that the transhumanist movement has raised such an amount of attention in this context, and the potential attractiveness of their ideas should not be neglected. On the other hand, it is a particular ideology and should be treated as one. If it is equated with important traditions of European thought such as humanism or Enlightenment thought, and seen as today's representative of the strong belief in science, technology, and progress, then Europe runs the risk of a polarisation, or of severe conflicts about science, technology, and the future of our societies.

This may even amount to a "culture war" similar to those in the U.S. on Darwinism and some reproductive technologies. Moreover, ardent promoters of HET tend to downplay the relevance of the eugenicist legacy for the debate on human enhancement by pointing out real and pretended differences between eugenics and their approach and by emphasising the fact that the historical eugenics movement can in no way be reduced to the ideology and crimes of Nazi Germany. Referring to left-wing and other progressive eugenicists of the past, such as Julian Huxley, they try to dissociate eugenics from Nazism and they often distance themselves of the technocratic visions of species improvement. In line with our individualistic *zeitgeist*, they often promote the notion of "liberal eugenics" (Agar 2005).

On the other hand, transhumanist and other adherents to an ideology of extreme progress, as well as some of their critics, present this ideology as the logical outcome or even the culmination of the strivings of social utopians, classical humanists, Enlightenment thinkers, and the progressives of technoscientific modernity. They portray what is a rather radical, technoscience-driven transition from a concept of the perfectibility of society to one of a perfectibility of life (Knorr Cetina 2007) as a smooth transition being led by a transhumanist avant-garde.

Moreover, the transhumanist ideology with its peculiar notions of progress and a betterment of humanity is, in deviation of the mainstream of social utopianism (Saage 2007, 2009, cf. Coenen 2006, 2007) and of modern progressivism, imbued with the above-mentioned eschatological and quasi-messianic hopes.

As described in the preceding sections, neither transhumanism in general nor the specific ideas on human enhancement are new or original, not even with regard to most of the technological visions.

What we have to deal here with is a well-established, albeit (in post-utopian times) often overlooked main strand of Western (and Russian for that matter) history of ideas whose visions of the future have only been changed by being technologically modernised and partly adapted to a more individualistic and anti-totalitarian *zeitgeist*.

If human enhancement is actually going to become a topical and persistent issue in Europe, and we think it very well may be, it would now be advisable for the EU to promote efforts to add self-reflexive and historical aspects, based on European history and taking European cultural and ethical diversity into account, to a discourse that is largely shaped by U.S. cultural traditions (or perhaps Anglo-Saxon traditions at large).

The debate on human enhancement could turn out to be, more than anything else, a debate about our social and political futures in which science and technology play a central role, but are at least not the only core issues.

Apparently, a lot of the fantasies, anxieties, and desires that shape bottom-up tendencies towards an enhancement society are in turn influenced by the above-mentioned campaigns, politics, and ideas of the promoters of the ideology of extreme progress (cf. Coenen 2008b; Grunwald 2008), and all the roots of this ideology are post-Darwinian collectivistic and scientistic worldviews, if not authoritarian or totalitarian: these roots are a politically often rather conservative quasi-religion of progress in the nineteenth century, a more or less liberal vision of rational technocratic rule in the first half of the twentieth century, and a communist or socialist scientism between the 1920s and the 1960s, which added to this tradition a strong focus on applied science as well as the detailed visions of HET which have only partly been modified since then.

The legacy of this ensemble of traditions is, however, not only felt in the spread of these technological visions, which have been disseminated and refined by science fiction and futurology, but also in the following developments:

- The above-mentioned technocratic or even quasi-totalitarian visions of the NBIC initiative and some transhumanists are explicitly or evidently informed by these traditions of the early and mid twentieth century.

- The religion of science and the ideology of technoscientific progress have only been modernised by twenty-first century transhumanists and their allies, but not changed in their core.
- The new ideologues of extreme progress are, in fact, individualistically arguing utilitarian philosophers and their adherence to the collectivistic utilitarianism or Marxism of their forerunners is, if present at all, limited to a rather vague notion of social democracy or to watered-down versions of social progress, but they are not liberals in the sense that their highest value is individual freedom.

This last point requires some short explanation.

No doubt, the overwhelming majority of transhumanists and their allies are liberals when it comes to conservative cultural traditions, such as the Catholic one, to the freedom of scientific research, to drug use, or to "morphological freedom". Many of them, albeit apparently not the majority, are ardent liberals with regard to economics.

Their societal visions are nonetheless very often illiberal: openly in the technocratic visions of key players of the NBIC initiative and some transhumanists, and at least implicitly in the goal of a "perfectionist enhancement", which can run counter to the liberal respect for autonomy and the associated commitment to protecting individuals from other people's conceptions of the good (Dekker 2008).

The apparent contempt of some influential ethicists and geneticists for people they deem utterly inferior to their idealised future (post)human being, is based on a peculiar notion of utilitarianism, combined with a denial of rights for certain individuals. Often these are instruments to promote far-reaching techno-eschatological visions.

In sum, we hold that the "top-down" promotion of HET and the societal tendencies which veer toward an enhancement society are taking place in the context of a public renaissance of the ideology of extreme progress. This ideology is now bereft of their radically left-wing elements, which were important in the early to mid twentieth century. The transhumanist movement has become an influential player in the discourse on new technoscientific developments and, in particular, in the debate and activities on HET. The term "transhumanism" is, in fact, sometimes used synonymously with "human enhancement". Attempts to ignore or ridicule the transhumanists as an insignificant techno-cult (which were rather widespread in the 1990s and at the beginning of the present decade) have turned out to be futile endeavours. Although many of the transhumanist visions have a smack of science fiction (of the unrealistic, "space opera" kind), they have managed to gain considerable ground in the ethicopolitical debate on human enhancement as well as rather widespread attention in diverse academic fields and in the media.

It would, however, be highly misleading to pose the transhumanist movement as a stakeholder in the debate on new technologies that is on par or on eye-level with some other stakeholders such as the churches. While it is true that transhumanists and conservative bioethicists have together long dominated the debate on human enhancement from the extremes, the influence of transhumanist ideas far exceeds the movement's social relevance and its political power. The transhumanist movement can be deemed the spearhead, or at least the most vocal and activist element, of a broader social current which is characterised by its promotion of an ideology of extreme progress.

This ideology, albeit often ignored, can be counted among the major European and Western ideologies, with roots going back at least to the early twentieth century. European policy-makers and civil societies should be aware of the existence of this "player" in the debate on science and technology, and assess this ideology in light of European culture and value systems.

Taking into account the dynamic interrelations of society and technology, Staman et al. (2008) have emphasised that it is doubtful whether the two main levels for public and private decision-making, namely the state and the individual, suffice to collectively deal with emerging HET. However, their emergence and foreseeable future development pose questions that "demand such a wider, collective approach" (Staman et al. 2008, 156), and the creation of new forums for societal deliberations on "scientific, medical and cultural norms, identities and practices" (ibid.).

We strongly agree with this, and also with the view that such an approach has to be aware, on the one hand, of the "[t]errifying examples" (Staman et al. 2008, 153) of state-driven collective endeavours to define what is to be human (e.g. the old eugenics programmes), and, on the other hand, of the fact that, "despite apparent individualism and its inherent freedom of choice" (Staman et al. 2008, 155), many people tend to make the same technological and lifestyle choices (e.g. with regard to IVF). Such societal tendencies toward an enhancement society in turn are shaped by important socioeconomic and other factors. In light of these considerations, neither an individualistic ethics nor a state-driven top-down approach will be appropriate when it comes to the social shaping of emerging technologies that have the potential to be used as HET. New venues for public deliberation are needed as well as a broader knowledge basis for a self-critical reflection of our technoscientific civilisation.

In the context of research and technology development, health and other policies, it appears to be one of the crucial questions whether either invasive means of enhancing individual performance are seen to epitomise progress in science and technology, or a broader notion of progress is maintained which aims at social progress, centring on an improvement of infrastructures in the broadest sense which include high-technology solutions for a diversity of individual demands. As Lin and Allhoff (2008) have argued, it is important to keep in mind that the debate on human enhancement is not just a theoretical discussion about ethics, but it has bearing on the real world with policy decisions that may affect not just the would-be enhanced, but also researchers, manufacturers, social institutions, as well as our ideals of freedom and human dignity – and, we may add, our notions of social progress, justice, and European culture and history.

# 3. THE GOVERNANCE OF HUMAN ENHANCEMENT AND THE EU

In the present chapter, we discuss the governance of human enhancement with regard to the EU. This chapter prepares the ground for our specific proposals and ideas concerning policy options for EU policy-makers (see Chapter 4).

The sketch of the European debate about human enhancement given in section 3.1 focuses on rather high-level EU statements and on EU-funded activities and research projects. We present in more detail the discussions and activities on nanotechnology and converging technologies (see Sect. 3.1.1), and the pertinent Opinions of the European Group on Ethics in Science and New Technologies (EGE; see Sect. 3.1.2).

In our overview of selected European projects (see Sect. 3.2) that conduct scientific research on or develop HET, we concentrate on projects that were funded within the Framework Programmes (FP) for Research and Technological Development.

We found that both the European discussions on human enhancement and the EU-funded activities display a remarkable degree of diversity as regards topics and normative stances. The debates and activities are, however, often disconnected or only loosely interconnected and could, moreover, profit from an integration of a wider range of stakeholders and academic disciplines. In the first expert meeting carried out for this study, we discussed this situation against the background of the diverse challenges to the social, (dis)ability, medical, and ethical frameworks raised by a perspective of human enhancement and by the developments in the field of HET. The results of the expert meeting are the main basis for our discussion of the HET-related challenges to existing European normative frameworks (see Sect. 3.3).

Specific legal and regulatory aspects of human enhancement are separately discussed in section 3.4. Given that the discussion of such issues is only in its infancy, we resort to analyses and examples from different sources, including some non-European ones. The aim of this section is to point out some of the most relevant legal aspects and to identify a number of possible starting points for a regulation of HET in Europe.

In the last part of this chapter (see Sect. 3.5), we discuss, in preparation of our proposals concerning the strategic orientations and policy options (see Chapter 4), some possible first steps toward a governance of human enhancement. This discussion is based on the results of the second expert meeting which was carried out for this study.

## 3.1 The European Debate on Human Enhancement

We will focus in the following section on statements about and analyses of human enhancement undertaken by institutions of the EU or their advisors, or within the framework of EU-funded research projects.

However, these activities should be seen against the background of a growing interest in certain HET and the issue of human enhancement in various Member States, which most often focuses on ethical and societal aspects.

The following are but a few examples (cf. e.g. HoC S&T Committee 2007; Gerlinger et al. 2008; Nationaler Ethikrat 2005): some national ethics committees have prominently tackled the issue, while a number of national political institutions (including governmental departments and agencies, as well as parliamentary committees) have funded research on or discussed the ethical, legal and societal implications of human enhancement, for example with regard to doping in sports, pharmacological cognitive enhancers, and the health sector in general. At least in one Member State (Germany) and, for that matter, in Switzerland, the non-therapeutic use of pharmacological cognitive enhancers has aroused significant attention in the media, occasionally even making it to the headlines of national newspapers. Parliamentary committees in Germany and the UK have funded or conducted research on and prominently discussed new and visionary HET in sports (such as gene doping) which occasionally, in the case of Germany, have also generated considerable interest in the national media. Examples of how European civil society deals with the topic and, in particular, of the positions held by churches have been presented above.

The following exposition of activities and discussions related to EU research policy should be seen against this backdrop, which may be interpreted as the emergence of a European political and societal discourse on the topic of human enhancement.

### 3.1.1 Nanotechnology, Converging Technologies and Human Enhancement

The EU reacted to the new debate on human enhancement (which focuses on second-stage and non-genetic enhancements) largely in the course of activities on nanotechnology and the closely related discourse on "converging technologies". As mentioned above, political discussions and activities on nanotechnology and nanoconvergence often centre on the topic of human enhancement (see Sect. 2.8.3; cf. e.g. Ach/Lüttenberg 2008, Coenen 2009).

While it is far from clear to what extent the nanosciences and nanotechnologies as enabling technosciences may contribute to human enhancement, it is obvious that "nanotechnology" as such has been the major, and still is an important, *chiffre* for the discourse on human enhancement (with contributions on neuroethics catching up recently). Reasons for this might be (a) the broad interdisciplinary character of the field, (b) its relevance with regard to materials, (c) the strong visionary roots and shaping of the political discourse on nanotechnology, and, finally, (d) the advent of the debate on converging technologies within the discourse on nanotechnology.

Apparently, most of the relevant EU activities which have explicitly dealt with the topic of human enhancement have taken place in the context of activities on the ethical and societal aspects of nanosciences and –technologies (cf. TAB 2008).

The EU High-Level Expert Group "Foresighting the New Technology Wave" on Converging Technologies (CT) was established explicitly as a reaction to the challenging ideas and visions of the NBIC initiative in the U.S. (see Sect. 2.8.3). The group published its final report in 2004 and criticised (EU HLEG FNTW 2004) that some proponents of CT (obviously including the NBIC initiative and some of its transhumanist allies) advocate and pursue an "engineering of the mind" by physically altering or enhancing the human brain as well as an "engineering of the body".

In contrast, the group argued that CT should be dedicated to an "engineering for the mind" (improvements of the cognitive environment) and "for the body". However, in the view of the group, either way, humans may end up surrendering more and more of their freedom and responsibility to a mechanical world that acts for them. Some visions of CT would imagine cognitive enhancements while underestimating the complexity of cognitive processes. CT research should therefore include a study of current limits, also to avoid bad public investments.

In the view of the group, the prospects of CT for human enhancement appear to be the most sensitive to public debate. Alternatively, the distinction between therapeutic prosthetics and the business of human enhancement could be maintained, sticking to the emphasis on non-tradable goods in the Lisbon Agenda. The group argued that one has to ask how neutral or socially coercive the decision of an individual is to gain an advantage for themselves or their children through artificial enhancement. Inversely, when entire environments are engineered to structure human action, would individuals still have a legally and socially protected choice to opt out?

Particularly troubling and internationally destabilising are, in the view of the group, technologies for the enhancements of soldiers' bodies, for the remote manipulation of soldiers' minds, and other military applications. In the future, business could market consumer spin-offs of military developments and thus prepare the ground for enhancement technologies and other controversial applications. Some prosthetic and therapeutic aids may be developed with intended spin-off applications for military, entertainment and general enhancements.

As part of the background of the group's activities as well as of several EU-funded ethical and social-scientific research projects (such as CONTECS and ENHANCE; see Sect. 3.1.3) which followed after the publication of the group's final report, one has to take the fact into account that human enhancement has attracted considerable and continuous attention by the staff of the Directorate-General for Research (DG Research), responsible for the funding of research and activities on the ethics and future prospects of new technologies or for nanosciences and nanotechnologies (for an overview and the following, see TAB 2008).

On the one hand, several staff members who are or were responsible for funding ethical and foresight research emphasised that the approach of the NBIC initiative in the U.S., with its interest in second-stage HET and their use for military and other non-medical purposes, is not suitable for the EU.

On the other hand, there is a fear, in particular among the units of DG Research that organise the funding of R&D, that the mental association of nanotechnology and other fields of R&D with HET could lead to public mistrust in these fields.

This fear or unease became evident, to give but one example, at the European Forum on Nanosciences, held in Brussels in October, 2006, and co-organised by COST (European Cooperation in the field of Scientific and Technical Research), the European Commission, the European Parliament / Scientific Technology Options Assessment (EP/STOA), the European Science Foundation (ESF), and the ERA-NET Consortium on Nanoscience in the European Research Area (NanoSci-ERA).

During the discussions about the question of how converging nanosciences and nanotechnologies might transform society, the perspective of human enhancement and its pitfalls were mentioned several times, and it was repeatedly argued that Europe needs an alternative societal vision of the future prospects of nanosciences and CT.

In line with the U.S. and international ethicopolitical discourse, nanotechnology and CT have thus become the focus of debate on human enhancement in the EU, too. This was also reflected in official EU statements:

- As early as in 2006, the European Parliament (EP) emphasised the need to respect high ethical principles and welcomed the planned reviews of issues such as non-therapeutic human enhancement and links between nanosciences and nanotechnologies and individual privacy (European Parliament 2006). The EP expected the reviews to be public and to include a thorough analysis of nanomedicine.
- In 2008, following a public consultation which even included the proposal to ban a wide range of HET, the European Commission proposed a code of conduct for responsible nanosciences and nanotechnologies research, in which it is stated under the title "Prohibition, restrictions or limitations" that "nanosciences and nanotechnologies research organisations should not undertake research aiming for non-therapeutic enhancement of human beings leading to addiction or solely for the illicit enhancement of the performance of the human body" (European Commission 2008, 9).

Several ongoing or recently completed EU-funded projects on nanotechnology or CT have included research on ethical and societal aspects of human enhancement in their work. Much of this research was informed and inspired by the work of the above-mentioned high-level expert group on converging technologies (EU HLEG 2004). Most of the activities stick, for example, to the group's critical stance towards an "engineering of the mind" and towards the posthumanist and other technofuturist overtones of the NBIC initiative in the United States.

One can mention here, for example, the FP6 projects (i) CONTECS which included analyses of ethical aspects of human enhancement and the ideological framing of the debate on human enhancement, (ii) DEEPEN which also looked at the possible use of emerging nanotechnologies to enhance human bodily and cognitive capacities, (iii) KNOWLEDGE NBIC which analyses converging technologies, including HET and the discourse on them, with a view on broader tendencies in science and society, (iv) NANOBIORAISE in which also philosophical and other core questions with regard to human enhancement were discussed, (v) NANOLOGUE which aimed at fostering the societal dialogue about nanotechnology and, for this purpose, also analysed key documents of the debate on CT and human enhancement, (vi) ETHICSCHOOL which organised two summer schools in 2008 on the ethics of nanotechnology and CT and also produced an e-learning module on these issues, and (vii) NANO2LIFE, a European Network of Excellence on nanobiotechnology, which looked at CT with a special view to its ethical aspects and to the topic of neurodegenerative diseases, and which also joined forces with the project NANOBIORAISE to discuss topics such as second-stage HET.

Moreover, the issue of human enhancement, including its more visionary aspects, also played a role in a STOA project on converging technologies (STOA 2006), and will most probably also be a topic in FP7 projects such as "The Nanomed Round Table".

It is obviously beyond the scope of the present overview to summarise the results of all these projects. We will, however, in the following point out some interesting findings and approaches to the topic with regard to three of these projects.

In its analysis of the visions and the state of the art in converging technologies, the CONTECS project (cf. Andler et al. 2008) came to the conclusion that visions and the state of the art in R&D are considerably distant from each other and that the gap is especially wide with regard to human enhancement and HET in the fields of neuroenhancement, physical enhancement, and biomedicine. However, according to the authors, one reason for this finding might be that in these fields there are more disciplines, methods and approaches to be combined than in other fields and therefore a greater need for and more challenges to interdisciplinary R&D. The final report of the CONTECS project also analysed how the topic of human enhancement and certain non-therapeutic HET were promoted by the NBIC initiative and other actors in the U.S. and how this relates to transhumanism, including its above-mentioned historical forerunners (see Sect. 2.8.6). The authors hold that the debate about human enhancement raises several important matters. These include: (i) issues around what it means to be human, human dignity, human nature, deference for nature and human diversity, (ii) challenges to established concepts of personhood and personal identity, (iii) the questions of (self-) determination and free will, and (iv) issues such as work ethics, aspiration, effort, and authenticity. The authors argue that more attention should be paid to issues that are largely neglected in the debates so far, such as (i) more realistic or ethically urgent uses of HET (e.g. drugs, deep brain stimulation, or future mandatory enhancements for soldiers and other groups) and (ii) artistic, lifestyle and identity-political forms or visions of enhancement and modification (e.g. in architecture, media art, science fiction, and queer politics).

If certain second-stage HET would really become available, policy makers would have to think about quality criteria for devices and implants, and devise approval procedures for the use in therapy, rehabilitation or for lifestyle/recreational use. Also, as a result of access to such technologies, new divides within and between societies may emerge. This can be anticipated in advance and accordingly, international agreements could be made.

In the project KNOWLEDGE NBIC, the topic of human enhancement is also discussed not only pertaining to certain technologies and the differences between the U.S. and EU initiatives on converging technologies, but as relevant from a broader historical and societal perspective. In the first output of the project (cf. www.contecs.org), Steve Fuller (2008) argues that the CT agenda, in Europe as well as in the U.S, takes up a new notion of regarding human beings as means for the production of benefits (i.e. human capital for a nation's economy or society). The author holds that, financial matters aside, the main obstacles to making advances in CT may be more ethical than technical, because potential HET will probably develop faster than public willingness to test and use them. The extreme prospects of genetic and neural re-engineering – both in terms of risks and benefits – would indeed revisit the classic questions of social engineering.

However, in the view of the author, a nostalgic appeal to an evolutionary naturalism simply obscures what is, in effect, a straightforward political decision about the care with which we protect future generations. In this context, the history of eugenics is relevant to the project of human enhancement because it establishes the point of view from which one is to regard human beings: namely, not as ends in themselves but as means for the production of benefits, be it to the economy or to society more diffusely understood. The view that the individual has to perceive its body as a site of experimentation opens up several contested prospects: It would come along with radical changes in the sense of self, as well as our relationship to others, in what amounts to a scientific license for risk-seeking behaviour of the most fundamental order. Transhumanism's normative horizons veer towards the indefinite promotion of various abilities, regardless of the species identity of their possessors, rendering normally abled people "always already disabled" (cf. Wolbring 2005, 2008b). This is complemented by arguments for a "duty to enhance" and a mandatory participation in scientific experiments. Such a worldview justifies a kind of human self-sacrifice for the sake of some other being that more fully realises what we most value in ourselves, a notion of posthumanism which the author relates to a "high-tech political theology" and technological gnosis. The report concludes by discussing some ideas concerning policy options: The author holds that a realistic starting point for policy is not a generalised scepticism towards the promised HET associated with CT but an expectation that many will come to pass, albeit perhaps in diminished form. In any case, a minimal state or inter-state response would be to ensure that current socio-economic inequalities are not exacerbated (cf. e.g. Garcia/Sandler 2008) by the introduction of HET in a market environment. However, a more proactive policy would be preferred, especially one prepared to quickly incorporate HET into established social welfare systems, while monitoring the consequences of mass adoption and restricting access outside those recognised systems.

Moreover, state or inter-state response would ensure that already existing inequalities are not exacerbated by the introduction of enhancement technologies. The report emphasises that policy making in CT has to consider on the one hand the question of how we conceptualise the human being and human life at all, and on the other the element of risk that may accompany enhancement politics and for which states should provide welfare safety or insurance.

Among the results of the project DEEPEN, at least two papers are worth mentioning in our context.

Baumberg et al. (2007) argue that mood enhancement may become very powerful in a world where nanotechnology is pervasive. For example, minute sensors might be embedded within our bodies (including our brains) and discreetly observe us in our environment. Their output might processed by incredibly powerful nanotechnology-enabled computers, which might be able to administer far more powerful drugs (or electrical stimuli) far more effectively, so that we could, for example, be in a perpetually good mood. The authors doubt, however, whether it is necessarily desirable for us to be in a perpetually positive mood, and they raise the question whether creativity might be negatively affected by such technologies.

In another paper that stems from the work on the DEEPEN project, Ferrari (2007) argues with regard to the discussions about CT that the debate on the amelioration of human capabilities quickly turned into a discussion of its implications for the philosophical concept of human nature and of the legitimacy of modifying it. For her, the idea that technological progress is inevitability orientated toward the enhancement of human performance in the logic of the NBIC initiative's approach plays a central role in the ethical debate on CT.

Ferrari points out that the discussion of possible technological modifications of the capabilities of (certain) human individuals and of society has very quickly become characterised by a polarisation of positions between, on the one hand, transhumanists and other radical promoters of the creation of biologically and technologically superior human beings, and, on the other hand, those who stress that nature and character are morally valuable categories and rely on concepts such as finitude and humility, i.e. the inviolability of human nature. In Ferrari's view, the orientation of NBIC convergence towards the amelioration of human capabilities celebrates the triumph of technological control of every dimension: the individual, the societal, and the natural. She holds that arguments such as the loss of authenticity and of humility do not seem to have really grasped the challenges posed by the new technologies. Much of the current debate on enhancing human nature tends to be reduced to a discussion of the possible risks (harms and abuses) of new technologies, offering nothing but a sophisticated form of risk assessment, and losing the critical appraisal that represents the crux of ethical analysis. The author argues that the questions surrounding CT would gain much substance if they were framed in a more concrete manner, for example, based on a scrutiny of the socioeconomic effects and the environmental impact of these new technologies, and focused on how power is distributed and which model of technological progress is supported.

### 3.1.2 The European Group on Ethics in Science and New Technologies

The European Group on Ethics in Science and New Technologies (EGE) has also studied the issue of human enhancement in the context of the discourse on nanosciences and nanotechnologies.

In their Opinion No. 21 on nanomedicine (EGE 2007), the group argued that the border between medical and non-medical applications is not entirely clear, but that it is possible to give examples clearly illustrating both cases. The prospects of more and more human enhancement interventions would raise questions not only for the state but also for the individual. The group asked how we can preserve the plurality of life styles and avoid the transformation of the medical system into a mere service system for whatever desire individuals may have. Moreover, the EGE argued that maintaining the distinction between medical and non-medical uses is important with respect to European research funding policies, because non-medical research funding of nanomedicine may not be advocated as easily as research funding within the medical sphere. The Group proposed that HET should not be given priority. In the view of the group, health care concerns must be met first.

However, in another, earlier Opinion by the EGE, the group discussed the topic of human enhancement in detail, including some of its very visionary aspects. We refer here to Opinion No. 20 on ICT implants (EGE 2005) and the related documents.

In its work on emerging and visionary ICT implants, the group started with a state-of-the-art review of ongoing R&D activities and existing applications in this field. With regard to human enhancement, it discussed the idea of an "enhanced" human being against the concepts of perfectibility (cf. Knorr Cetina 2004) and corporeality, and visionary ideas about new forms of individual "body design" and the danger of a new racism in a posthuman era.

In the view of the group, the "borderline between repairing and enhancing" is not strict, although there are clear examples of both applications. It stated that the idea of letting ICT devices be implanted under our skin to enhance human capabilities and not just to repair deficiencies gives rise to science fiction visions characterised by threats and benefits. The group noted that, in some cases, the implantation of microchips is already taking place, with the potential for individual and social forms of control.

The group identified a number of ICT implants for which special caution would be necessary, such as implants that (a) cannot be removed easily, (b) influence, determine or change psychic functions, (c) could be misused in several ways for all kinds of social surveillance and manipulation, for instance in the case of children or disabled persons, (d) influence the nervous system and particularly the brain and thus affect our human identity as a species as well as individual subjectivity and autonomy, (e) are part of military applications, (f) involve by-passing normal sensory experience, or (g) will influence future generations biologically or culturally.

The EGE made "the general point that non-medical applications of ICT implants are a potential threat to human dignity and democratic society". Therefore, such applications "should respect in all circumstances the principles of informed consent and proportionality and, whenever aiming at surveillance purposes, they should comply with special rules."

The group stressed that certain uses of ICT implants should be banned (e.g. implants used for changing the identity, memory, self-perception and perception of others or for enhancing one's own capabilities in order to dominate others). By referring to habeas corpus and in terms of a constructive critique of informational reductionism, the EGE weighed the self-transformative nature of human beings and their use of technologies against the risks of the human body being perceived as totally controllable and malleable raw material. With regard to informational reductionism (cf. Dupuy 2007), which also treats the human body as data, the EGE argued that such a view oversimplifies the complex relations between the human body, language and imagination. Extrapolating the enhancement tendencies into the future, this logic might even lead to the transformation of the human race. Based on a concept of human corporeality that is apparently informed by European philosophical traditions such as phenomenology, the group stressed that human dignity concerns the human self as an embodied self. In its Opinion the EGE thus wrote: "The downright reduction of our body to a device does not only enhance the trend (…) towards turning it increasingly into a tool to allow continuous surveillance of individuals. Indeed, individuals are dispossessed of their own bodies and thereby of their own autonomy. The body ends up being under others' control. What can a person expect after being dispossessed of his or her own body?"

Referring to the limits imposed on the freedom to use one's own body by provisions under which it is prohibited to turn one's body, its parts or products into sources of profit (Article 3 of the Charter of Fundamental Rights; Article 21 of the Convention on Human Rights and Biomedicine; Article 4 of UNESCO's Universal Declaration), the EGE, for example, raised the question whether an extensive construction of the principles of non-commodification and non-instrumentalisation might lead one to conclude that implanting ICT for purposes that are, broadly speaking, for personal profit or advantage (e.g. to get into a disco under preferential conditions) should not be permitted.

The EGE, even if compared to the U.S. President's Council on Bioethics (PCB; see Sect. 2.1.1 and 2.3.2), contributed to the widening of philosophical perspectives on human enhancement. Moreover, it analysed a field that only played a marginal role in the work of the PCB, which centred its study on the biotechnologies and biosciences, including the use of "neuro-ceuticals" and longevity research.

It is notable that the EGE made rather surprisingly specific recommendations concerning a still highly visionary field of R&D. Consequently, the objective of its Opinion was primarily to raise awareness and questions concerning the ethical dilemmas created by a range of ICT implants in this rapidly expanding field. In the view of the EGE, ethical awareness and analysis must take place now in order to ensure they have an appropriate and timely impact on the various technological applications. Nevertheless, where the group deemed it necessary, the Opinion also proposed clear ethical boundaries, legal principles and several concrete steps that should be taken by responsible regulators in Europe.

The EGE opined that efforts should be made to ensure that ICT implants are not used to create a two class society or to increase the gap between the industrialised countries and the rest of the world. Access to ICT implants for enhancement should be used only:

- To bring children or adults into the "normal" range for the population, if they so wish and give their informed consent, or,
- To improve health prospects (e.g. to enhance the immune system to be resistant to HIV). As for health purposes, access to ICT implants for these purposes should be based on need rather than on economic resources or social position.

The EGE stressed that the following possibilities should be banned:

- ICT implants used as a basis for cyber-racism.
- ICT implants used for changing the identity, memory, self perception and perception of others.
- ICT implants used to enhance capabilities in order to dominate others.
- ICT implants used for coercion towards others who do not use such devices.

In the view of the group, there must be a broad social and political debate as to what kind of applications should be accepted and legally approved, particularly concerning surveillance and enhancement. A precautionary approach is recommended by the EGE. The member states and their national ethics councils (or corresponding institutions) would have a responsibility to create conditions for education and constructive, well-informed debates in this area.

### 3.1.3 Other Relevant EU-Funded Projects

Several ongoing or recently completed EU-funded projects have conducted research on ethical aspects of human enhancement or have included this aspect of new and emerging technologies in their work. One can mention here, for example, the projects ENHANCE, ETHICBOTS, EURON and ECD ("Meeting of Minds. European Citizens' Deliberation on Brain Science").

The ENHANCE project is a recently completed specifically targeted research project within FP6 that examined the ethics of human enhancement in four application areas, namely cognitive enhancement, life extension, mood enhancement and physical performance. Its goal was to explore and analyse ethical questions about "dual-use" technologies which may be applied to make people think better, feel happier, live longer or improve their performance in sports. The project aimed to achieve a deeper understanding of the ethical and philosophical issues surrounding the use of emerging technologies for purposes beyond that of therapy. Intermediate results of ENHANCE emphasised that the future of human enhancement is open and can be socially and politically shaped. In another context, the project coordinator had argued that HET may make an important contribution to our biological, psychological and social life, but their introduction should be guided by policy-making and by a shared understanding of fundamental values like justice, solidarity, human dignity and responsibility (Ter Meulen 2006).

In particular, policy-makers should take care of the access to HET, and look at their impact on the position of handicapped individuals, and the care for the vulnerable groups. An interesting aspect of the project was the fact that the highly multidisciplinary project team included a rather broad spectrum of value stances, including the positions of leading transhumanists who were among the project partners (see, for example, their overview on HET: Bostrom/Sandberg 2006). Some of the project's results will be published in a forthcoming book (Ter Meulen et al. 2009).

The ETHICBOTS project, also recently completed and carried out by a highly multidisciplinary group of researchers, included expertise on artificial intelligence, robotics, anthropology, ethics, philosophy of science, psychology and cognitive science. Its aim was to identify and analyse technoethical issues concerning the integration of human beings and artificial (software/hardware) entities. One of the three forms of such integration is physical, invasive integration, as achieved by bionic research. Among the ethical issues analysed by the group were the preservation of human identity and integrity, the precautionary principle, the issues of economic and social discrimination, responsibilities for (possibly unintended) warfare applications, and the nature and impact of human-machine cognitive and affective bonds on individuals and society. Based on an analysis of the state of the art in robotics, prosthetics and brain-computer interface (BCI) technology and the first-hand experiences of microelectrode arrays implanted into the median nerve fibres of a healthy human individual, acquired by one project partner (Kevin Warwick, see Sect. 1.2.1), the group also analysed the ethical relevance of the distinction between augmentation of human capabilities and restoration of lost functions. With regard to the non-therapeutic use of BCI for enhancing human performance, the project however concluded that far-reaching visions are based on presently unwarranted extensions of known scientific and technological possibilities and therefore ethically not topical.

The project had close contact with EURON, the European Robotics Research Network, which continues to exist despite its EU funding having finished. So-called "roboethics" are an integral part of the work of this network, including the aspect of human enhancement or augmentation by invasive brain-machine interfaces. Attention was drawn to a possible scenario in which technology might allow for an enhancement of human performance over and above that of the majority of humans. The researchers discussed the question of whether there are cases in which a technology should be considered unacceptable despite it having potential for compensation as well as enhancement.

In the ECD project, a consortium of technology assessment bodies, science museums, academic institutions and public foundations from nine European countries organised a "Citizen's Deliberation on Brain Science". The citizens also discussed what in their view constitutes an improvement of the brain, assessed both research developments and ethical and sociopolitical aspects of issues at stake in the field of brain science, and delivered a set of recommendations relevant to policy-makers and the wider scientific and research communities. While the citizens concentrated on therapeutic and preventive measures (including non-medical and non-technological ones) as opposed to the use of HET for non-therapeutic or other non-restorative or non-preventive goals, discussions about human enhancement took place with regard to the issue of "Normalcy vs. Diversity".

Throughout these deliberations, and in their recommendations to EU policy-makers, the citizens emphasised that diversity should not be seen as a problem but as a positive aspect. In their view, European society can only move forward if we learn to accept diversity, which they described as a basic prerequisite for democracy. The European Parliament and other institutions should focus on the acceptance of cognitive and physical diversity in the education system and the workplace in order to prevent stigmatisation. The citizens recommended clarifying which variations exist within "normality" and what should be interpreted as a "real" disease in order to avoid unnecessary treatment and a further medicalisation of society.

### 3.1.4 Conclusions

While advisors to the European Commission and pertinent projects of accompanying research have discussed in detail the perspective of human enhancement and related technologies, official political statements on the topic of human enhancement are still rare and appear to indicate a need for conceptual clarification. Moreover, different members of the staff of DG Research frame the issue differently, and there is no consistent use of the prospects or of a single concept of human enhancement in EU policy. Given that there are indications of the emergence of a broader political or even societal discourse on human enhancement in Europe, at least in some Member States and among civil society actors such as churches, EU decision-makers should consider changing this state of affairs.

In general, one can say that the ethicopolitical discourse on human enhancement in Europe is rather diverse and that it includes pro-enhancement positions as well as more or less sceptical ones. Possibly, the conceptual vagueness in the emerging EU policy on human enhancement is caused by this diversity. However, in overall terms, the European debate tends to take a critical stance on radical HET, "engineering of the mind", the transhumanist overtones of the debate and its often highly speculative character.

On the other hand, transhumanist perspectives and actors are part of the EU discourse, and even some EU officials raise the subject of the highly visionary or radical aspects of HET. One example of this is a short article by a member of staff of DG Research on an EU website (Bonazzi 2006), in which he listed a number of EU-funded projects on CT (see Sect. 3.2). One aim of these projects is to develop new devices with which to compensate for disabilities and impairments, but these are also discussed by the author as technologies for a possible "reconstruction of man".

## 3.2 Selected EU-Funded Research and Development Projects

The following overview of selected EU-funded R&D projects which are relevant from a perspective of human enhancement is in no way intended to be exhaustive, but only illustrative with regard to what the EU is funding in relevant technoscientific R&D.

As mentioned above, various position statements on human enhancement have been made by units or members of staff of DG Research as well as by the EGE and other actors. Some of these statements imply that there are already R&D projects on HET funded by the EU.

However, the former head of DG Research's unit "Nano- and converging Sciences and Technologies" has emphasised quite recently on several occasions that the EU is not funding any R&D projects on HET at all (cf. Malsch 2007).

Again, conceptual ambiguities may explain this apparent contradiction, as can the - as it were – "dual use" aspect of certain technologies: Apparently, the former head of the unit uses a notion of human enhancement which is restricted to interventions on the human body with no therapeutic purpose and excludes prosthetics. In other documents or contributions to the debate, however, a broader concept is used which may also include prosthetic and therapeutic technologies or interventions.

Sticking with our own notion of human enhancement, in the following we present selected EU-funded and other projects which can be deemed to be R&D projects in the field of HET.

However, while projects of accompanying research on potential human enhancement technologies can be identified quite easily, it is rather difficult to find projects in which techno-scientific R&D is funded that might be used for human enhancement purposes.

In the above-mentioned short article by a staff member from DG Research and published on an EU website (Bonazzi 2006), various EU-funded projects on CT are characterised as possible contributions to a long-term "reconstruction of man". The author argues that the main outcome of NBIC convergence "could be a spectacular enhancement of the capability to improve human health, nature and quality of life", but "could also help to control emotions, personal behavior and general state of conscience". Accordingly, various new projects on CT that are funded by the European Commission to address several remedies for human health could "affect also the control of sensations, perceptions and state of mind".

In the article, various ongoing or recently completed projects are given as examples and presented under catchy titles:

- "Mind-repairing for better thoughts": The NEURONANO project aims at developing "innovative neuronal nano-engineered biochips to help repair or replace the altered or damaged functions of both spinal cord and brain networks." In the same line, the project SINGLEMOTORFLIN "develops ancillary research on biological and artificial machines and motors." It should "help to design artificial interfaces between the biological and non-biological dynamics of neuronal networks and to treat more specifically the neurodegenerative syndromes."
- "Grasping the future…": The SMARTHAND project "promotes the uptake of converging sciences in the area of rehabilitation." It aims at developing "an intelligent artificial hand looking and feeling like a real human limb, relieving phantom pains and helping both functional and psychological rehabilitation of disabled amputees." The goal is to exploit "the potentials of nanotechnology to interface preserved sensory-motor mechanisms, allowing the design of an intelligent grasping system equipped with an optimal feedback mimicking life-like control."
- "Nanobionic sensations": The project NANOBIOTACT is dedicated to the development of "an articulated artificial finger with embedded nano-sensors to sense and interpret touch by mimicking the neural processes that have evolved in people."

  Its broad range of envisioned applications include "tactile testing of new products, prosthetic limbs with a very vivid sense of touch, robotics with controlled grip and tele-activities, applicable to remote surgery." A major impact is expected "in the quality of life, enabling the design of more effective treatments for ageing and for patients with impaired neurological functions."
- "Lord, let me see!" Therapeutic neuronal electrical stimulation is already applied to treat some neurodegenerative diseases but its use could have an even higher impact for treating blindness. To do that, it is necessary to develop "fully biocompatible and stable devices for retina stimulation." This "adventurous challenge" is taken by project DREAMS, developing "innovative diamond-based nanotransducers to improve the neuroelectronic interface which supports vision." This approach is also "expected to pave the way for the development of hybrid neuronanoelectronic architectures for bio-sensing and biological computing, whose range of applications broadens from drug detection to cancer diagnosis."

The author argues, under the heading "Towards a new man?", that "this new way of seeing, touching, sensing and moving is leading to a new perspective for man to think or re-think himself and his nature". He asks what the ethical boundaries are of reconstructing lost physical or mental functions, "as this could lead to engineering a broader improvement of human capabilities", like the biological processes where both "conscience" and "thinking" root. In his view, the "broadening of the epistemological territory by converging disciplines, focused just where the matter espouses the spirit", might well turn out to be "the ultimate challenge" in techno-scientific convergence.

Besides DG Research, other DGs are also funding projects which can be deemed relevant in a HET context. In FP7, for example, the units on "Future and Emerging Technologies" (FET) of DG Information Society and Media which explicitly focus on rather visionary research directions, are continuing and intensifying funding projects on:

- "Bi-directional interfaces" ("interfaces between electronic or electro-mechanical systems and living entities" at or close "to the cellular level, with adequate control and/or signal processing algorithms", enabling "direct interfacing to the nervous system or to other types of cells")
- "Biohybrid artefacts" ("new artefacts will involve tightly coupled ICT and biological entities", e.g. "neural or other types of biological tissue", for "new forms of computation, sensing, communication or physical actuation or adaptation")

While most of the research funding of FET is on new ICT in the strict sense and on robotics, bio-ICT convergence is an integral element of FET funding activities. In the view of FET (EC ISM DG not dated), the "convergence between the bio-, nano-, info- and cognitive sciences will enable major advances toward realising the Lisbon agenda." While this would "be most clear in the health sector", through the design of new drugs and new diagnostic and therapeutic processes, FET also aims at funding "realistic efforts" to develop implementations of "human augmentation", defined as "the ICT-based enhancement of human capabilities."

In a strategy paper for FP7, FET argued that "out of the confluence between closely interacting networks of increasingly sophisticated devices, the creation of new immersive experiences, the natural interaction with ICT systems and the mingling of living and non-living ICT technologies, a progressive extension of human performances (…) is likely to emerge (…)." In particular, FET-funded projects on processes of convergence between ICT, the life sciences, biotechnology, neurotechnology, cognitive science and "presence research" can be deemed relevant in a HET context, for example:

- CYBERHAND (development of an artificial cybernetic hand; FP5; cf. Sect. 1.2.2)
- PRESENCIA ("research encompassing sensory enhancement, neuroscience and cognition"; FP5)
- MAIA ("brain-computer interfaces to robots"; FP6)
- PRESENCCIA ("research encompassing sensory enhancement, neuroscience, cerebral-computer interfaces and application"; FP6)
- NEUROBOTICS ("fusion of neuroscience and robotics for augmenting human capabilities"; FP6)
- BRAINSTORM ("on-chip simultaneous intracellular recording and stimulation of electrical and biochemical activities from hundreds of neurons"; "efforts are driven by the desire to use neuro-electronic hybrids system for basic research and for achieving direct communication between brains and computers in brain-computer interfaces"; FP7)
- CYBERRAT ("brain-chip interface for high-resolution bi-directional communication"; "innovative interface between a semiconductor chip or an ensemble of semiconductor chips and the brain of a living rat"; the approach "will have a general applicability" to several brain circuits "such as those underlying vision, hearing and attention"; FP7)
- RENACHIP ("rehabilitation of a cerebellar function by a biomimetic silicon chip")

Clearly, most of these projects as well as other EU-funded projects (which, for example, also target neuro-electric interfaces) are geared to therapeutic purposes or prosthetic and assistive technologies. However, occasionally the strategic perspectives underlying the funding schemes are oriented to other, more general and non-therapeutic applications for human enhancement as well.

In general, European approaches to the fields relevant for human enhancement appear to be less focused on individual enhancements than U.S. approaches, and instead aim at finding socially integrated solutions which are largely based on body-external devices.

Accordingly, a comparative study comes to the conclusion that the focus of R&D in the field of brain-computer interfaces (BCI) throughout the world is decidedly uneven, with invasive BCI almost exclusively centred in North America, and non-invasive BCI systems evolving primarily from European and Asian efforts (Berger et al. 2007). However, in the view of the authors, the main reason for the European approach appears to be the strong influence of animal rights advocates protesting against BCI experiments with apes.

The same study points out that, in terms of funding, BCI and brain-controlled robotics programs have been hallmarks of recent European research and technological development, with the range and investment levels of multidisciplinary and multinational programs in Europe appear to far exceed that of most university and government-funded BCI programs in the United States and Canada.

## 3.3 Challenges to Existing Normative Frameworks

We have found that the dominant approach in the EU to the topic of human enhancement seems to be an ethically diverse and reflected method of tackling the issue. However, we have also come to the conclusion that the debates and activities are still often disconnected and could be enriched and promoted by integrating a wider range of stakeholders and academic disciplines. Against this background, the project team discussed the challenges to social, (dis-)ability, medical and ethical frameworks and the related conceptual problems raised by the rise of HET and the new perspective of human enhancement with a number of experts. In the following, we will not try to summarise the discussion and the contributions by the invited experts in all their richness, but focus on some of the most interesting results of this first expert meeting (see section 1.2 of the Appendices) that was carried out in the course of the project, and provide our own interpretation of its results.

Obviously, the central question with regard to the topic of human enhancement is ‘what are and should the targets and goals of enhancements be?’. Broadly speaking, this relates to guiding visions in society and politics, and to ideological factors, anthropological concepts and fundamental values that shape science and technology-related debates and activities and may lead to shifts in the definitions of such notions as health, (dis)ability, impairment, normality, and therapy.

It became clear that, at least with regard to the broader and more visionary aspects of human enhancement, a distinction needs to be made between enhancement of the species, with its eugenicist overtones, and enhancement of individuals.

Leaving aside the question of the feasibility of genetic enhancements of the species, there was consensus among the experts that an enhancement of the species is not suitable as a guiding vision, for historical, pragmatic and metaphysical reasons. Quite rightly in our view, it was pointed out that proponents of human enhancement tend to focus on actual and future means of cognitive enhancement as a royal road for solving a variety of personal and societal problems, culminating in the vision of an "enhancement society".

While the experts concurred neither in their assessments of the state of the art in the pertinent HET nor in their views on the relevance of the NBIC initiative in the U.S., there was broad consensus that such visions might be conducive to a specific political shaping of the ongoing and emerging developments in second-stage HET. An alternative guiding vision for the development of HET, better suited to the European context, could be the simultaneous improvement of individual well-being and social cohesion. This vision was approved by all experts.

Focusing on the example of so-called mood or emotional enhancement, the experts discussed the relations between social and individual factors in human enhancement. One expert argued that human enhancement could be contextualised within a medical framework in which all interventions are conceptualised as measures to help individuals to cope with society. Accordingly, when individuals suffer emotionally, due for example to their general shyness, their discontent with their body, or their nervousness in certain situations (e.g., stage fright), we should not make any artificial distinction between therapy and enhancement, but should approve any effective measure that relieves their suffering and help them cope with society. Other experts disagreed and pointed out that (i) such an approach would further the problematic tendency of a medicalisation of social problems, that (ii) in health policy, as in any policy field, we have to set priorities and that clearly therapeutic interventions should be prioritised, and that (iii), in a framework shaped by a radical perspective of human enhancement, the social "duty" to confirm to a norm would become a duty to fix yourself to the norm by technological means. While there was disagreement among these experts as to whether it would make sense to draw a line between therapy and enhancement, they concurred that such boundaries are shifting and that, for example, the road to an enhancement society could be paved by a further medicalisation of social problems and individual needs. It was pointed out that some radical proponents of human enhancement not only argue that there is a general "duty to enhance" oneself from the perspective of species enhancement, but also characterise certain bodily structures as deficient and reduce "disability" to a problem that can only be solved by interventionist technological fixes. Such a "sad view of the human body", as one expert called it, was characterised as being based on problematic notions of normality. Moreover, it was argued that the human body is reduced to data, in the informational paradigm, and the complex interrelations of bodily and psychological processes are faded out.

Nevertheless, the experts agreed that recent progress in brain research, neurotechnologies and other fields of R&D clearly demonstrates that there is potentially a new quality of interventions into the human mind and body. In this context, reference was made to the Kantian distinction between a physiological anthropology, based on a scientific understanding and manipulation of the brain, and a pragmatic anthropology, based on knowledge about the social sphere, the world, and human behaviour.

We now appear to be on the verge of realising such a physiological anthropology, to the extent that there are at least new means of manipulating brain activities. Accordingly, even extreme visions deserve attention, such as the NBIC initiative's vision of a new social technology based on new neurotechnologies and other converging technologies.

There was broad consensus among the experts that second-stage enhancements, particularly those based on new human-technology interfaces, should be assessed with a view to possible shifts in power relations. It was pointed out that the persistent paradigm of control and domination of nature in Western culture, might negatively affect certain European values when "applied" to "human nature", such as those expressed in the idea of Man created in the image of God or the concepts of human dignity and autonomy. While the "intuitive" rejection of interventions which go "under the skin" might often be apt, the fundamental question appears to be how such HET might create new options for social and even remote control as well as the manipulation of human beings.

With reference to the widespread critique of the highly speculative features of the debate and some political activities on human enhancement, the experts discussed the impacts of visions, far-reaching expectations and grandiose promises on research policy and society. Fields such as stem cell research, cancer and Alzheimer research, nanotechnology and artificial intelligence were characterised as being strongly influenced by strategies of hype and hope. It was pointed out that there appears to be a vicious circle, with policy actors eager for scientific and technological breakthroughs with high societal impacts and scientists making exaggerated promises. In ethical, societal and political discourses, the speculative "if's" (cf. Nordmann 2007) are not innocent, because they may serve to shape S&T in certain directions. The technocratic and scientistic speculations, in particular, appear to be conducive to the fading out of any risks which are not of health-related or environmental nature. Social risks, such as those related to shifts in power relations or the pathologisation of more and more bodily or mental traits are peripheral to the discourse. In the view of several experts, the discussions and publicly funded research projects on HET still focus too often on highly visionary aspects and ignore or belittle ongoing developments in pharmaceutical research, neurotechnologies, and prosthetics. On the other hand, far-ranging visions must be taken into account, because they can shape societal and technological futures.

Several experts emphasised that the discourse on HE is strongly influenced by an uncritical 'faith in science' and that alternative visions of the future and proposals to solve societal problems are largely absent or neglected. When focusing on individual enhancements by technological means, we may fade out low-tech or no-tech measures such as improving school meals or creating information- and knowledge-rich learning environments. There is thus a need for alternative imaginations and societal visions related to S&T and more public participation. In a similar vein, it was argued that an improvement of infrastructures should, in principle, occur prior to the funding of individual HET, so that people with special needs, including the growing population of elderly people, can choose how to realise their 'social functioning'. Again, it was stressed by several experts that the (necessarily vague) distinction between therapy and enhancement should be maintained for pragmatic reasons in a health policy context.

However, it was also pointed out that there are strong tendencies, particularly in "ageing societies", to redefine what is "natural" or "normal" and that as long as there is no consistent modernisation of infrastructures, many people will look for new artefacts or even individual enhancements of their bodies to secure their place in society. Here we have to take into account societal changes which have profoundly altered the social roles and images of people, both young and old.

There was broad consensus among the experts that the notions of health, well-being and disability have to be adjusted accordingly, taking into account conceptualisations which are well-established in some political and social discourses, but still not in the socio-political mainstream. Some experts argued in favour of a distinction between therapeutic and non-therapeutic enhancements. The ambiguity of established concepts becomes evident when we consider a person born without arms, who is however, otherwise healthy and not impaired, and receives new prosthetic arms which may in the future allow him to perform at a superior level to persons with natural arms and may include species-untypical functions.

It was argued that it is necessary to create a society in which the broadest variety of individual needs is taken into account, so that individual enhancements are a matter of real choice and do not gradually become socially mandatory.

There was consensus among the experts with regard to the following points:

- If a perspective or concept of human enhancement is used in a policy context, it is of fundamental importance to identify as precisely as possible the targets and the overarching goals of human enhancement.
- A perspective of human enhancement might be applied to a wide range of new or emerging science and technology fields and their related guiding visions (such as in nanomedicine and regenerative medicine), even if these fields have hitherto been partly ignored in the recent debates on human enhancement on account of their explicitly medical character.
- When it comes to regulatory questions, specific applications (and not technologies) should be targeted, possibly supplemented by the definition of general principles for pertinent research funding and policy, or even by some general bans (for example in the military context).
- Given their potentially disruptive effects on society, it is all the more important that the governance of HET starts early, includes all stakeholders and allows for public participation.
- There is a need for a guiding vision in the further development of research and technologies relevant to human enhancement. Such a guiding vision should be based on a societal perspective which focuses on social cohesion and distributive justice as frameworks of individual choice.
- In research and technology policies, it is important to break the vicious circle of promises and expectations in which excessive visions increasingly shape science-policy interactions, leaving the general public as astonished bystanders.

- Broadly speaking, in a policy context the perspective of human enhancement should be focused on ongoing and emerging developments and not on far-ranging visions. This should also be true for more or less explicitly therapeutic contexts (such as the use of drugs like Ritalin™ and Viagra™, or the development of more and more sophisticated prosthetics). However, some policy problems may already arise today from anticipations that are not yet realistic, such as with transhumanist and other pro-enhancement activists who attempt to gain private or even public funding for highly visionary research.
- If in the future there is a consensus that certain forms of human enhancement (that are generally accepted to be safe and in line with European fundamental values) should be a matter of individual choice, there will be an even more urgent need to adjust all relevant technological and social infrastructures and processes to the broadest variety of individual needs, so that no individual is pressured to opt for HET.
- However, in a policy context, there are also some good reasons to avoid coupling the concept of human enhancement with individual choice altogether (such as the shifting distinction between therapy and enhancement, the proximity to eugenicist ideals, or the strong transhumanist influence in the discourse on human enhancement).

In our view, the discussions during the expert meeting regarding the human enhancement perspective exemplified that, as long as conceptual pitfalls are taken into account and the highly problematic aspects (such as proximity to eugenicist ideologies) are not ignored, new light can be shed on recent developments in S&T and society and their interrelations.

Obviously, the new HET and the related visions aggravate the tension between established views of health, therapy, disability, normality and impairment on the one hand, and more complex or encompassing conceptualisations of the relationships between individual well-being, equitable social structures and technoscientific innovations on the other.

Given that the concept of human enhancement, which is already an established (and actually a fashionable) topic in ethical research, is slowly penetrating policy discourses, there is a need for a politically viable notion of human enhancement. There are good pragmatic reasons to maintain the distinction between therapeutic and non-therapeutic measures in a health policy context; and there are also good reasons for foregoing any strict division between therapy and enhancement. The results of the expert meeting therefore affirmed us in our view that one should generally distinguish here between non-enhancing therapies, therapeutic enhancements, and non-therapeutic enhancements.

Moreover, it became clear that the perspective of human enhancement is also a challenge to a variety of European traditions of thoughts and fundamental values. While the societal discourse on new and emerging technologies should in no way be reduced to the issue of human enhancement, the specific perspective of human enhancement may prompt a re-evaluation of the interrelations of S&T, society and the individual in the European context. If only some of the visions of second-stage HET are realised in the future, there will be a growing need for equitable social structures and, in particular, for sociotechnical infrastructures in which the diversity of individual needs and social demands are taken into account.

## 3.4 Legal and Regulatory Aspects of Human Enhancement

Many HET are developed in a medical context but can be used in ways that go beyond medical practices. As the notion of applications of (medical) S&T in the sense of enhancement is a quite recent phenomenon and as some of the HET are mere visions and only in rare cases already in practice, a discussion of legal questions raised by HET has not yet begun or is only in its infancy.

This does not mean, of course, that the needs or options for juridical regulations have not been discussed in the fields of technology or application that are thought to bear a potential for enhancing or altering human functions or states of mind.

In the field of human genetics, in pharmaceuticals, and in the medical sector in general, legal stipulations are in place to define both good (medical) practice and the rights of doctors and patients which serve to foster ethical principles and to prevent the misuse of biomedical applications. Current regulations, however, do not cover or deal with a central problem connected with HET, i.e. the distinction between the medical use of devices, technologies and procedures on the one hand and, on the other, the "non-medical" use of the same technologies for enhancing bodily functions, the capacities of the human mind, or manipulating mental states be it for life-style, everyday life or professional purposes. As an expert discussion of this has not yet even begun, the present report can only give some indications and ideas of the juridical problems that might arise from HET.

The basic and most obvious practical juridical problem caused by HET is associated with the problem of separating a medical application of a given technology from a non-therapeutic enhancement application and developing a clean distinction between legally allowed (or even obligatory) use and ethically doubtful practice that consequently would be liable to legal regulation or prosecution. As has been argued in the present report, it is difficult to separate illegitimate from legitimate use of enhancement technologies. Neither of the distinctions under discussion – natural vs. unnatural or therapeutic use vs. non-therapeutic – is always sufficiently selective.

An indication of the problem in clearly distinguishing harmful or ethically questionable "illegal" uses from beneficial and ethically acceptable "legal" uses of HET is the current practice of prosecution of doping in sports. The problem is not only to keep pace with the development of ever new drugs or other methods for enhancing bodily performance and to prove in every individual case that misuse is present. The problem is also to justify the ban on certain substances and practices while allowing others. As Greely (2004) has shown, it can easily be argued that the current practice of prosecuting doping lacks logic consistency and juridical justification. In sports all kinds of practices to increase physical performance (fortitude, endurance, readiness and speediness) are allowed, despite the fact that many of them involve health risks, e.g. physical conditioning, special nutrition and nutritional supplements, surgery to avoid injuries.

Other practices, however, are marked as being unfair and distorting competition, and thus are banned legally and prosecuted (with how much serious effort ever). The most prominent doping substance nowadays – according to Greely –- is a case in point for the poor legitimisation of legal practice in doping control: EPO as a means to increase the share of oxygen in human blood (and thus enhancing the performance of e.g. racing cyclists or track and field athletes) is officially banned.

However, practices that have the same effect (i.e. of increasing oxygen in blood) are accepted as "natural advantages" or normal training practice such as living in high level mountain regions, practicing in such regions before major competitions or practicing in tents with reduced oxygen share. It is very likely that with the diffusion of HET in everyday life demands will be raised for the "unfair" use of HET in competitive situations in school or professional life to be banned or prosecuted while at the same time others may argue that the use of e.g. Ritalin™ is judicially not different from practices for improving your concentration capability, for instance by "autogenous training".

From an ethical perspective, regulatory decisions with regard to HET have to start by clarifying the extent to which and where enhancement technologies do interfere with "human rights" and "human dignity". In this respect the notion of personal autonomy and human freedom is crucial. It follows from the principle of personal autonomy that as long as there is no negative impact on the health of a person or of third parties that is associated with the use of HET, it has to be left to the individual to determine whether or not to make use of HET. Regulatory restrictions of the freedom of individual choice could be legitimised if the use of HET conflicted with the principle of fairness of competition and of the equal distribution of chances. As has been argued for nanomedicine and its potential for enhancing human capabilities, "it is one thing to claim the right to enjoy the benefit of nano- or neuromedical enhancing technologies but, if the benefits cannot be fairly distributed, this will not sit well with a commitment to human rights. Whichever way we look at it, then, whether it proves to be a case of too many or too few having access to enhancing technologies, the ethics seem to be problematic" (Brownsword 2008, 80).

Apart from the principle of fairness, for some forms of HET it might be possible to argue that HET interferes with the principle of human autonomy. On the one hand it can be argued (in favour of HET) that enhancement can be regarded as an expansion of human autonomy by enabling people to go beyond their individual capacities (e.g. helping a shy person to behave self-confidently). On the other hand, however, HET might just as well be regarded as reducing autonomy by affecting a person's capacity for self-determination and liability, by for example interfering in personal identity in the case of an envisioned manipulation of a person's memory by supporting remembering positive or suppressing negative content of the mind or by affecting a person's capacity for self-determination by consuming drugs that suppress natural barriers of anxiety or natural reactions to avoid overly stressful or threatening situations. In the case of brain interfaces, the questions of personal identity and the ascription of liability to a person or to the technology (in the case of failures) have been raised.

Autonomy and fairness can be regarded as providing guiding principles for regulatory intervention. It will, however, be difficult to draw clearcut distinctions and case-by-case analysis and decision might be needed.

Bio-medical or pharmacological research is the main area where procedures and technologies are being developed that bear a potential to enhance. When considering the options for regulating HET technologies on a European level, one therefore could think of starting from existing regulations for the medical sector (cf. Guerra 2008).

As is the case with drugs currently used for enhancement purposes (such as Ritalin™), it is most likely that in the future drugs will be developed for medical purposes and thus will be subject to clinical testing and national or. EU approval procedures might also be employed for enhancing or modifying cognitive or emotional states of mind. According to regulation EC No. 726/2004 on the authorisation and supervision of medical products, a community authorisation procedure ("centralised authorisation procedure") applies for human medicines that are derived from biotechnology processes and are intended for treatment (among others) of neurodegenerative disorders. Companies may also apply for a European authorisation under supervision of the European Medicines Agency (EMEA) if the medicine is a significant medical innovation.

Thus any drug or medicine with a potential for enhancement would probably be covered by a European regulation for pre-market approval. Aspects considered by this procedure (as by any national regulation for approval of drugs), however, are mainly the efficacy and safety of medicines. Questions and problems associated with enhancement drugs which go beyond health-related aspects dealt with in clinical trials and drug approval procedures are not covered. Regulations deal with a trade off between risks and side effects of a drug and its benefit for the treated patients. Non-medical enhancement purposes, ethical questions and possible societal side effects related to a respective use of a medicine are not the subject of the approval procedure.

We can thus conclude that there is a provision that covers possible medical risks of future enhancement drugs. The extent that regulators would be willing or able to license drugs that are suited to enhance cognition or alter emotional states for use in people who are healthy might however be a new issue to be dealt with in the realm of medical drugs approval (POST 2007). Whatever the conclusion of a regulator in this respect would be, a decision on licensing for use in healthy people might imply the assessment of not only medical benefits and risks but also the ethical, social and legal problems and side effects associated with enhancement drugs, which so far are not the subject of drug approval.

The same applies to other devices – such as electronic brain implants. As has been discussed for the U.S. in a paper produced at Stanford Law School (Chan 2007), devices such as cochlea implants or brain-computer interfaces do or would most likely fall into the realm of the U.S. Food and Drug Administration's regulatory jurisdiction over medical devices and the category system established for pre-market approval. The most restrictive approval and control mechanisms in this system are foreseen for so called "high-risk" (class III) devices, for which "implanted cerebella stimulators" are mentioned as examples in the FDA regulations. As far as a device based on brain-computer interface would imply a "potentially unreasonable risk of illness and injury", which according to the FDA regulation is the criteria for a device being categorised as "class III", it would be covered by the FDA's most stringent form of review, i.e. Premarket Approval (PMA).

A comparable procedure would apply in the European context according to the European Medical Devices Directive (COUNCIL DIRECTIVE 93/42/EEC of 14 June 1993 concerning medical devices). In Article 1, the Directive defines "medical device" as follows: " 'medical device' means any instrument, apparatus, appliance, material or other article, whether used alone or in combination, including the software necessary for its proper application intended by the manufacturer to be used for human beings for the purpose of:

- diagnosis, prevention, monitoring, treatment or alleviation of disease,

- diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap,

- investigation, replacement or modification of the anatomy or of a physiological process,

- control of conception,

and which does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means."

Since any enhancement technologies based on a brain-computer interface would imply "the replacement or modification of the anatomy or of a physiological process" they would consequently be subject to the approval procedures foreseen by the Directive.

However, as is the case for FDA regulations, the Directive would solely assess a device for its medical implications (risks and efficacy). Issues raised by the perspective of enhancing the human body, such as equality and fairness as well as possible issues of the authenticity of action and liability are not addressed by this system of approval. As these kinds of issues go beyond the scope of any medical consideration, it also can be doubted that they reasonably could be dealt with in the existing medical devices regulations. Even with regard to risk issues brain-computer interfaces are expected to challenge the existing medical approval system as new risks such as adverse brain feedback or risks related to device failures will have to be considered (Chan 2007, 37).

Future discussion of possible regulations for enhancement technologies might have to clarify to what extent it is at all possible and appropriate to include regulations for HET in the existing regulatory framework mainly dealing with medical aspects. As far as enhancement technologies or procedures are employed in a medical context, a regulation might be possible within the regulatory framework. However, for many enhancement technologies or drugs, the problem is precisely that they are employed for non-medical purposes or without any intervention by a medical practitioner.

For future regulations it thus might be crucial to differentiate between enhancement methods which require the intervention of a medical professional and those which do not, or respectively between enhancement applications that have to be regarded as medical drugs or as substances that are marketed as cosmetics, food or similar products. In an ongoing project on human enhancement conducted by the Office of Technology Assessment at the German Parliament (TAB), such legal aspects of enhancement are studied in more detail. The legal experts Jürgen Simon, Jürgen Robienski, and Rainer Paslack, who have worked together on such aspects in a study commissioned for the TAB project, have pointed out (in personal communication) that, in German law, regulating enhancement in the context of medical law confronts severe problems when attempting to clarify to what extent enhancement can be subsumed under what is defined as "medical practice":

Many enhancements can not be regarded as treatment of a disease nor as a measure of prevention of a disease. Whereas for a medical indication some kind of "objective" disease or suffering is necessary, enhancement may be based on subjective request or on the perception of some kind of "unsatisfactory" personal state.

The problem with enhancement becoming socially accepted is that this distinction which is crucial for medical law might be blurred. With more enhancement options becoming available it might well be that the concept of a healthy person might change and therapy is not regarded as a measure to re-establish the "natural" state of health but a physical or mental state that is achievable with existing methods of enhancement. Many legal corollary problems induced by the diffuse boundaries between medical and non-medical applications are conceivable. To what extent they will become relevant and what the appropriate ways are to deal with them are at present difficult to decide, as Simon and colleagues pointed out in personal communication: A very practical problem is to what extent enhancement treatment is covered by the public health and insurance system.

Nowadays, costs of treatment are covered only as far as the bodily functions of a client are impaired or as far as the client is suffering from disfiguring anatomic deviance. This principle might have to be discussed in the future and readjusted for enhancement purposes. A case illustrating the problem is the current discussion about the coverage of costs for cosmetic surgery in case the client might be psychologically impaired by a (objectively even slight) deviance from the dominant ideal of beauty (body dismorphic disorder). Another problem that might become relevant is the question of doctor's liability. So far according to medical law regulating the doctor-client relation (such as the German "Arztvertrag") the doctor does not owe the patient successful treatment but only "best medical practice". It might be not justifiable to regard enhancement treatment as belonging to the patient-doctor relation. The doctor offers a service which cannot be regarded as a mere treatment of disease but as a service to "improve" or "embellish" bodily features comparable to "cosmetics" for which a claim for recourse can be applied in case the "treatment" fails. It is also conceivable that in the future legal stipulations have to be found for liability in case of damage caused by employees when HET technologies are involved. Is the employee accountable or does the failure and damage have to be ascribed to the enhancing technology or drug. Finally, it is conceivable and discussed in the literature that in the future stipulations for "mandated enhancement" (e.g. in criminal law courts) may have to be found. A hypothetical example is discussed by Garland (2004, 15): "Could a court or other authority ask or compel someone to take a selective serotonin reuptake inhibitor (…) in order to make that individual less angry, less impulsive, and less irritable, even though the person does not have a diagnosed psychiatric condition?"

The central and most challenging question the legal system will be confronted with by HET is: What are the barriers for intervening in human nature and for a person's right to alter its bodily functions or state beyond natural barriers? The fundamental problem is that with HET our notion of normalcy or naturalness that may form barriers to intervention in human features and capacities gets blurred. The legal discourse on how to regulate HET thus depends on the cultural and ethical discourse on human nature. This general discussion has to inform the legal discussion about where to draw the line, i.e. in what cases it is legitimate to restrict a persons right of self determination with respect to intervention in his own body or brain (to enhance oneself).

The fundamental legal principle of liberal societies, the right of self determination and autonomy of the individual, does not give a clear guideline about restricting human enhancement as long as an individual decision for making use of HET does not interfere with the fundamental rights of others.

Deliberations on ethically acceptable vs. unacceptable forms of enhancement to inform the regulatory discourse might have to start from the concept of the "person". In this respect it is not only the clear impairment of a person's autonomy that may be rejected, as in the case of drugs that directly affect a person's capacity for self-determination in the sense of taking accountable decisions. It might also be asked to what extent the diffusion and application of HET might change the social context and culture in a way that the extent to which an autonomous decision for or against making use of HET is possible at all might be doubted. As soon as HET have become a "normal" aspect of competition in everyday professional life, it appears to be problematic to suppose a free and sovereign decision of an individual to apply enhancement.

It can also be discussed to what extent HET may impair the personal structure of an individual in a new, ethically questionable way (Merkel et al. 2007, 329ff, Crone 2006). Personal autonomy not only implies personal sovereignty (self government) but also "authenticity" in the sense of regarding ones own action and behaviour as belonging and being in line with one's own "identity". Enhancement technologies that intervene in a person's emotional state by manipulating his or her ability to suppress certain emotions and anxieties (as used, e.g. by military pilots) as well as HET to "steer" or "filter" a persons ability to remember parts of his personal history, could – when going beyond "healthy" barriers – be regarded as impairing or even destroying (at least temporarily) the identity of a person and thus affecting his autonomy by inducing action and behaviour that can be regarded or experienced by being not an "integrated" part of a persons identity.

## 3.5 First Steps toward the Governance of Human Enhancement

In the preceding section, we indicated some potential starting-points for regulatory discussions or activities. We also previously mentioned relevant Opinions of the European Group on Ethics in Science and New Technologies (see Sect. 3.1.2) as well as the European Commission's proposal for a code of conduct for responsible nanosciences and nanotechnologies research, in which it is stated that "nanosciences and nanotechnologies research organisations should not undertake research aiming for non-therapeutic enhancement of human beings leading to addiction or solely for the illicit enhancement of the performance of the human body" (European Commission 2008, 9).

In the second expert meeting (see Sect. 1.3 of the Appendices) carried out in the course of the project, regulatory questions were discussed in more detail. In the following, we will outline and interpret the main results of these discussions. The results relate to the questions: Who should regulate what? What should the general approach be to the regulation of HET? Which specific issues for regulation can be identified? What are the overarching challenges in the regulation of HET? And how could the process of political and societal deliberation on the governance of human enhancement get started?

There was consensus among the experts that policy-makers have to strike a balance between somewhat contradictory objectives: effectiveness and enforceability on the one hand, and flexibility (to allow for appropriate reactions to future technological developments) on the other.

In the discussions, a case-by-case approach, possibly complemented by a little "hard law", was contrasted with a more restrictive approach that would, for example, prohibit the use of HET for any other purpose than the prevention of serious diseases. This would delegate to the patient the burden of proof that a particular condition meets that requirement. The experts agreed, however, that policy-makers are not the only actors involved in regulation. They, therefore, supported the view that the process should be conceptualised in terms of steps taken toward a "governance" of human enhancement and include a broad range of governmental and non-governmental actors.

It was also argued that, in the case of technologies with a potential for human enhancement, there is a role for professional self-regulation. In a case-by-case approach, doctors and researchers could agree to common guidelines and sets of principles, and create advisory committees for each case. Yet there was also general agreement that self-regulation can only do so much, and some public regulation is needed.

This is not only because the reimbursement issue must be solved by other actors, particularly national governments and insurance companies. For one thing, self-regulation will not stop practitioners from catering to a patient's every wish as long as there is money to be made. Moreover, precise public regulation could protect doctors from the charge of performing risky interventions without any therapeutic value.

In the discussion, a number of specific issues for regulation were identified. These included:

- Inner-European cross-border medical care,
- The practical requirements when it comes to certain second-stage HET (e.g. compulsory cooperation between neurosurgeons and psychiatrists and their accordant training in the case of brain implants),
- Registration of certain interventions (such as DBS) for allowing a structured build-up of experience that is now lacking.
- Orphan technologies (such as certain applications of DBS) which should be made available to all who need them even though they are not profitable in economic terms,
- The use of HET in the military and other non-medical domains.

It was argued further that policy-makers should support specialisation in the field of highly advanced HET such brain implants, to reduce the risks for patients and improve efficacy.

In the course of the discussion, a number of overarching challenges for regulation were also identified: As with so many issues of European regulation, one major obstacle is the diversity of the member-states in their values and institutions; i.e. in this case their health care systems. Of course, European regulators have enormous experience in making arrangements that somehow allow for institutional differences. And some common ground could be found, based on shared values such as justice and solidarity.

Another challenge is the fact that new treatments with a potential for human enhancement may be stumbled upon in the course of standard therapeutic treatments. While it is possible to regulate research projects, serendipitous discoveries cannot, by definition, be ruled out by some kind of law or regulation. Medical ethical committees could play a role here.

Another problem is the risk of non-compliance, which is in fact a twofold risk of rules not being observed: both within the health system, and outside it. In a competitive setting, attempts to allow only a limited number of centres of expertise to perform certain interventions may meet with resistance. The risk of non-compliance outside the system is of a different order, i.e. practitioners who are only interested in making profits. This could lead to unequal access to expensive treatments and may have spectacularly unsuccessful results. There was broad consensus among the experts that for the sake of consumer protection, an attempt should be made to regulate all practitioners, including those outside the public medical system.

Finally, there is also a risk of non-acceptance by the public. Apart from the invasiveness of many techniques, which could be considered an inherent constraint, there is the obvious cost factor: not all treatments are affordable for a public health insurance system. But is society capable of imposing constraints on individual choice for the good of the collective? Patients' claims predominate in discussions on any medical progress, which makes it very difficult to impose constraints. The historical eugenics trauma adds to this.

Besides identifying these rather specific issues and challenges, there was another important result from the expert meeting: It became obvious that one of the first steps to be taken in a possible governance of human enhancement is the delineation of general policy approaches and the development of proposals for initiating and politically organising deliberation on the issue.

It was emphasised that regulation is a good thing for practical matters, but regulation alone is not sufficient for the major question regarding the direction society at-large should take regarding human enhancement and the new HET. There was broad consensus that there are overarching issues transcending the level of single HET, such as medicalisation, equity, changing norms about normality, and visions of our future society. Accordingly, we outlined possible general approaches to the issue of human enhancement after the expert meeting. Moreover, in our view – and this was confirmed by the results of the expert meeting – arenas are lacking where the big questions can be politically deliberated and the gap bridged between the broader public and practitioners and experts. Here we see a role for parliaments as the interface between policy-makers and the public. At the core of our proposals concerning policy options (see Chapter 4), there is thus the idea of establishing a temporary committee of the European Parliament. This could, on the one hand, clarify the policy challenges posed by the tendencies towards an enhancement society and by the various HET, and, on the other hand, prepare for and stimulate a social dialogue on the topic of human enhancement at-large. These ideas for possible general approaches to the issue and the design of a political process were discussed during a workshop in the European Parliament in February 2009 (see Sect. 2 of the Appendices)

# 4. POLICY OPTIONS FOR THE EU

As demonstrated in the previous chapters, human enhancement issues are not just academic: the technologies and trends involved can have both beneficial and adverse effects on several kinds of political domains. New human enhancement technologies and trends provide opportunities for individuals and for society. They also pose new risks and tend to create new needs and social demands.

This tendency in itself puts a strain on solidarity and healthcare systems. The issues touch upon matters that are relevant at EU level, such as health budgets, research policies, and economic issues. Differences among member states will probably lead to tensions in the future. In addition to interventions by nation states, EU policies will have to address these issues.

Currently however, the EU has no platform for monitoring and discussing human enhancement issues. Arenas are lacking where the normative issues can be politically deliberated and the gap between the needs and the concerns of the broader public and the practitioners and experts bridged. We concluded in Chapter 4 that there is a role for the European Parliament here. We believe that such a platform should be created on the basis of a critical vision of the phenomenon of human enhancement.

How could the EU initiate and politically organise a broader deliberation on human enhancement issues? What form could EU involvement in human enhancement issues take? In this chapter, we draw some conclusions on the outlines of a European approach to the important issues in the form of a proposal.

The essence of this proposal is to set up a European body for the development of a normative framework for human enhancement that guides the formulation of EU policies in this field. For the establishment of such a body, we see two institutional options, both of which have been chosen in the past for human genetics and genetic testing. The European Parliament could decide to set up a temporary committee, as was done for human genetics in 2000 (ref. Temporary Committee 2001). Alternatively the European Commission could decide to install a working group in which members of the European Parliament participate – comparable to the working group established for genetic testing in 2004 (McNally et al. 2004). It would be the task of this working group or committee to further explore the need and lay the ground for possible further regulation of human enhancement issues that affect such political domains as health, research and economy in the EU. The involvement of the European Parliament in such a working group would be highly desirable in order to strengthen the group's intermediate and public role.

The present proposal has been developed in the course of the STOA project and has been discussed in two separate rounds of consultation: The first discussion platform was the expert meeting in The Hague held in October 2008 (referred to in the following text as 'the expert meeting'). The second platform took the shape of a workshop with a group of experts, Members of the European Parliament and other stakeholders, was held in the European Parliament in Brussels in February 2009, and was organised by the STOA committee (referred to as 'the STOA workshop'). Both discussion platforms dealt with the possibilities of regulation of human enhancement in the EU.

As a result of these consultations, we can substantiate he proposal for a working group or temporary parliamentary committee in this chapter. In Sect. 4.1, we introduce the political domains in the EU that are impinged by human enhancement trends and that, therefore, need to be addressed in a human enhancement policy. In Sect. 4.2, we sketch the strategic options the possible body needs to deliberate in order to formulate a normative framework for EU policies in this field. Finally in Sect. 4.3, the tasks of a European body on human enhancement are described in more detail.

## 4.1 Domains challenged by human enhancement trends

The broad ethical and societal issues and the problems in specific fields of R&D mentioned in previous chapters require a political response and some form of political action, both at EU level and in the individual member states. Before introducing and discussing possible policy options in Sect. 4.2., we here distinguish three political domains that are most affected by human enhancement trends, in order to describe in more detail the political challenges that should be met in a European approach to human enhancement issues. Particular political challenges at least arise in the following three domains of European policy.

***Healthcare systems***

The main political challenge at present comes from the fact that healthcare systems are still regulated by the member states, without any overall direction imposed by the EU. Given the free movement of people and the freedom to provide services across the European Internal Market and the new directive on cross-border healthcare that is in preparation, this means that national healthcare systems will be put under pressure to allow what is allowed elsewhere, as otherwise people will travel abroad to get the enhancement they cannot get at home. This will force up the overall costs of the healthcare systems. It has already been recognised that the EU needs a healthcare framework that respects common values and shared principles, as reflected in the Council of Europe's request that the European Commission should ensure the development of such a framework (2006/C 146/01). Special attention should be paid to the consequences of human enhancement for (cross-border) healthcare in this context.

***Research and development***

The issue of human enhancement is also relevant to the EU in the field of R&D and the technology market. Research on medical technologies and treatments that carry a potential for use in terms of non-therapeutic enhancement is already funded and ongoing in the EU. Besides what can overall be seen as the rudimentary stage of non-therapeutic HET, it appears to be highly probable that non-therapeutic enhancement drugs, for instance, are becoming more effective, that human-machine-interaction tends to become increasingly close, and that many social practices and the activities of important promoters of radical HET will create a stronger impetus towards an enhancement society.

On the one hand, the economy and the citizens of the EU could benefit from human enhancement, the economy by developing and selling the individual technologies and individuals by using these to attain a higher quality of life and/or to boost their productivity. It should not be forgotten, however, that some of these technologies could have undesired consequences, including an adverse impact on social cohesion.

Research that might lead to the development of human enhancement technologies should, therefore, not be funded uncritically. Further deliberation is needed on policy guidelines and funding criteria for human enhancement. We need to make sure that proposed research really will serve socially desirable goals. This also requires, as participants of both rounds of consultation emphasised, a broad public (European) deliberation and reflection on the regulation of possible HET and on the fundamental normative and societal aspects.

***Competitiveness of European economies***

The individual European economies will have to become more competitive if the goal set in the Lisbon Treaty – the transformation of the EU into a single dynamic, knowledge-based economy – is to be achieved. The necessary impetus could come from traditional means of stimulating the economy, such as by encouraging people to pursue further education or by funding innovative research.
However, human enhancement technologies might assist in this process in a number of different ways. One particular example might be through the emergence of a market for enhancement technologies, but possibly also by increasing the quality of life and the working conditions of Europeans. However, there is still not much known about the efficacy, or possible adverse effects of the technologies in question, and it is far from clear that there any technological developments in the field of human enhancement that could give a significant competitive advantage to individuals or whole economies in the near future.

Nevertheless, from this perspective, it may be asked whether the EU will be able to compete in future with other regions of the world that may opt to follow a more liberal approach towards the use and development of human enhancement technologies. Such a global imbalance could have other consequences in addition to harming the EU's economic competitiveness, such as a trend towards the illicit use of uncontrolled, untested and possibly unsafe enhancement techniques within the EU.

## 4.2 Developing a normative framework

The impact of human enhancement in these three political domains demands a political response from the proposed working group or temporary committee. This political response cannot be formulated straightforwardly, as it will depend on normative choices towards human enhancement that have to be considered first.

In a systematic approach to developing policy strategies, five basic approaches for the regulation of human enhancement are conceivable. In this section, we explain and discuss these five policy options in order to outline the scope of the normative framework:

1. A total ban on any technology that alters "human nature";
2. A *laissez-faire* approach;
3. A reasoned pro-enhancement approach;
4. A reasoned restrictive approach; and
5. A systematic case-by-case approach.

A total ban on any technology that alters "human nature" clearly is the most restrictive option. To implement such a total ban, one would need to define "human nature" and explain which alterations are acceptable and which are not; this might be an impossible task. This option would also involve banning at least some of the human enhancement technologies already in use. It would also have to take a fine line between medically indicated treatment and enhancement into account, and would need a lot of maintenance.

The *laissez-faire* approach which most closely resembles the current situation, would encounter serious problems too. If all the member states were to establish different regulations and fund different practices, as already appears to be current practice, this would lead to further inequalities between the member states and most probably to an increase in medical or human enhancement tourism, the former already being a European problem. All these problems would have to be addressed by the EU. Besides, some human enhancement technologies such as those for military applications would seem to be problematic in themselves and hence in need of regulation. Moreover, social cohesion and individual rights to physical integrity and protection against discrimination might be adversely affected in a performance-orientated society in which the competitive pressure would extend to the use of performance-enhancing drugs and technologies.

In the view confirmed by the participants in the expert meetings and the STOA workshop held during the project, these two strategies are, therefore, neither desirable nor realistic. Several human enhancement technologies are already in the process of development or being used, and a total ban appears to be neither feasible nor, even if based on a strict definition of human enhancement, wholly desirable. The *laissez-faire* approach will only postpone the need for regulation, and leave the positive as well as negative societal consequences that some of the technologies could have to unfold. A *laissez-faire* approach would also mean that there are no criteria for EU-funded research into human enhancement technologies. This could have undesirable consequences, ranging from a lack of ethical awareness about these technologies to funding of specific enhancement technologies that might be regarded ethically problematic by relevant groups of society.

It thus needs to be decided whether human enhancement technologies should be regulated in the EU by a reasoned pro-enhancement approach, a reasoned restrictive approach, or a systematic case-by-case approach.

In a reasoned pro-enhancement approach, EU policy would explicitly fund R&D on (non-therapeutic) human enhancement technologies, while preserving all applicable elements of existing ethical frameworks and, as a matter of course, respecting fundamental European values. In such a strategy, EU policy would try to stimulate a societal dialogue about how risk-averse we can be, and how open to innovations which might run counter to traditional value systems. Initiatives to stimulate discussion of deregulation in such areas as drug and doping policies or reproductive technologies could be elements of this strategy.

This pro-enhancement approach acknowledges and addresses existing tendencies such as those towards the medicalisation of society and the widespread desire for almost unlimited self-determination. This approach would furthermore be able to keep EU institutions and their citizens up to date with new technologies.

On the other hand, this approach might be problematic from a broader normative point of view and even for practical reasons, for example because it may not be easy to square human enhancement technologies with fundamental European values. It also remains to be decided whether the line between acceptable and unacceptable human enhancement technologies should be drawn in principle ahead of time, or should be determined post facto. Furthermore, human enhancement could have undesirable side effects that are only discovered in the long term.

Finally, it is far from clear whether the technologies and trends that are most intensively discussed in the human enhancement debate really would facilitate achievement of such goals as the creation of a competitive, dynamic European knowledge society or the improvement of European innovation systems.

In line with the last-mentioned argument, a reasoned restrictive approach would always have to be based on consideration of whether proposed human enhancement solutions to social and individual problems really do have added value when compared with non-technological or other technological solutions, and whether funding priorities need to be changed accordingly. Moreover, the precautionary principle would have to be applied as systematically and comprehensively as possible in this approach, since – in this view – individual enhancements should never be allowed to threaten the social fabric and fundamental cultural values. The ideologies and social prejudices underlying the recent trend towards human enhancement would have to be subject to further scrutiny and critical examination. The EU could promote efforts to add self-reflexive and historical aspects to a discourse that is largely shaped by the U.S., taking European cultural and ethical diversity into account and with a special view on the ideology of extreme progress and its roots in European history. Some kinds of R&D or interventions, such as human enhancement technologies for military purposes, might be banned altogether.

The benefit of this approach is that it includes built-in control over human enhancement and its consequences. This strategy might protect EU citizens from unwanted consequences of human enhancement, while still allowing them to benefit from a few, carefully researched technologies.

It is moreover compatible with a continued focus on the question of how economically competitive knowledge societies can be created without an undue shift of attention to individual technologies.

On the other hand, a more liberal approach to human enhancement might facilitate a competitive response of the European community to an increase in individual demands for enhancement technologies or a shift to a pro-enhancement policy in other parts of the world. Furthermore, the reasoned restrictive approach requires an explicit framework or set of criteria to test each individual human enhancement technology for admissibility.

Finally, in a systematic case-by-case approach, a normative perspective on human enhancement would be taken into account whenever a technology- or science-based intervention aimed at improvement of individual human performance is proposed.

Any decision on whether to allow such an intervention or to fund relevant R&D would be based on a process involving consultation of all groups directly affected by such interventions as well as on expertise from all relevant fields and disciplines (selected to reflect the cultural diversity of Europe).

This approach does not demand a single large regulatory system: instead, specific regulations tailored to fit within an over-all framework would be drawn up as new technologies appeared on the scene. This overall framework would allow existing human enhancement trends to be systematically taken into account and deliberated on in due course, with input from those most closely affected. Since no regulations would have to be drafted for technologies not yet in existence, it would be possible to spread the burden of work over time.

On the debit side, the EU would have to maintain a regulatory mechanism for human enhancement in the long term, and would have to abstain from adopting a clear position on the issue of human enhancement in general in order to permit such a flexible and highly deliberative approach.

The reasoned pro-enhancement approach, the reasoned restrictive approach, and the systematic case-by-case approach were discussed by the participants of the STOA workshop.

In general, participants agreed that human enhancement can have far-reaching implications both for individuals and for society and, therefore, also for the EU. An EU-wide policy thus might be needed, especially as human enhancement technologies in the medical context are already being used and discussed, and others are on the horizon. Participants generally felt that these developments also should not be stopped. Despite the real and serious risks, human enhancement also presents valuable opportunities that should be further explored. However, a strong need was felt for developing a coherent normative framework.

With regard to the policy options, and taking into account the wide range of risks and opportunities, the participants of the STOA meeting seemed to favour a case-by-case approach. Potential technologies should be evaluated on an individual basis, based on shared European values and beliefs and on the latest insights into technology, society, and philosophy.

Participants further emphasised that any approach to the challenges posed by human enhancement would need some kind of participation by European citizens. This is because human enhancement technologies directly touch upon and even challenge human values, as they are recognised, cherished and protected by the EU.

Roberto Mordacci, Professor of Philosophical Anthropology and Bioethics at the University of San Raffaele (Italy) added some general criteria to the discussion, to strengthen the outlines of the normative framework to be created. These criteria are based on dimensions of the human condition, and they serve to assess new human enhancement technologies whether they should be permitted.

As a starting point Professor Mordacci highlighted five dimensions of the human condition which we tend to consider fundamental for our self-respect and mutual cooperation:

- A recognisably human body;
- Naturally unrestricted desire: there is no limit to what we can desire, only to what we can achieve;
- A complex theoretical and practical rationality, which distinguishes us from most animals;
- Freedom of will, although this is disputed at the practical level; in political and ethical issues we start from the premise that we are free and we cherish that freedom; and
- Equal dignity.

On the basis of these five dimensions, Professor Mordacci argued that a general principle for assessing human enhancement might be that a technology or treatment aiming at human enhancement can be permitted if does not:

- Intentionally disfigure the human body;
- Intentionally restrict the breadth of human desire, for instance create a person whose only desire is to run;
- Impair the exercise of human rationality, for instance by limiting our ability to consider different aspects of an argument;
- Impede the human ability to choose freely; or
- Violate the equal dignity of individuals, in other words, generate discrimination or unfairness.

In our view, the deliberations on policy options and public participation as well as the anthropological criteria as formulated by Professor Mordacci could be taken by the proposed working group or committee as a starting point for developing a normative framework.

## 4.3 A European Body on Human Enhancement Technologies

As mentioned above, the essence of our proposal is to set up a European body to develop a normative framework for human enhancement that can guide the formulation of EU policies in this field. It would be the task of the body to further explore the topic and lay the ground for possible further regulation of human enhancement issues that, for example, affect the domains of health, research and economy in the EU. As demonstrated in the previous chapters, there would be a wealth of resources available for the work of such a body, some of it generated in EU-funded projects.

The European Parliament would be an appropriate place to provide a forum that reflects European cultural diversity by including representatives from different member states. A temporary committee at the European Parliament which would analyse, on the basis of pertinent expertise, the challenges raised by HET, would most probably shape the debate in a substantial way.

A working group set up by the Commission would also need to involve different kinds of experts. It should be careful to give room for consultation of the broader public during the development of the normative framework and during the subsequent regulatory process. We hold that members of the European Parliament should play a crucial role in such a working group.

The primary task of the body, be it a working group or a temporary committee, would be to develop a normative framework for human enhancement that should be based on evaluation criteria comparable to those discussed at the STOA workshop (see Mordacci above). The normative framework would help to:

- Evaluate the effectiveness and risks of the technologies in question;
- Organise a comprehensive impact assessment of human enhancement technologies (taking into account political, ethical, legal, societal, cultural, political, safety, security, and health aspects);

- Assess whether the EU should fund technologies that are potentially disruptive to the social fabric, or European cultural value systems;
- Identify further research needs on the topic of human enhancement and single human enhancement technologies;
- Define the limits within which each country can regulate human enhancement within its own boundaries;
- Prevent undesirable (side) effects of human enhancement technologies within member states and the EU as a whole;
- Prevent inequalities arising in healthcare between member states;
- Prepare the ground for a policy on the funding of human enhancement research;
- Prepare and stimulate a social dialogue on the topic of human enhancement at large.

In order to achieve these objectives, the body would have to properly monitor the current and emerging developments in HET. By doing this, it would have to establish a solid ground for discussions on normative and regulatory aspects by carefully defining the subject of its activities. It must be ensured that the work of the body is not overloaded by highly visionary or ideological thoughts and aspirations currently triggered by the term "enhancement". It should, however, monitor relevant activities, in Europe or elsewhere, in which more radical visions of human enhancement are promoted. Without neglecting possible future societal changes, one of the most prominent tasks of the body would be to focus the debate on human enhancement on emerging technologies and observable societal trends that might lead to an increased use of enhancement technologies in everyday life.

The mandate of the body can be further supported by specific activities which:

- Collect, analyse and discuss data and existing policy documents concerning specific human enhancement technologies and the overall field of human enhancement;
- Further analyse the ethical, social and cultural trends towards human enhancement, including, to a certain degree, the impact of far-ranging visions and specific ideologies on our views of humanity, society, and technoscience, and assess their moral and social consequences for the EU;
- Further clarify the political challenges which are posed by the tendencies towards an enhancement society and by the various enhancement technologies;
- Analyse in more detail the risks for individuals, such as addiction, psychological complications, and adverse health effects of surgical interventions;
- Make use of state-of-the-art public participation tools;
- Carry out a series of surveys to learn more about European public opinion on the various facets of the issue;
- Monitor private R&D inside Europe and R&D carried out outside Europe, to detect innovative technologies that may require regulation;

- Identify specific new problems (e.g. the role of informed consent in trials of new technologies) at the level of individual human enhancement technologies or human enhancement as a whole which require regulation and follow-up.

The body will have to rely on different kinds of expertise. Social, ethical, technological, natural-scientific, medical, and policy expertise should all be involved in the work. Moreover, consultation of the broader public during the development of the normative framework and during the subsequent regulatory process is advisable.

As regards the composition of the proposed European body on human enhancement technologies, it is important for it to reflect European cultural diversity by including representatives from different member states. This body would thus not only function as an intermediary between science and technology and the EU, but also be a place where the developing technologies can be discussed in the light of European values.

# REFERENCES


- Ach, J., Lüttenberg, B. (eds.) (2008): Nanobiotechnology, Nanomedicine and Human Enhancement. Berlin, Münster
- Agar, N. (2005): Liberal Eugenics: In Defence of Human Enhancement. Malden
- Alexander, B. (2003): Rapture. How Biotech Became the New Religion. New York
- Anderson, J. (2008): Neuro-Prosthetics, the Extended Mind, and Respect for Persons with Disability. In: Düwell, M., Rehmann-Sutter, C., Mieth, D. (eds.): Bioethics and the Limits of Human Existence (International Library of Ethics, Law, and the New Medicine 39), pp. 259-274
- Andler, D., Barthelmé, S., Beckert, B., Blümel, C., Coenen, C., Fleischer, T., Friedewald, M., Quendt, C., Rader, M., Simakova, E., Woolgar, S. (2008): Converging Technologies and their Impact on the Social Sciences and Humanities (Final report of the CONTECS project, May 2008), http://www.contecs.fraunhofer.de/images/files/contecs_report_complete.pdf
- Arehart-Treichel, J. (2008): Monitor Suicide Risk After Surgery for Parkinson's, Clinicians Urged. In: Psychiatric News 43/23, p. 15
- Austen, I. (2004): Athletic Profiling. In: The New York Times, September 12, 2004
- Baillie, H., Casey, T. (eds.) (2005): Is Human Nature Obsolete? Cambridge/MA
- Bailly, L. (2005): Stimulant medication for the treatment of attention-deficit hyperactivity disorder: evidence-b(i)ased practice? In: Psychiatric Bulletin 29, pp. 284–287
- Bainbridge, W. (2004): Progress toward Cyberimmortality. In: Immortality Institute (ed.): The Scientific Conquest of Death. Buenos Aires (ebook), www.imminst. org/book1/, pp. 107–122
- Bainbridge, W. (2005): The Coming Conflict between Religion and Cognitive Science. In: Wagner, C. (ed): Foresight, Innovation, and Strategy: Toward a Wiser Future. Bethesda/MD: World Future Society, pp. 75-87
- Bainbridge, W., Roco, M. (eds.) (2006a): Managing Nano-Bio-Info-Cogno Innovations: Converging Technologies in Society. Dordrecht
- Bainbridge, W., Roco, M. (eds.) (2006b): Progress in Convergence. Technologies for Human Well-Being. Annals of the New York Academy of Sciences Vol. 1093, Boston
- Baldwin, S., Cooper, P. (2000): How should ADHD be treated? head to head. In: The Psychologist 13/12, pp. 598–602
- Barclay, L. (2002): Designer Disability: Newsmaker Interviews with Richard Alastair Preiss, FRCS, MBChB, and Ellie E. Rosenfeld. In: Medscape (online), http://www.medscape.com/viewarticle/443057
- Barkley, R. (1997): ADHD and the Nature of Self-Control. London
- Baruch, S., Javitt, G, Scott, J, Hudson, K. (2004): Pre-implantation genetic diagnosis: A discussion of challenges, concerns, and preliminary policy options related to the genetic testing of human embryos. Washington

- Baruch, S., Javitt, G, Scott, J, Hudson, K. (2005): Human germ line genetic modification: Issues and options for policy makers. Washington
- Baumberg, J., Charbit, F., Cronin,L., Gee, M., Kearnes, M., Macnaghten, P., Makatsoris,H., Ramsden, J., O'Reilly, R., Webb, M. (2007): Where is nano taking us? In: Nanotechnology Perceptions 3, pp.3–14
- Beckert, B., Blümel, C., Friedewald, M. (2007): Visions and Realities in Converging Technologies. In: Innovation 20/4, pp. 375–394
- Bennett, K., Haggard, M. (1999): Behaviour and cognitive outcomes from middle ear disease. In: Archives of Disease in Childhood 80, pp. 28–35
- Berger, T., Chapin, J., Gerhardt, G., McFarland, D., Principe, J., Soussou, W., Taylor, D., Tresco, P. (2007): WTEC Panel Report on International Assessment of Research and Development in Brain-Computer Interfaces (Final Report). Baltimore, http://www.wtec.org/bci/BCI-finalreport-10Oct2007-lowres.pdf
- Bernal, J.D. (1970): The World, the Flesh and the Devil. An Inquiry into the Future of the Three Enemies of the Rational Soul. London (orig. 1929)
- Biever, C. (2006): Brain-implant enables mind over matter. In: New Scientist, 12 July, 2006, http://www.newscientist.com/article/dn9540-brainimplant-enables-mind-over-matter.html
- Blitz, P. (2005): Sport, genetica en selectie. In: Hilvoorde; I. Van, Pasveer, B. (eds.): Beter dan Goed. Over genetica en de toekomst van topsport. Diemen/Den Haag, pp. 80-95
- Bloom; B., Dey, A., Freeman, G. (2006): Summary Health Statistics for U.S. Children: National Health Interview Survey, 2005, National Center for Health Statistics. Vital Health Stat 10(231). URL: http://www.cdc.gov/nchs/data/series/sr_10/sr10_231.pdf
- BMA (British Medical Association) (2007): Boosting your brainpower: ethical aspects of cognitive enhancements (Discussion paper). London, http://www.bma.org.uk/ethics/health_technology/CognitiveEnhancement2007.jsp
- Bonazzi, M. (2006): Reconstructing Man? The Power of converging technologies. http://cordis.europa.eu/wire/index.cfm?fuseaction=article.Detail&rcn=11117
- Bond, P.J. (2002): Converging Technologies and Competitiveness. In: Roco/Bainbridge 2002, pp. 28–30
- Bootin, M.L. (2006): Deep Brain Stimulation: Overview and Update. In: Journal of Clinical Monitoring and Computing 20, pp. 341—346
- Bostrom, N. (2003): Human Genetic Enhancements: A Transhumanist Perspective. In: Journal of Value Inquiry 37/4, pp. 493-506

- Bostrom, N. (2008a): Letter from Utopia (Version 1.6). In: Studies in Ethics, Law, and Technology 2/1, pp. 1-7 http://www.nickbostrom.com/utopia.html
- Bostrom N. (2008b): Dignity and Enhancement. In: Human Dignity and Bioethics: Essays Commissioned by the President's Council on Bioethics. Washington, pp. 173-207
- Bostrom, N., Roache, R. (2007): Ethical Issues in Human Enhancement, http://www.nickbostrom.com/ethics/human-enhancement.pdf
- Brancaccio, M. (2001): From Instability to Hyperactivity, 1890's–1990's, PhD thesis, University of Amsterdam
- Breggin, P. (1998): Talking Back to Ritalin. What doctors aren't telling you about stimulants for children. Monroe
- Brom. F., Schuijff, M., (2009): Sterker, fitter, slimmer, mooier. Sleutelen aan gezonde mensen, om ze nog perfecter te maken, is de trend. Waar blijft het politieke debat? In: Trouw, 24 January 2009, p. 39
- Brown, N., Michael, M. (2003): A Sociology of Expectations: Retrospecting Prospects and Prospecting Retrospects. In: Technology Analysis and Strategic Management 15/1, pp.3-18
- Brownsword R. (2008): Regulating Nanomedicine – The Smallest of Our Concerns? In: Nanoethics 2, pp.73-86
- Brzezinski, Z., Rosenthal, J. (1994): The New Dimensions of Human Rights. Fourteenth Annual Morgenthau Memorial Lecture on Ethics and Foreign Policy. New York (Carnegie Council), http://www.cceia.org/resources/publications/morgenthau/269.html#1
- Brzezinski, Z. (2004): The Choice: Global Domination or Global Leadership. New York
- Burkhard, P., Vingerhoets, F., Berney, A., Bogousslavsky J., Villemure, J.-G., Ghika, J. (2004): Suicide after successful deep brain stimulation for movement disorders. In: Neurology 63, pp. 2170—2172
- Canton, J. (2004): Designing the Future: NBIC Technologies and Human Performance Enhancement. In: Roco/Montemagno 2004, pp. 186–198
- Chan, E. (2007): The FDA and the Future of the Brain-Computer Interface: Adapting FDA device Law to the Challenges of Human-Machine Enhancement. Stanford Law Scholl (unpublished manuscript)
- Cobb, M. (2008): 2008 ASU-CNS National Survey on Human Enhancement Technologies, http://faculty.chass.ncsu.edu/cobb/toplines_nano.pdf
- Coenen, C. (2006): Der posthumanistische Technofuturismus in den Debatten über Nano-technologie und Converging Technologies. In: Nordmann, A., Schummer, J., Schwarz, A. (eds.): Nanotechnologien im Kontext. Philosophische, ethische und gesellschaftliche Perspektiven. Berlin, pp. 195-222

- Coenen, C. (2007): Utopian Aspects of the Debate on Converging Technologies. In: Banse, G., Hronszky, I., Nelson, G. (eds.): Assessing Societal Implications of Converging Technological Development. Berlin, pp. 141–172, http://www.itas.fzk.de/deu/lit/epp/2007/coen07-pre01.pdf (ITAS pre-print)
- Coenen, C. (2008a): Schöne neue Leistungssteigerungsgesellschaft? In: TAB-Brief 33, pp. 21-27, http://www.tab.fzk.de/de/brief/brief33.pdf
- Coenen, C. (2008b): Verbesserung des Menschen durch konvergierende Technologien – Christliche und posthumanistische Stimmen in einer aktuellen Technikdebatte. In: Böhm, H., Ott, K. (eds.).: Bioethik – menschliche Identität in Grenzbereichen (Schriften der Evangelischen Forschungsakademie 40). Leipzig, pp. 41-124
- Coenen, C. (2009): Deliberating Visions: The Case of Human Enhancement in the Discourse on Nanotechnology and Convergence. In: Kaiser, M., Kurath, M., Maasen, S., Rehmann-Sutter, C. (eds.): Governing Future Technologies. Nanotechnology and the Rise of an Assessment Regime, Chapter 5, Series: Sociology of the Sciences Yearbook, Vol. 27. Doordrecht, Heidelberg (forthcoming)
- Coenen, C., Fleischer, T., Rader, M. (2004): Of Visions, Dreams, and Nightmares: The Debate on Converging Technologies. In: Technikfolgenabschätzung - Theorie und Praxis, 13/3, pp. 118-125, http://www.itas.fzk.de/tatup/043/coua04a.htm
- Coghill, D. (2005): Attention-deficit hyperactivity disorder: should we believe the mass media or peer-reviewed literature? In: Psychiatric Bulletin 29, pp. 288–291
- Coles, D. (2005): Ethics and the European Commission (Kick-off Project ETHICBOTS), http://ethicbots.na.infn.it/meetings/kom/coles.ppt
- Cole-Turner, R. (2006): More than Human: Religion, Bioethics, and the Transhuman Prospect, paper prepared for "Continuity + Change: Perspectives on Science and Religion", June 3-7, 2006, in Philadelphia, PA, USA, http://www.metanexus.net/conferences/pdf/conference2006/Cole-Turner.pdf
- Conrad, P. (2007): The Medicalization of Society: On the Transformation of Human Conditions into Treatable Disorders. Baltimore
- Conrad, P., Leiter, V. (2004): Medicalization, Markets and Consumers. In: Journal of Health and Social Behavior 45 (extra issue), pp. 158–176
- Crone K. (2006): Biotechnologische Gedächtnismanipulation und personales Selbstverständnis. In: Hübner, D. (ed.) Dimensionen der Person: Genom und Gehirn, Paderborn, pp. 223-238
- CSPO, ACG (Consortium for Science, Policy & Outcomes at Arizona State University, Advanced Concepts Group, Sandia National Laboratories) (2006): Policy Implications of Technologies for Cognitive Enhancement (Workshop, 3.5.2006, Arizona State University), www.cspo.org/documents/FinalEnhancedCognition Report.pdf
- Darnovsky, M. (2001): The case against designer babies. In: Tokar, B. (ed.): Redesigning life? The worldwide challenge to genetic engineering. New York, pp. 133-149

- De Volkskrant: Bussemaker: Embryo-selectie mag bij ernstige borstkanker, May 27, 2008, p. 1
- Dekker, T. (2009): The illiberality of perfectionist enhancement. In: Medicine, Health Care and Philosophy 12, pp. 91-98
- Deuschl, G. (2006): A Randomized Trial of Deep-Brain Stimulation for Parkinson's Disease. In: The New England Journal of Medicine 355/9, pp. 896—908
- Döring, O. (2002): Einstellungen zum Anfang des menschlichen Lebens in der chinesischen Diskussion. Eine Skizze in fünf Thesen. In: Robertson, C.Y. (ed.): Der perfekte Mensch. Genforschung zwischen Wahn und Wirklichkeit (Schriften des Instituts für Angewandte Kulturwissenschaft der Universität Karlsruhe, TH, 8. Band), Baden-Baden, pp. 205-235
- Drexler, K.E. (1986): Engines of Creation – The Coming Era of Nanotechnology. New York
- Dupuy, J.-P. (2007): Some Pitfalls in the Philosophical Foundations of Nanoethics. In: Journal of Medicine and Philosophy 32/3 (Mai 2007), pp. 237–261
- Dvorsky, G. (2003): And the Disabled Shall Inherit the Earth, http://www.betterhumans.com/Features/Columns/Transitory_Human/column.aspx?articleID=2003-09-15-2
- EC ISM DG (European Commission, Information Society and Media Directorate-General) (not dated): Future and Emerging Technologies in FP7, Working Paper (online until 2007)
- EGE (European Group on Ethics in Science and New Technologies) (2005): Ethical aspects of ICT implants in the human body. Opinion N° 20, http://ec.europa.eu/european_group_ethics/publications/docs/avis20compl_en.pdf
- EGE (The European Group on Ethics in Science and New Technologies) (2007): Opinion on the ethical aspects of nanomedicine. Opinion N° 21, http://ec.europa.eu/european_group_ethics/activities/docs/opinion_21_nano_en.pdf
- Eizmendi, G., Azkoitia, J., Craddock, G. (2007): Challenges for Assistive Technology AAATE 07 (9th European Conference for the Advancement of Assistive Technology in Europe). Amsterdam
- Elwan, A. (1999): Poverty and Disability: A Survey of the Literature. Worldbank (Social Protection Discussion Paper Series, No. 9932), http://siteresources.worldbank.org/DISABILITY/Resources/Poverty/Poverty_and_Disability_A_Survey_of_the_Literature.pdf
- Engelbart, D.C. (1962): Augmenting Human Intellect: A Conceptual Framework, SRI Summary Report AFOSR-3223, prepared for: Director of Information Sciences, Air Force Office of Scientific Research, Stanford Research Institute, SRI Project No. 3578, http://www.dougengelbart.org/pubs/augment-3906.html
- Esfandiary, F. (1974): Transhumans – 2000. In: Maggie Tripp (ed.): Woman in the Year 2000. New York, pp. 291-298

- Est, R. van, Klaasen, P., Schuijff, M., Smits, M. (2008): Future man – no future man. Connecting the technological, cultural and political dots of human enhancement (Rathenau Instituut). Den Haag
- ETC Group (2006): Nanotech Rx. Medical Applications of Nano-scale Technologies: What Impact on Marginalized Communities? (Sep 12, 2006), http://www.etcgroup.org/en/materials/publications.html?pub_id=593
- EU HLEG FNTW (EU High Level Expert Group "Foresighting the New Technology Wave" (2004): Converging Technologies – Shaping the Future of European Societies (Alfred Nordmann, Rapporteur). Brussels, http://ec.europa.eu/research/conferences/2004/ntw/pdf/final_report_en.pdf
- Euchner, W. (2005): Der künstlich verbesserte Mensch und die 'künstliche Intelligenz' - Vorgeschichte und aktuelle Dimension. In: Leviathan 33/1, pp. 40-68
- European Commission (2008): Commission Recommendation of 07/02/2008 on a code of conduct for responsible nanosciences and nanotechnologies research, C(2008) 424 final. Brussels
- European Parliament (2006): Nanoscience and nanotechnology. European Parliament resolution on nanosciences and nanotechnologies: an action plan for Europe 2005-2009 P6_TA(2006)0392 (2006/2004(INI). Brussels
- Farah, M., Illes, J., Cook-Degan, R., Gardner, H., Kandel, E., King, P., Parens, E., Sahakian, B., Rootwolpe, P. (2004): Neurocognitive enhancement: what can we do and what should we do? In: Nature Reviews Neuroscience 5, pp. 421–425
- Ferrari, A. (2008): Is it all about human nature? The ethical challenges of converging technologies beyond a polarized debate. In: Innovation. The European Journal of Social Science Research 21/1, pp. 1-24
- Fiedeler, U. (2008): Stand der Technik neuronaler Implantate, Wissenschaftliche Berichte FZKA 7387 (März 2008). Karlsruhe
- Foddy, B., Savulescu, J. (2007): Ethics of Performance Enhancement in Sport: Drugs and Gene Doping. In: Ashcroft, R.E., Dawson, A., Draper, H., McMillan, J.R. (eds.): Principles of Health Care Ethics, Second Edition, pp. 511-519
- Franklin, S. (2006): Better by design? In: Miller, P., Wilsdon, J. (eds.): Better Humans? The politics of human enhancement and life extension. London, pp. 86-94
- Fukuyama, F. (2002): Our posthuman future: Consequences of the biotechnology revolution. New York
- Fuller, S. (2008): Research trajectories and institutional settings of new converging technologies (CIT6 No. 028334 KNOWLEDGE NBIC, Specific Support Action CIT6, Deliverable 1), http://www.converging-technologies.org/docs/Knowledge%20NBIC%20D1.pdf
- Garcia, T., Sandler, R. (2008): Enhancing Justice? In: Nanoethics 2/3, pp. 277-287
- Garland B. (2004): Neuroscience and the Law - Brain, Mind, and the Scales of Justice. (published by the Charles A. Dana Foundation and the American Association for the Advancement of Science). Washington, New York

- Garreau, J. (2005): Radical Evolution. New York
- Geller, A. (2006): Doc's designer defect baby. Disabled by choice. New York Post, December 22, 2006
- Gerlinger, K., Petermann, T., Sauter, A. (2008): Gendoping. Wissenschaftliche Grundlagen - Einfallstore – Kontrolle (Studien des Büros für Technikfolgen-Abschätzung beim Deutschen Bundestag 28). Berlin
- Gezondheidsraad (2006): Pre-implantatie genetische diagnostiek en screening. Den Haag: Publicatienummer 2006/01
- Giesen, K.-G. (2004): Transhumanisme et génétique humaine«. In: L'observatoire de la génétique 16, www.ircm.qc.ca/bioethique/obsgenetique/archives/archives.html
- Gordijn, B. Chadwick, R. (eds.) (2008): Medical Enhancement and Posthumanity (The International Library of Ethics, Law, and Technology 2). n.p.
- Greely H. (2004): Disabilities, Enhancements, and the Meanings of Sports. Research Paper No.82, Stanford Law School
- Greely, H., Sahakian, B., Harris, J., Kessler, R.C., Gazzaniga, M., Campbell, P., Farah, M.J. (2008): Towards responsible use of cognitive enhancing drugs by the healthy. In: Nature 456, pp.702-705.
- Green, R. (2008): Building babies from the genes up. In: The Washington Post, April 13, 2008, p. B01
- Grin, J., Grunwald, A. (eds.) (2000): Vision Assessment: Shaping Technology in 21st Century Society. Berlin et al.: Springer
- Grunwald, A. (2004): Vision Assessment as a new element of the Technology Futures Analysis Tool-box. In: Proceedings of the EU-US Scientific Seminar: New Technology Foresight, Forecasting & Assessment Methods, Seville, May 13-14, 2004, http://www.jrc.es/projects/fta/index.htm
- Grunwald, A. (2007): Converging technologies: Visions, increased contingencies of the conditio humana, and search for orientation. In: Futures 39/4, pp.380–392
- Grunwald, A. (2008): Auf dem Weg in eine nanotechnologische Zukunft. Philosophisch-ethische Fragen. Freiburg, München
- Guerra G. (2008): European Regulatory Issues in Nanomedicine. In: Nanoethics 2, pp. 87-97
- Habermas, J. (2001): Die Zukunft der menschlichen Natur. Frankfurt am Main
- Haisma, H., Hon, O. de (2005): Ziek, beter, best: van gentherapie tot genetische doping. In: Hilvoorde, I. Van, Pasveer, B. (eds.): Beter dan Goed. Over genetica en de toekomst van topsport. Diemen/Den Haag, pp. 120-137
- Haisma, H., Hon, O. de (2006): Gene Doping. In: International Journal of Sports Medicine 27, pp. 257-266

- Haldane, J. (1995): Daedalus or Science and the Future (A Paper Read to the Heretics, Cambridge, February 4, 1923). In: Dronamraju, K. (ed.): Haldane's Daedalus Revisited. Oxford, pp. 23-51
- Harris, J. (2005): Enhancements are a moral obligation. Wellcome Trust, London, http://www.wellcome.ac.uk/doc_WTD023464.html
- Harris, J. (2007): Enhancing Evolution: The Ethical Case for Making Better People. Princeton
- Hathaway, F., Burns, E., Ostrer, H. (2009): Consumers' Desire towards Current and Prospective Reproductive Genetic Testing. In: Journal of Genetic Counseling 18/2, 137-146
- Hayles, K. (1999): How We Became Posthuman. Chicago, London
- Heinz Awards (2007): Biomechatronics Pioneer Honored with $250,000 Heinz Award for Technology, the Economy and Employment, Press Release September 12, 2007, Pittsburgh, http://www.heinzawards.net/pub/recipients/pdf/Hugh_Herr_Press_Release_13th_Heinz_Awards.pdf
- Hellegers, A., McCormick, R. (1978): Unanswered questions on test tube life. In: America, (August), pp. 74-78
- Hennen, L., Grünwald, R., Revermann, C., Sauter, A. (2008): Einsichten und Eingriffe in das Gehirn. Die Herausforderung der Gesellschaft durch die Neurowissenschaften. Studien des Büros für Technikfolgen-Abschätzung Nr. 24. Berlin
- Hintum, M. v. (2009), Plaagstootjes tegen een al te dwangmatig brein; Deep Brain Stimulation Onderzoek van het AMC onder patienten geeft gemengd beeld van de effectiviteit van hersenbehandeling". In: de Volkskrant, January 24, 2009, Kenniskatern p. 5
- HoC S&T Committee (House of Commons, Science and Technology Committee) (2007): Human Enhancement Technologies in Sport, Second Report of Session 2006–07 (together with formal minutes, oral and written evidence), ordered by The House of Commons to be printed 7 February 2007, HC 67 [Incorporating 1506-i and ii, Session 2005–06], published on 22 February 2007. London: The Stationery Office Limited
- Hochberg, L., Serruya, M., Friehs, G., Mukand, J., Saleh, M., Caplan, A., Branner, A., Chen, D., Penn, R., Donoghue, J. (2006): Neuronal ensemble control of prosthetic devices by a human with tetraplegia. In: Nature 442, pp.164–171
- Hook, C. (2004): Transhumanism and Posthumanism. In: Post, S. (ed.): Encyclopedia of Bioethics (3rd edition). New York, pp. 2517-2520
- Huber, W. (2002): Der gemachte Mensch. Christlicher Glaube und Biotechnik. Berlin
- Hughes, J. (2004): Battle Plan to Be More than Well, http://transhumanism.org/index.php/th/more/509/

- Hughes, J. (2006): Human Enhancement and the Emergent Technopolitics of the 21st Century. In: Bainbridge/Roco 2006a, pp. 285–307
- Hughes, J. (2008a): Back to the future. Contemporary biopolitics in 1920's British futurism. In: EMBO reports 9 (special issue), pp. 59-63.
- Hughes, J. (2008b): Millennial Tendencies in Responses to Apocalyptic Threats. In: Bostrom, N., Cirkovic, M. (eds.): Global Catastrophic Risks. Oxford; pp. 73-89, Oxford
- International Theological Commission (2002): Communion and Stewardship: Human Persons Created in the Image of God. Vatican
- JASON (JASON Defense Advisory Panel) (2008): Human Performance, JSR-07-625, http://www.fas.org/irp/agency/dod/jason/human.pdf
- Joly, P.-B., Kaufmann, A. (2008): Lost in Translation? The Need for 'Upstream Engagement' with Nanotechnology on Trial. In: Science as Culture 17/3, pp. 225 - 247
- Joy, B. (2000): Why the future doesn't need us. In: Wired 8.04, http://www.wired.com/wired/archive/8.04/joy.html
- Jotterand, F. (2008): Beyond Therapy and Enhancement: The Alteration of Human Nature. In: Nanoethics 2/1, pp. 15-23
- Juengst, E. (1998): What Does Enhancement Mean? In: Parens, A. (ed.), pp. 29-47
- Kaku, M. (1997): Visions. How Science Will Revolutionize the 21st Century. New York
- Kalden, A., Beker, P. (eds.) (1993): Het perfecte kind: Kunstmatige voortplanting in Nederland. Hoogezand
- Kendall, T. & Klaassen, P. (2007): Interview with Dr. Tim Kendall, May 23, 2007 (unpublished)
- Kessler. R., Berglund P., Demler, O., Jin. R., Merikangas, K., Walters, E. (2005): Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. In: Archives of General Psychiatry 62/6, pp.617–27
- Khushf, G. (2005): The Use of Emergent Technologies for Enhancing Human Performance: Are We Prepared to Address the Ethical and Political Issues? In: Public Policy & Practice (E-Journal) 4/2, http://www.ipspr.sc.edu/ejournal/Archives0805.asp
- King Baudouin Foundation, Rathenau Institute (2004) Proceedings and Synthesis report: Connecting Brains and Society. The Present and Future of Brain Science: what is possible, what is desirable, International Workshop, 22/23 April 2004, Amsterdam

- Klöpping, W., Jonkman, A., Valk, P., Simons, M. (2005): Efficacy of Modafinil and Caffeine to Counteract Hypnotic Induced Sleepiness during Sustained Operations. In: RTO/NATO (The Research and Technology Organisation of NATO) (ed.): Strategies to Maintain Combat Readiness during Extended Deployments – A Human Systems Approach (Meeting Proceedings RTO-MP-HFM-124). Neuilly-sur-Seine, pp. 32-1 – 32-6
- Kluger, J. (2007): Rewiring the Brain. In: Time, August 30, 2007, http://www.time.com/time/magazine/article/0,9171,1657822,00.html
- Knorr Cetina, K. (2004): Beyond Enlightenment: The Rise of the Culture of Life. In: European Communities (ed.): Modern Biology & Visions of Humanity. Brussels, pp. 29–41
- Knorr Cetina, K. (2007): The rise of a culture of life. In: EMBO reports 6, S1, pp. 76–80
- Kopell; B., Greenberg, B., Rezai, A.R. (2004): Deep Brain Stimulation for Psychiatric Disorders. In: Journal of Clinical Neurophysiology 21/1, pp. 51—67
- KPMG et al. (2002): Aren't we all positive? A (socio) economic analysis of doping in elite sport. Prepared for the European Commission, Directorate General of Education and Culture, Section Sport
- Kurzweil, R. (2005): The Singularity is Near. When Humans Transcend Biology. New York et al.
- LaFleur, W. (2008): Enhancement and Desire: Japanese Qualms about Where Biotechnology is Taking Us. In: Journal of Law, Medicine & Ethics 36/1, pp. 65-72
- Lare, W. van (2007): Knoeien met genen: het gebruik van het middel Epo door sporters is kinderspel vergeleken met gendoping. In: Algemeen Dagblad, August 4, 2007, p. 10
- Lebedev, M., Nicolelis, M. (2006): Brain–machine interfaces: past, present and future. In: Trends in Neurosciences 29/9, pp. 536–546
- Lin, P., Allhoff, F. (2008): Untangling the Debate: The Ethics of Human Enhancement. In: Nanoethics 2/3, pp. 251-264
- Lösch, A. (2006): Anticipating the futures of nanotechnology: Visionary images as means of communication. In: Technology Analysis and Strategic Management 18/3-4, pp. 393–409
- Lynch, G. (2002): Memory Enhancement: The Search for Mechanism-Based Drugs. In: Nature Neuroscience 5, pp. 1035-1038
- Macer, D. (1994): Universal Bioethics and the Human Germ-line. In: Politics & Life Sciences 14, pp. 27-29
- Macer, D., Akiyama, S., Tan Alora, A., Asada, Y., Azariah, J., Azariah, H., Boost, M., Chatwachirawong, P., Kato, Y., Kaushik, V., Leavitt, F., Macer, N., Ong, C., Srinives, P., Tsuzuki, M. (1995): International perceptions and approval of gene therapy. In: Human Gene Therapy 6, pp. 791-803

- Maher, B. (2008): Poll results: look who's doping. In: Nature 452, pp. 674–675
- Malacrida, C. (2004). Medicalization, ambivalence and social control: mothers' descriptions of educators and ADD/ADHD. In: Health 8/1, pp.61-80, http://hea.sagepub.com/cgi/content/abstract/8/1/61
- Malsch, I. (2007): Human enhancement from different perspectives (revised second edition), access: www.nanoforum.org
- Marx, J. (1999): How Stimulant Drugs May Calm Hyperactivity. In: Science 283, pp. 306
- Mauron, A. (2005): The Choosy Reaper. In: EMBO reports 6 (special issue), pp. 67-71
- Mayberg; H., Lozano, A., Voon, V. McNeely, H., Seminowicz, D., Hamani, C., Schwalb, J., Kennedy, H. (2005): Deep Brain Stimulation for Treatment-Resistant Depression. In: Neuron 45, pp. 651—660
- McNally, E., Cambon-Thomsen, A., Brazell, C., Cassiman, J., Kent, A., Lindpaintner, K., de Faria, P., Niese, D.; Roscam Abbing, H., Solbakk, H.; Tack, H.; Tambuyzer. E.; Weihrauch, T., Wendel, E. (2004): Ethical, legal and social aspects of genetic testing: research, development and clinical applications. Brussels: European Commission
- Mehlman, M., Rabe, K. (2002): Any DNA to declare? Regulating Offshore Access to Genetic Enhancement. In: American Journal of Law and Medicine 28/2-3, pp.179-213
- Meisenberg, G. (2009): Designer babies on tap? Medical students' attitudes to pre-implantation genetic screening. In: Public Understanding of Science 18, 149-166
- Merkel, B., Boer, G., Fegert, J., Galert, T., Hartmann, D., Nuttin, B., Rosahl, S. (2007): Intervening in the Brain - Changing Psyche and Society (Ethics of Science and Technology Assessment Vol.29). Berlin, Heidelberg, New York
- Miah, A. (2002): Philosophical end ethical questions concerning technology in sport. The case of genetic modification. De Montfort University (PhD thesis)
- Miah, A. (2003): Be Very Afraid: Cyborg Athletes, Transhuman Ideals & Posthumanity. In: Journal of Evolution & Technology 13 (ejournal), http://jetpress.org/volume13/miah.htm
- Miah, A. (2006): Rethinking Enhancement in Sport. In: Bainbridge/Roco 2006b, pp. 301-320
- Miah, A. (2007): Genetics, Bioethics & Sport. In: Sport, Ethics and Philosophy 1/2, pp. 146-158
- Miller, P., Wilsdon, J. (eds.): Better Humans? The politics of human enhancement and life extension. London
- Minsky, M. (1994): Will Robots Inherit the Earth? http://web.media.mit.edu/~minsky/papers/sciam.inherit.txt

- Minzenberg, M., Carter, C. (2008): Modafinil: A Review of Neurochemical Actions and Effects on Cognition Neuropsychopharmacology 33(7), pp. 1477-1502
- Mitchell, C., Kilner, J. (2003): Remaking Humans: The New Utopians Versus a Truly Human Future, www.cbhd.org/resources/biotech/mitchell_kilner_2003-08-29.htm
- Moravec, H. (1994): Robots Inherit Human Minds, www.frc.ri.cmu.edu/~hpm/project.archive/general.articles/1995/RobotMind.talk.html
- Moravec, Hans (1999): Robot: Mere Machine to Transcendent Mind. New York, Oxford
- Moreno, J. (2006): Mind Wars. Brain Research and National Defense. New York, Washington
- Murphy, J., Laird, N., Monson, R., Sobol, A., Leighton, A. (2000): A 40-year perspective on the prevalence of depression: The Stirling County Study. In: Archives of General Psychiatry 57/3, pp. 209–15
- Nationaler Ethikrat (2005): Forum Bioethik: Auf dem Weg zum besseren Menschen? Der Einsatz der Medizin zur Steigerung körperlicher und geistiger Fähigkeiten (official transcript, May 21, 2005), Berlin
- Nebbeling, J. (2008): Transhumanist Philippe van Nedervelde: 'We will become managers of the mixing console of our brains' (Interview). In: Flux Magazine (Rathenau Institute) 1/1, pp. 21-23
- Neftel, K., Adler, R., Kappeli, L., Rossi, M., Dolder, M., Kaser, H., Bruggesser, H., Vorkauf, H. (1982): Stage fright in musicians: a model illustrating the effect of beta blockers. In: Psychosomatic Medicine 44/5, 461-469
- Nicolelis, M. (2002): Human-machine Interaction: Potential Impact of Nanotechnology in the design of Neuroprosthetic Devices aimed at Restoring or Augmenting Human Performance. In: Roco/Bainbridge 2002, pp. 251–255
- Nijholt, A. (2008): BCI for Games: A 'State of the Art' Survey. In: Stevens, S., Saldamarco, S. (eds.): Entertainment Computing – ICEC 2008 (7th International Conference, Pittsburgh, September 25-27, 2008, Proceedings), Berlin, Heidelberg, New York, pp. 225-228
- Nordmann, A. (n.d.): Ignorance at the Heart of Science? Incredible Narratives on Brain-Machine Interfaces, http://www.unibielefeld.de/(en)/ZIF/FG/2006Application/PDF/Nordmann_essay.pdf
- Nordmann, A. (2007a): If and Then: A Critique of Speculative NanoEthics. In: NanoEthics 1/1, pp. 31–46
- Nordmann, A. (2007b): Die Menschen von morgen, die Herausforderungen von heute. In: Technology Review (online), 21.12.2007, http://193.99.144.85/tr/artikel/print/100963
- Nordmann, A., Schummer, J., Schwarz, A. (eds.) (2006): Nanotechnologien im Kontext. Philosophische, ethische und gesellschaftliche Perspektiven. Berlin

- Normann, C., Berger M. (2008): Neuroenhancement: status quo and perspectives. In: European archives of psychiatry and clinical neuroscience 258, Suppl 5, 110-114
- NSCU (North Carolina State University) (2008): Survey Highlights Support For Nanotech In Health Fields But Disapproval Elsewhere. In: ScienceDaily, Nov 18 2008, http://www.sciencedaily.com-/releases/2008/11/081113100718.htm
- Nutt; D. J., Fone, K., Asherson, P., Bramble, D., Hill, P., Matthews, K., Morris, K. A., Santosh, P., Sonuga-Barke, E., Taylor, E., Weiss, M., Young, S. (2007): Evidence-based guidelines for management of attention-deficit/hyperactivity disorder in adolescents in transition to adult services and in adults: recommendations from the British Association for Psychopharmacology. In: Journal of Psychopharmacology 21/1, pp. 10–41
- NYU (NYU Langone Medical Center / New York University School of Medicine) (2009): Consumers Desire More Genetic Testing, But Not Designer Babies. In: ScienceDaily, January 26 2009, http://www.sciencedaily.com-/releases/2009/01/090126100642.htm
- O'Brien; L., Holbrook, C., Mervis, C., Klaus, C., Bruner, J., Raffield, T., Rutherford, J., Mehl, R., Wang, M., Tuell, A., Hume, B., Gozal, D. (2003): Sleep and Neurobehavioral Characteristics of 5- to 7-Year-Old Children With Parentally Reported Symptoms of Attention-Deficit/Hyperactivity Disorder. In: Pediatrics 111/3, pp. 554–563
- Okun; M.S., Green, J., Saben R., Gross, R. Foote, K.D., Vitek, J.L. (2003): Mood changes with deep brain stimulation of STN and Gpi: results of a pilot study. In: Journal of Neurology Neurosurgery and Psychiatry 74, pp.1584-1586
- Orland, B. (2005): Wo hören Körper auf und fängt Technik an? Historische Anmerkungen zu posthumanistischen Problemen. In: Orland, B. (ed.): Artifizielle Körper – Lebendige Technik. Technische Modellierungen des Körpers in historischer Perspektive. Zürich, 9-42
- Parens, E. (1998a): Special Supplement: Is better always good? The Enhancement Project. In: The Hastings Center Report 28/1, pp.1-17
- Parens, E. (ed.) (1998b): Enhancing human traits: ethical and social implications. Washington
- Parrinder, P. (1995): Shadows of the Future. H.G. Wells, Science Fiction and Prophecy. Liverpool
- Paschen, H., Coenen, C., Grünwald, R., Oertel, D., Revermann, C. (2004): Nanotechnologie. Forschung, Entwicklung, Anwendung. Berlin, Heidelberg, New York
- Paul, D. (2005): Genetic Engineering and Eugenics: The Uses of History. In: Baillie/ Casey (eds.), pp. 123-151
- PCB (U.S. President's Council on Bioethics) (2003): Beyond Therapy. Biotechnology and the Pursuit of Happiness. Washington
- Peters, T. (2002): Playing God? Genetic Determinism and Human Freedom. New York, London

- Plomin, R. et al. (1998): A quantitative trait locus (QTL) associated with cognitive ability in children. In: Psychological Science 9, pp. 159-166
- PMO (Pièces et Main d'Oeuvre) (2006): Nanotechnologies/Maxiservitudes. Paris
- Porter, R. (2002): Madness. A Brief History. Oxford
- POST (Parliamentary Office of Science and Technology) (2007): Better Brains. Postnote No. 285. London: Houses of Parliament
- Rafalovich, A. (2001): Psychodynamic and Neurological Perspectives on ADHD: Exploring Strategies for Defining a Phenomenon. In: Journal for the Theory of Social Behaviour 31/4, pp. 397–418
- Rapoport; J., Buchsbaum, M., Zahn, T., Weingartner, H., Ludlow, C., Mikkelsen, E. (1978): Dextroamphetamine: Cognitive and Behavioral Effects in Normal Prepubertal Boys. In: Science 199/4328, pp. 560–563
- Reason, R. (1999): ADHD: A psychological response to an evolving concept. In: Journal of Learning Disabilities 32/1, pp. 85–91
- Regis, Ed. (1990): Great Mambo Chicken and the Transhuman Condition. New York
- Repantis, D., Schlattmann, P., Laisney, O., Heuser, I. (2008): Antidepressants for neuroenhancement in healthy individuals: a systematic review. In: Poiesis & Praxis. International Journal of Technology Assessment and Ethics of Science. DOI: 10.1007/s10202-008-0060-4, published online 27 November 2008
- Reynolds, G. (2007): Outlaw DNA. In: The New York Times, July 3, 2007, http://www.nytimes.com/2007/06/03/sports/playmagazine/0603play-hot.html
- Riis, J., Simmons, J., Goodwin, G. (2007): Preferences for Psychological Enhancements: The Reluctance to Enhance Fundamental Traits. In: Journal of Consumer Research 35/3, pp. 495-508
- Roco, M., Bainbridge, W. (eds.) (2002): Converging Technologies for Improving Human Performance, http://wtec.org/CT/Report/NBIC_report.pdf
- Roco, M., Montemagno, C. (eds.) (2004): The Coevolution of Human Potential and Converging Technologies. Annals of New York Academy of Sciences 1013, New York
- Rodgers, M. (2006): Gene-doped athletes? Cool, say some readers. Not everyone thinks genetic modification is such a horrible idea. In: MSNBC.com,Technology & Science Innovation, http://www.msnbc.msn.com/id/11373554/
- Rovner, S. (2007): Molecules For Memory. Several companies are developing compounds that improve memory, but ethical issues abound. In: Chemical & Engineering News 85/36 (September 3, 2007), pp. 22-24, http://pubs.acs.org/cen/coverstory/85/8536cover2.html
- Rose, N. (2007): The Politics of Life Itself. Biomedicine, Power and Subjectivity in the Twenty-First Century. Princeton NJ
- Rose, S. (2006): Brain Gain. In: Miller, P. and Wilsdon, J. (eds.) Better Humans? The politics of human enhancement and life extension. London, pp.16-27

- Rosenwald, M. (2003): Can an electronic device replace damaged brain circuits? In: Popular Science (June 2003), http://www.popsci.com/scitech/article/2003-06/chip-ol-block
- Ruibal, S. (2005): A new tool to catch sports cheats: Test for gene doping could be breakthrough. In: USA Today, December 5, 2006, http://www.usatoday.com/sports/2006-12-05-gene-doping-test_x.htm
- Saage, R. (2007): Politik und Konvergenztechnologien in den USA. In: Leviathan 35/4, pp. 540-559
- Saage, R. (2009): Scientific-Technical and Normative Foundations of the New Man. In: Sic et Non 11/2009 (ejournal), http://www.sicetnon.org/content/phil/Scientific-Technical_and_Normative_Foundations_of_The_New_Man_Richard_Saage.pdf
- Sahakian, B., Morein-Zamir, S. (2007): Professor's Little Helper. In: Nature 450, pp. 1157-1159
- Saletan, W. (2005): The Beam in Your Eye. If steroids are cheating, why isn't LASIK? In: Slate (online), April 18, 2005, http://www.slate.com/id/2116858/
- Saletan, W. (2006a): Deformer babies: The deliberate crippling of children. In: Slate (online), September 21, 2006, http://www.slate.com/id/2149854/
- Saletan, W. (2006b): Better than sex: The growing practice of embryo genetics. In: Slate (online), September 16, 2006, http://www.slate.com/id/2149772/
- Sandberg, A., Bostrom, N. (2006): Converging Cognitive Enhancements. In: Bainbridge/Roco 2006b, pp. 201–227
- Sandberg, A., Savulescu, J. (2008): Neuroenhancement of Love and Marriage: The Chemicals Between Us. In: Neuroethics 1/1, pp. 31-44
- Sandomir, R. (2002): Olympics: Athletes may next seek genetic enhancement. In: The New York Times, March 21, 2002, section D, p. 6
- Santhanam, G., Ryu, S., Yu, B., Afshar, A., Shenoy. k. (2006): A high-performance brain-computer interface. In: Nature 442, pp. 195-198
- Savulescu, J. (2001): Resources, Down's syndrome, and cardiac surgery. In: BMJ 322, pp. 875-876
- Savulescu, J. (2006): Justice, Fairness, and Enhancement. In: Bainbridge/Roco 2006b, pp. 321–338
- Schlaepfe; T., Cohen, M., Frick, C., Kosel, M., Brodesser, D., Axmacher, N., Joe, A., Kreft, M., Lenartz, D., Sturm, V. (2008): Deep Brain Stimulation to Reward Circuitry Alleviates Anhedonia in Refractory Major Depression. In: Neuropsychopharmacology 33, pp. 368—377
- Scheufele, D., Corley, E., Shih, T.-j., Dalrymple, K., Ho, S. (2008): Religious beliefs and public attitudes toward nanotechnology in Europe and the United States. In: Nature Nanotechnology 4/2, pp. 91 – 94

- Schmorrow, D. (2002): Augmented Cognition: Building Cognitively Aware Computational Systems (DARPAtech 2002 Symposium "Transforming Fantasy", Anaheim, 29.7.-2.8.2002), www.darpa.mil/DARPATech2002/presentations/ipto_pdf/speeches/SCHMORRO.pdf
- Selgelid, M. (2007): An Argument against Arguments for Enhancement. In: Studies in Ethics, Law, and Technology 1/1, Art. 12, http://www.bepress.com/selt/vol1/iss1/art12, DOI: 10.2202/1941-6008.1008
- Selgelid, M. (2009): Afterword. Advancing Posthuman Enhancement Dialogue. In: Gordijn/Chadwick, R. (eds.): Medical Enhancement and Posthumanity. pp. 237-240
- Selin, C. (2008): The Sociology of the Future: Tracing Stories of Technology and Time. In: Sociology Compass 2/6, 1878–1895
- Sententia, W. (2006): Cognitive Enhancement and the Neuroethics of Memory Drugs. In: Bainbridge/Roco 2006a, pp. 153–172
- Shorter, E. (1997): A History of Psychiatry. From the Era of the Asylum to the Age of Prozac. New York
- Siep, L. (2006): Die biotechnische Neuerfindung des Menschen. In: Abel, G. (ed.) Kreativität (Akten des XX. Deutschen Kongresses für Philosophie). Hamburg, pp. 306-323
- Silver, L. (1997): Remaking Eden: Cloning and beyond in a Brave New World. New York
- Simonite, T. (2008): Nerve-tapping neckband used in "telepathic" chat. In: New Scientist, 12 March, 2008, http://www.newscientist.com/article/dn13449
- Singer, P. (2007): Why not let doping close the gene gap? In: The Japan Times online, 19.08.2007, http://search.japantimes.co.jp/cgi-bin/eo20070819a2.html
- Singh, I. (2002): Bad Boys, Good Mothers, and the "Miracle" of Ritalin. In: Science in Context 15/4, pp. 577–603
- Singh, I. (2004): Doing their jobs: mothering with Ritalin in a culture of mother-blame. In: Social Science & Medicine 59, pp. 1193–1205
- Singh, I. (2005): Will the "Real Boy" Please Behave: Dosing Dilemmas for Parents of Boys with ADHD, The American Journal of Bioethics 5/3, pp. 34–47
- Singh, I. (2006): A Framework for Understanding Trends in ADHD Diagnoses and Stimulant Drug Treatment: Schools and Schooling as a Case Study. In: BioSocieties 1/ 4, pp. 439–452
- Slob, M. (2007): Uitschakelbare dwang: hersenstimulering met elektrode helpt mensen met dwangstoornis. In: NRC Handelsblad, 28 Juli 2007, p. 16-17
- Slusser, G. (2009): Dimorphs and Doubles: J. D. Bernal's "Two Cultures" and the Transhuman Promise. In: Westfahl, G., Slusser, G. (eds.): Science Fiction and the Two Cultures: Essays on Bridging the Gap between the Sciences and the Humanities. Jefferson (forthcoming)

- Smits, M. and M. Schuijff (2009): Op weg naar de perfecte mens. In: Trouw, 17 January 2009, p. 39
- Staatssecretaris VWS (2006): Brief aan Voorzitter van de Tweede Kamer: Pre-implantatie genetische diagnostiek en pre-implantatie genetische screening. TK 97256 2
- Staman, J., Dijstelbloem, H., Smits, M. (2008): Afterword. In: Zonneveld, L., Dijstelbloem, H., Ringoir, D. (eds.), pp. 149-157
- Sterling, B. (2000): Olympic Engineering. In: The New York Times, September 16, 2000, section A p. 15
- STOA (European Parliament Scientific and Technological Options Assessment) (2006): Technology assessment on converging technologies. STOA 183, IP/A/STOA/SC/2005-183, Study by the European Technology Assessment Group (Authors: Berloznik, R., Casert, R., Enzing, C., Van Est, R., Van Lieshout, M., Versleijen, A.). Brussels, http://www.europarl.europa.eu/stoa/publications/studies/stoa183_en.pdf
- Stock, G. (1999): The prospects for human germ line engineering. In: Telepolis, http://www.heise.de/tp/r4/artikel/2/2621/1.html
- Stock, G. (2002): Redesigning humans: Choosing our children's genes. London
- Stock, G. et al. (1998): Engineering the Human Germline Symposium Report, http://www.ess.ucla.edu/huge/report.html
- Swedin, E. (2006): Designing babies: a eugenics race with China? In: The Futurist 40/3, pp. 18-21
- Swierstra, T. (2004): Van rechtvaardigheid naar het goede leven: Genetica en genomics in de dagbladen. In: Leschot; H., Willems, D. (eds.): De genetische ontrafeling van veel voorkomende aandoeningen. Maarsen, pp. 103-124
- TAB (Office of Technology Assessment at the German Parliament) (2004): Präimplantationsdiagnostik: Praxis und rechtliche Regulierung in sieben ausgewählte Ländern, Working Report 94 (author: Hennen, L., Sauter, A.). Berlin
- TAB (Office of Technology Assessment at the German Parliament) (2008): Konvergierende Technologien und Wissenschaften. Der Stand der Debatte und politischen Aktivitäten zu „Converging Technologies", Background Paper 16 (author: Coenen, C.). Berlin, http://www.tab.fzk.de/en/projekt/zusammenfassung/hp16.htm (online summary in English)
- TAB (Office of Technology Assessment at the German Parliament) (2009): TA-Project: Pharmacological and Technical Interventions for Improving Performance: Perspectives of a More Widespread Use in Medicine and Daily Life ("Enhancement"), http://www.tab.fzk.de/en/projekt/skizze/enhancement.htm
- Taylor, E. (2004): AGAINST 'ADHD is best understood as a cultural construct'. In: British Journal of Psychiatry 184, 9

- Temporary Committee on Human Genetics and other new technologies in modern medicine (2001): Report on the ethical, legal, economic and social implications of human genetics. European Parliament, Session Document A5-0391/2001
- Ter Gast, E. (2007): Biotech pioneers: A philosophical inquiry concerning the genetically engineered mouse. Radboud University (PhD-thesis)
- Ter Meulen, R. (2006): The enhancement of human capacities by medical and biological technologies. Will we be better off? (Inaugural Address, 29th of November 2006, Centre for Ethics in Medicine, University of Bristol), http://www.bris.ac.uk/ethicsinmedicine/currentevents/inaugural.html
- Ter Meulen, R., Savulescu, J, Kahane, G. (2009): Enhancing Human Capacities (forthcoming)
- Throsby, K. (2004): When IVF fails: Feminism, infertility and the negotiation of normality. Houndsmills
- Timimi, S. (2004): ADHD is best understood as a social construct. In: British Journal of Psychiatry 184, pp. 8–9
- Timimi, S. and 33 Co-Authors (2004): A Critique of the International Consensus Statement on ADHD. In: Clinical Child and Family Psychology Review 7/1, pp. 59–63
- Tirosh-Samuelson, H. (2007): Facing the Challenges of Transhumanism: Philosophical, Religious, and Ethical Considerations. In: Global Spiral, October 5, 2007 (epublication), http://www.metanexus.net/magazine/tabid/68/id/10169/Default.aspx
- Turner; D., Sahakian, B. (2006): Neuroethics of Cognitive Enhancement. In: BioSocieties 1, pp. 113–123
- Van den Berg, B., Marcoen, A. (2004): High Antenatal Maternal Anxiety Is Related to ADHD Symptoms, Externalizing Problems, and Anxiety in 8- and 9-Year-Olds. In: Child Development 75/4, pp. 1085
- Warwick, K. (2008): Cybernetic Enhancements. In: Zonneveld, L., Dijstelbloem, H., Ringoir, D. (eds.): Reshaping the Human Condition: Exploring Human Enhancement (published by Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network and the Parliamentary Office of Science & Technology). The Hague, pp. 123-131
- Wehling, P. (2008): Von der Schüchternheit zur sozialen Angststörung: Die Medikalisierung alltäglichen Verhaltens. In: Neue Zeitschrift für Sozialforschung 4 (forthcoming)
- Wezenberg, E., Verkes, R., Ruigt, G., Hulstijn, W., Sabbe, B. (2007): Acute Effects of the Ampakine Farampator on Memory and Information Processing in Healthy Elderly Volunteers. In: Neuropsychopharmacology 32, pp. 1272–1283
- Wiesing, U. (2008): The History of Medical Enhancement: From *Restitutio ad Integrum* to *Transformatio ad Optimum*? In: Gordijn, B., Chadwick, R. (eds.), pp. 9-24

- Williams, E. (n.d.): Good, Better, Best: The Human Quest for Enhancement. Summary Report of an Invitational Workshop Convened by the Scientific Freedom, Responsibility and Law Program American Association for the Advancement of Science; 1.2.2006, http://ww.aaas.org/spp/sfrl/projects/human_enhancement/pdfs/HESummaryReport.pdf
- Winner, L. (2005): Resistance Is Futile: The Posthuman Condition and Its Advocates. In: Baillie/Casey (eds.), pp. 385-411
- Wolbring, G. (2005): The triangle of enhancement medicine, disabled people, and the concept of health: a new challenge for HTA, health research, and health policy (HTA Initiative 23, Alberta Heritage Foundation for Medical Research). Edmonton, http://www.ihe.ca/documents/HTA-FR23.pdf
- Wolbring, G. (2008a): Oscar Pistorius and the future nature of Olympic, Paralympic and other sports. In: SCRIPTed. A Journal of Law, Technology & Society 5/1 (ejournal), pp. 139-160, http://www.law.ed.ac.uk/ahrc/script-ed/vol5-1/wolbring.pdf
- Wolbring, G. (2008b). Why NBIC? Why human performance enhancement? In: Innovation; The European Journal of Social Science Research, 21(1), pp. 25-40
- Wolfensohn, J. (2002): Poor, Disabled and Shut Out, http://www.globalpolicy.org/socecon/develop/2002/1203disabled.htm
- Zonneveld, L., Dijstelbloem, H., Ringoir, D. (eds.) (2008): Reshaping the human condition: exploring human enhancement (Rathenau Institute, in collaboration with the British Embassy, Science and Innovation Network, and the Parliamentary Office of Science & Technology). The Hague.
- Zwi, M., Ramchandani, P., Joughin, C. (2000): Evidence and belief in ADHD. In: British Medical Journal 321, pp. 975–976

# APPENDICES

In the following, we provide information on the two expert meetings which took place in the course of the project (Appendix 1), and present a report on the STOA workshop in the European Parliament (Appendix 2).

## 1. The Expert Meetings

Two experts meetings were held during the project, covering the issues of shifting boundaries, changing concepts, and the governance of human enhancement

The first expert meeting was held in Brussels on Thursday September 18, 2008. This meeting was entitled: *Shifting Boundaries, Changing Concepts: The Challenges of Human Enhancement to Social, (Dis-) Ability, Medical and Ethical Frameworks*. The meeting focussed on how human enhancement may change, or is actually changing, notions as "(dis-) ability", "normalcy", "therapy", "perfectibility", "impairment", "ableism", and related social en ethical frameworks and policies. The participants discussed some of the more philosophical and social questions which were raised in the last chapter of Deliverable 1. Before the meeting, all participants received a document in which influential positions on HE were compiled. This document also included an overview of the relevant results from Deliverable 1 and questions to be discussed in Brussels. During the meeting there was a rich discussion, which was not just limited to the questions listed in advance.

On Friday, October 17, 2008 a second expert meeting was held in The Hague. This meeting was organised on the basis of the first deliverable and the first expert meeting. The goal of this expert meeting was to discuss the governance of human enhancement with stakeholders. The broad range of HET was limited to two cases, pre-implantation genetic diagnosis (PGD) and deep brain stimulation (DBS), which were thought to be helpful in shedding light on the collective of HET. All participants received a document in advance which provided information about human enhancement, the STOA project, the meeting, and the questions to be discussed. In the morning, there were two sessions: one on PGD and the other on DBS, while the afternoon session was plenary and tried to translate the specific problems of regulating human enhancement into a general perspective.

### 1.1 Invited Experts

We would like to thank all experts for their invaluable contributions to the project:

Eva Asscher (University of Tilburg, Tilburg Institute for Law, Technology, and Society)

Stuart Blume (University of Amsterdam, Faculty of Social and Behavioural Sciences, The Innovia Foundation)

Rafael Capurro (European Group on Ethics, Stuttgart Media University, and Steinbeis-Transfer-Institut of Information Ethics)

Damiaan Denys (University of Amsterdam, Academical Medical Centre)

Helmut Dubiel (Justus-Liebig University Giessen, Institut für Soziologie)

Arianna Ferrari (Technical University of Darmstadt, Institute of Philosophy)

Loes Gabriëls (University Hospital Leuven, Psychiatry)

Nine Knoers (Radboud University Nijmegen Medical Centre, Department of Human Genetics)

Laurens Landeweerd (University College Maastricht and Postdoctoral Fellow TU Delft)

Mohammed Maarouf (University of Cologne, Klinik für Stereotaxie und Funktionelle Neurochirurgie, Zentrum für Neurochirurgie)

Ineke Malsch (Malsch TechnoValuation, Utrecht)

Ruud H.J. ter Meulen (University of Bristol, Centre for Ethics in Medicine)

Ursula Naue (University of Vienna, Institute of Political Science)

An Ravelingien (Ghent University, Dept. Philosophy and Moral Sciences)

Maartje Schermer (Erasmus Medical Center Rotterdam, Dept. Medical Ethics and Philosophy of Medicine)

Mariken Stoutmeijer (Ministry of Public Health, Welfare and Sports, Directorate Medicine and Medical Technology, Netherlands)

Clare Williams (Kings College London, Centre for Biomedicine and Society)

## 1.2 The First Expert Meeting

***Full Title***

Shifting Boundaries, Changing Concepts: The Challenges of Human Enhancement to Social, (Dis-)Ability, Medical and Ethical Frameworks

*Place and Date*

Brussels (Office of the Helmholtz Association of German Research Centres), Thursday, 18 September, 11.30-16.30

*Questions for Discussion*

The project team compiled a list of questions for discussion that it deemed most relevant for the further project work or for EU policy.

- How do you assess the state of the art in HET (science fiction, technology in the making, or already science action?), also specified with regard to various fields of HET?
- What would be the chances and risks of an increased use of any or a specific perspective of human enhancement in EU policy contexts?
- With notions of "human enhancement" recently included in policy documents, what could be a proper definition of human enhancement for policy purposes?
- To what extent, if at all, should EU policy-makers, medical professionals and ethicists stick to the distinction between therapy and enhancement, also with regard to social, medical and individual needs?

- Should the notions of "disability", "ability", "ableism", "health", "normalcy" be readjusted with regard to the topic of human enhancement, and if so, how?
- If you accept a notion of "disability" which accentuates social barriers and discrimination rather than corporeality, how do you perceive, and how would you conceptualise, the new tendencies in limb prostheses and physical HET in general (in particular with regard to new "ability divides", the "transhumanisation of ableism", and health policy)? How do you judge, in particular, our definition of human enhancement with regard to disability politics and health and disability policy?
- Which European or Western traditions of thought might be conducive to and which might obstruct the development and acceptance of HET?
- Do you see a need for any new restrictions with regard to HET, and which ethical and legal frameworks require re-evaluation in light of the perspective of human enhancement?
- Which lines or fields of R&D related to human enhancement would you recommend for increased funding?
- Which specific role do you see for the European Parliament within the context of human enhancement?

These questions were discussed during the meeting.

The meeting was structured in the following way: it started with a general statement by each participant on the topic of human enhancement, its conceptualisation, its ethical, social and political implications, and the state of the art in selected HET. Afterwards all experts were invited to comment on these statements. This was followed by a round of questions and answers on broader ethical and social issues raised by the perspective of human enhancement. The results of these rounds of discussion were taken as the basis for statements and discussions on policy issues related to human enhancement. Finally, overarching questions of science and technology governance and foresight were discussed with regard to the European context and the issue of human enhancement.

***Some Results of the Meeting***

There was consensus that with regard to human enhancement the central question is: what are the targets and goals of enhancements?

Broadly speaking, this relates to societal and political guiding visions and to ideological factors, anthropological concepts and fundamental values that shape science- and technology-related debates and activities and may lead to shifts in the definitions of such notions as health, (dis)ability, impairment, normalcy and therapy.

Genetic enhancement by way of germline engineering was discussed as an extreme option for human enhancement, a technique that was banned in France, Germany and other European and non-European countries back in the 1990s. Taking this example and referring to the pertinent bioethical debates since the 1980s, the experts considered broader ethical and societal aspects of the issue of human enhancement.

One expert proposed as basic categories of analysis the distinctions between individual and species enhancements on the one hand, and between reversible and irreversible enhancements on the other. Accordingly, the ban on genetic enhancement by way of germline engineering can be justified by reference to human dignity (metaphysical reason) and for the pragmatic reason that the consequences of modifications are not foreseeable, but at the same time may affect the human species as a whole.

In this context, the usefulness and limits of animal models were discussed. Referring to the vision to enhance animals, put forward by some proponents of radical human enhancement, several experts questioned whether animal models will ever be useful in the human enhancement context due to the subjective qualities of many enhancements.

With regard to the prospects of a species enhancement, some societal implications were also discussed: the vision of a society, for example, in which all children are born after in-vitro fertilisation was deemed highly unrealistic by several experts. However, another expert pointed out that it is far from clear that germline engineering is as inconsistent with other cultural traditions as it is with European traditions.

It became clear that a distinction needs to be made, at least with regard to the broader and more visionary aspects of human enhancement, between the enhancement of the species, with its eugenicist overtones, and the enhancement of individuals. Leaving aside the question of the feasibility of genetic enhancements of the species, there was consensus that an enhancement of the species is not suitable as a guiding vision, for historical, pragmatic and metaphysical reasons.

Turning to such new or envisioned "second-stage enhancements" (George Khushf) by means of human-technology interfaces (such as neuroelectric implants), the experts discussed the competing visions that have been expressed in the debates on such individual enhancements. It was pointed out that proponents of human enhancement, in particular, focus on actual and future means of cognitive enhancement as the best way to solve a variety of personal and societal problems. Referring to the NBIC initiative on converging technologies in the US, the experts discussed North American visions of a highly competitive "enhancement society" and of using HET to maintain US superiority, also relating this topic to the Lisbon Agenda.

While the experts concurred neither in their assessments of the state of the art in the pertinent HET nor in their views on the relevance of the NBIC initiative in the US, there was broad consensus that such visions might be conducive to a specific political shaping of the ongoing and emerging developments in second-stage HET. An alternative guiding vision for the development of HET, better suited to the European context, could be the improvement of, at the same time, individual well-being and social cohesion. This vision was approved by all experts.

However, in the discussion of societal visions and specific HET it also became clear that various challenges are raised by the perspective of human enhancement: firstly, it was pointed out that the discourse on HET often displays a technocratic and scientistic stance towards societal and individual problems, promising technological fixes and fading out social relations. Secondly, it was discussed how anthropological concepts and views on human corporeality shape the debate on and the goals of human enhancement.

Thirdly, the experts discussed to what extent highly speculative visions of HET, coupled with specific ideological framings of the debate, may have an impact on research policy and other policy areas.

Focusing on the example of so-called mood or emotional enhancement, the experts discussed the relations between social and individual factors in human enhancement. One expert argued that human enhancement could be contextualised within a medical framework in which all interventions are conceptualised as measures to help individuals to cope with society. Accordingly, when individuals suffer emotionally, due for example to their general shyness, their discontent with their body, or their nervousness in certain situations (e.g. stage-fright), we should not make an artificial distinction between therapy and enhancement, but should approve any effective measure to relieve their suffering and help them cope with society.

Other experts disagreed and pointed out that (i) such an approach would further the problematic tendency of a medicalisation of social problems, that (ii) in health policy, as in any policy field, we have to set priorities and that clearly therapeutic interventions should be prioritised, and that (iii), in a framework shaped by a radical perspective of human enhancement, the social "duty" to confirm to a norm would become a duty to fix yourself to the norm by technological means. While among these experts there was disagreement whether it would make sense to draw a line between therapy and enhancement, they concurred that such boundaries are shifting and that, for example, the road to an enhancement society could be paved by a further medicalisation of social problems and individual needs.

It was pointed out that some radical proponents of human enhancement not only argue, from a perspective of species enhancement, that there is a general "duty to enhance" oneself, but also characterise certain bodily structures as deficient and reduce "disability" to a problem that can only be solved by interventionist technological fixes. Such a "sad view of the human body", as one expert called it, was characterised as being based on problematic notions of normalcy. Moreover, it was argued that the human body is also reduced to data in the informational paradigm, while the complex interrelations of bodily and psychological processes are faded out.

Nevertheless, there was broad consensus that recent progress in brain research, neurotechnologies and other fields of R&D clearly demonstrates that there is potentially a new quality of interventions into the human mind and body. In this context, reference was made to Kant's distinction between a physiological anthropology, based on a scientific understanding and manipulation of the brain (which Kant characterised as fruitless), and a pragmatic anthropology, based on knowledge about the social sphere, the world, and human behaviour. We now appear to be on the verge of realizing such a physiological anthropology to the extent that there are at least new means of manipulating brain activities. Accordingly, even extreme visions, such as the NBIC initiative's vision of a new social technology based on new neurotechnologies and other converging technologies, deserve attention.

There was broad consensus among the experts that second-stage enhancements, particularly those based on new human-technology interfaces, should be assessed with a view to possible shifts in power relations.

It was pointed out that the persistent paradigm of control and domination of nature in Western culture, when "applied" to "human nature", might negatively affect certain European values, such as those expressed in the idea of Man created in the image of God or in the concepts of human dignity and autonomy.

While the "intuitive" rejection of interventions which go "under the skin" might often be to the point, the fundamental question appears to be how such HET might create new options for social and even remote control as well as manipulation of human beings.

Referring to the widespread critique of the highly speculative features of the debate and some political activities on human enhancement, the experts discussed the impacts of visions, far-reaching expectations and grandiose promises on research policy and society. Fields such as stem cell research, cancer and Alzheimer research, nanotechnology and artificial intelligence were characterised as strongly influenced by strategies of hype and hope.

It was pointed out that there appears to be a vicious circle, with policy actors eager for scientific and technological breakthroughs with high societal impacts and scientists making exaggerated promises.

In ethical, societal and political discourses, the speculative "if's" are not innocent, because they may serve to shape S&T in certain directions. The technocratic and scientistic speculations, in particular, appear to be conducive to the fading out of any risks which are not of a health-related or environmental nature.

Social risks, such as those related to shifts in power relations or the pathologisation of more and more bodily or mental traits, are peripheral to the discourse, which is reflected in the funding of "accompanying" ethical and social-scientific research on new technologies. In the view of several experts, the discussions and publicly funded research projects on HET still focus too often on highly visionary aspects and ignore or belittle ongoing developments in human enhancement-related pharmaceutical research, neurotechnologies and prosthetics. On the other hand, far-ranging visions have to be taken into account, because they can shape societal and technological futures.

Several experts also emphasised that the discourse on human enhancement is strongly influenced by an uncritical "faith in science" and that alternative visions of the future and proposals to solve societal problems are largely absent or neglected. When focusing on individual enhancements by technological means, we may fade out low-tech or no-tech measures such as improving school meals or creating information- and knowledge-rich learning environments. Moreover, the general public is confronted, as a bystander, with some specific imaginations in the modus of "hype and hope" only because they are ventilated by policy actors or members of the technoscientific elite. There is thus a need for alternative imaginations and societal visions related to S&T and more public participation.

In a similar vein, it was argued that an improvement of infrastructures should, in principle, take place prior to the funding of individual HET, so that people with special needs, including the growing population of elderly people, can choose how to realise their "social functioning". Again, it was stressed by several experts that the (necessarily vague) distinction between therapy and enhancement should be maintained for pragmatic reasons in a health policy context.

However, it was also pointed out that there are strong tendencies, particularly in "ageing societies", to redefine what is “natural” or “normal” and that, as long as there is no consistent modernisation of infrastructures, many people will look for new artefacts or even individual enhancements of their bodies to secure their place in society. Here we have to take into account societal changes which have, for example, profoundly altered the social roles and images of young and old people.

Moreover, one has to keep in mind that one and the same intervention may be an enhancement for one person and a therapy for another. There was broad consensus among the experts that the notions of health, well-being and disability have to be adjusted accordingly, taking into account conceptualisations which are well established in some political and social discourses, yet are still not in the socio-political mainstream.

Some experts argued in favour of making a distinction between therapeutic and non-therapeutic enhancements. The ambiguity of established concepts becomes evident when we consider a person born without arms, who is however healthy and not impaired and receives new prosthetic arms which may in the future allow him to perform at a superior level to persons with natural arms and may include species-untypical functions.

One expert argued that the root of many societal problems and of the conceptual vagueness in the debate on human enhancement may be the ideology of ableism in which preferences for certain abilities serve to discriminate social groups. It was argued that it is necessary to create a society in which the broadest variety of individual needs is taken into account, so that individual enhancements are a matter of real choice and do not become, step by step, socially mandatory.

While the meeting focused on broader ethical and societal aspects of human enhancement as well as on conceptual issues, the experts were also invited to make comments and proposals on policy issues and options.

Controversial or uncommented by other experts were the following statements: (i) for pragmatic reasons, the boundary between therapeutic and non-therapeutic interventions should be maintained; (ii) in the policy context and elsewhere, we should distinguish between therapeutic and non-therapeutic interventions into the human body; (iii) policy-makers should now act on the issue of mood enhancement (or “modulation of affective functioning”), considering, for example, the introduction of quality-of-life assessments in medical trials and a revision of drug policies; (iv) research on the potentially disruptive effects of HET from historical and broader scholarly perspectives should be more strongly funded, including research on anthropological concepts and European traditions of techno-visionary thought; (v) the rise of the HE perspective is based on the overall fetishisation of competitiveness, so the latter should be questioned as a core element of guiding visions, also in the EU context; (vi) EU research funding should be problem-driven and not focused on technological multi-purpose developments; (vii) given that concepts of human enhancement are already used in the European policy context (such as in the code of conduct for nano R&D), there is a need to clarify and consistently define and use the notion of human enhancement in this context, taking into account the full spectrum of stakeholders and by means of public participation.

Some consensual points were: (i) if a perspective or concept of human enhancement is used in a policy context, it is of fundamental importance to identify as precisely as possible the targets and the overarching goals of human enhancement; (ii) a perspective of human enhancement might be applied to a wide range of new or emerging science and technology fields and their related guiding visions (such as in nano- and regenerative medicine), even if these fields have hitherto been partly ignored in the recent debates on human enhancement on account of their explicitly medical character; (iii) when it comes to regulatory questions, specific applications (and not technologies) should be targeted, possibly supplemented by the definition of general principles for pertinent research funding and policy, or even by some general bans (for example in the military context); (iv) given their potentially disruptive effects on society, it is all the more important that the governance of HET starts early, includes all stakeholders and allows for public participation; (v) there is need for a guiding vision for the further development of research and technologies which are relevant in the human enhancement context and such a guiding vision should be based on a societal perspective which focuses on social cohesion and distributive justice as frameworks of individual choice; (vi) in research and technology policies, the vicious circle of promises and expectations should be broken in which excessive visions increasingly shape science-policy interactions, with the general public as astonished bystander; (vii) broadly speaking, in a policy context the perspective of human enhancement should be focused on ongoing and emerging developments, also in more or less explicitly therapeutic contexts (such as the use of drugs like Ritalin™ and Viagra™, or the development of more and more sophisticated prosthetics), and not on far-ranging visions. However, some policy problems may already arise today from anticipations that are not yet realistic, such as in the case of transhumanist and other pro-enhancement activists who attempt to get private or even public funding for highly visionary research; (viii) in case there is consensus in the future that certain forms of human enhancement that are generally accepted to be safe and in line with European fundamental values should be a matter of individual choice, there will be an even more urgent need to adjust all relevant technological and social infrastructures and processes to the broadest variety of individual needs, so that no individual is pressured to opt for HET. However, in a policy context, there are also some good reasons (such as the shifting distinction between therapy and enhancement, the proximity to eugenicist ideals, or the strong transhumanist influence in the discourse on human enhancement) to avoid the coupling of the concept of human enhancement with individual choice altogether.

***Our Conclusions***

The discussion exemplified that with the perspective of humane enhancement, as long as it is not rashly narrowed to certain concepts and as long as its highly problematic aspects (such as the proximity to eugenicist ideologies) are not ignored, new light can be shed on recent developments in science, technology and society, and their interrelations.

Obviously, the new HET and the related visions aggravate the tension between, on the one hand, established views of health, therapy, disability, normalcy and impairment and, on the other hand, more complex or encompassing conceptualisations of the relationships between individual well-being, equitable social structures and technoscientific innovations.

Given that the concept of human enhancement, which is already an established topic in ethical research, is slowly penetrating policy discourses, there is a need for a politically viable notion of human enhancement. If so, there are good pragmatic reasons to maintain the distinction between therapy and enhancement in a health policy context; from a societal as well as from a research policy perspective, however, the distinction between therapeutic and non-therapeutic enhancements may be more viable.

Such pragmatic and political questions appear to be most urgent, but the perspective of human enhancement is also a challenge for a variety of European traditions of thoughts and fundamental values. While societal discourse on new and emerging technologies should in no way be reduced to the issue of human enhancement, the perspective of human enhancement may prompt a re-evaluation of the interrelations of science, technology, society and the individual in the European context. If only some of the visions of second-stage HET are realised in the future, there will be a growing need for equitable social structures and, in particular, for sociotechnical infrastructures in which the diversity of individual needs and social demands are taken into account.

## 1.3 The Second Expert Meeting

***Full title***

The Governance of Human Enhancement: Exploring Regulatory Gaps and Wastelands

*Date and place*

17 October 2008, The Hague

*Topics of Discussion*

The second meeting aimed to explore and deliberate policy options for HET in the context of European R&D on such technologies, with a focus on pre-implantation genetic diagnosis (PGD) and deep brain stimulation (DBS).

In the cases of PGD and DBS there is neither lack of regulation, nor lack of debate. Current regulation, however, is bound to their limited medical practices, though their long-term impacts will probably transgress the medical domain. It is precisely these "regulative gaps" that were discussed during the meeting.

Our cases show that "regulatory wastelands" can be observed outside the current regulatory domains. The use of Ritalin™, for example, is controlled within the medical domain, but uncontrolled outside it. This tendency to extend the user options also characterises the other cases. In the case of PGD, we observed the trend of a widening of the allowed indication of its use. We also observed a trend towards medical tourism by potential parents living in countries that do not permit PGD on the genes the parents are searching for.

The following questions were discussed:

- Do you agree on our sketch of the characteristics and trends of the case? Can you add to this sketch?
- Which moral and politically relevant issues (with regard to Research Policy and Health Policy) come to the fore when considering the case? Do you agree on our inventory? Which elements are missing?
- Will current regulative institutions be adequate to weigh and address these issues? If so, why? Or do we perhaps need other or extra regulative mechanisms and institutions? Which regulatory gaps and wastelands do you observe with regard to the case?
- Where is there scope for interventions by governments? Where should Europe be in control? What should be left to the market? What should be left to nation states? Regarding risk and health assessment, what risks for health should be further regulated? Regarding research policy assessment, should research in human enhancement be steered and, if so, what directions in research should be encouraged, what directions should be discouraged? How should the research agenda of Europe be influenced? Regarding vision assessment: how can potential stakeholder preferences be articulated within these developments?
- On what issues should Europe formulate a broad Human Enhancement policy?

The overarching question was: what new dilemmas and questions arise in the context of human enhancement technologies that should be taken up either by national governments or by the EU?

***Some Results of the Meeting***

Preimplantation genetic diagnosis is often presented as a mere add-on to IVF. The experts of the PGD working group feel this to be a misrepresentation. The very fact that embryos are selected brings in new moral issues, Williams argues, as a choice has to be made.

Knoers points out that PGD was developed as an alternative to prenatal diagnosis (PND), the advantage being that no abortion is needed to prevent the birth of a severely handicapped child. The claim that PGS (preimplantation genetic screening) serves to enhance the success rate of IVF is incorrect. Williams says: "The actual data show it doesn't help." She adds that some centres still wield this argument in order to promote PGS to patients. Knoers is happy to report that this is not the Dutch practice: "The possibility is mentioned, but it is not offered as the best option."

How likely is it for PGD to develop into an enhancement technology? Several facts argue against this.

For one, PGD requires IVF, which is an invasive treatment. "It is complex and risky and no fun at all," as Hennen puts it. "The invasiveness is comparable to an abortion," Knoers says. "For one thing, the woman has to be hormonally activated." PGD is also disempowering: instead of being in charge of their own reproduction, couples come to depend on the medical profession. These factors make it unlikely that large numbers of fertile couples would ever turn to PGD for reproduction.

This is underlined by the fact that even IVF clients do not routinely take advantage of all that PGD has to offer. In the UK, PGD treatments are counted in hundreds, not thousands. Furthermore, in the months since the Dutch controversy over screening embryos for a familial breast cancer gene in the Maastricht academic medical centre, such screening has taken place five times, all told.

While the invasiveness of PGD is often underestimated, Knoers thinks its potential for human enhancement is generally much overestimated. "We will come to better understand the links between genes and characteristics such as intelligence, but never to the same degree we understand the monogenetic disorders that PGD has targeted so far. It's intrinsically impossible, as environmental effects will be much more relevant here." Hennen believes that media reports foster a belief in 'genetic determinism' that is scientifically outdated.

All present agree that by far the most effective way of having an intelligent child is the time-honoured 'technique' of choosing an intelligent partner. PGD will never even rival it. The famous 'designer baby' – a beloved cliché since the 1970s – is most unlikely to be brought about by PGD.

Even though deep brain stimulation is past its experimental stage and has now been applied to tens of thousands of Parkinson's disease patients worldwide, it is still "the last option", as Maarouf says. "If it is possible to treat patients with medicines instead of DBS, that is the thing to do," he adds, speaking as a surgeon who is "happy to help people by means of DBS to improve their life." The operation is not a simple one, though: "DBS requires eight hours of surgery."

What makes DBS a remedy of last resort is the serious drawbacks for the patients involved, as Gabriëls points out. Some of the patients feel their life has not even improved. In others, DBS simply doesn't work. She feels that media reports tend to overlook this, and even Internet forums where patients discuss their experiences overemphasise the successes.

Dubiel, who has first-hand experience of DBS as a method of alleviating the symptoms of Parkinson's, feels that, on balance, he is better off now than five years ago, before he had the device. He has experienced serious problems though, some of them entirely unexpected both to him and to physicians. One unexpected setback is that he finds it easier to talk with the stimulator off, but when he turns it back on, walking is more difficult than before. Another downside is the eeriness of the experience: "The reaction to the brain stimulus is a totally new condition, unrelated to any 'story about myself' and impossible to share with people without DBS." In all, he finds it extremely difficult to weigh up DBS's advantages against its disadvantages.

Gabriëls points out that even though DBS is, strictly speaking, a reversible technology – the device can be switched off – in a more profound way it isn't, because the 'eerie' experience that Dubiel referred to can never be 'reversed' in the sense of erased. This sheds a sobering light on the much-touted reversibility.

While it is agreed that DBS is a valuable technique for Parkinson's patients, there is considerable doubt about its experimental use as a treatment for depression.

DBS can undoubtedly have a mood-enhancing effect. But as Denys points out, "enhancing someone's mood is not the same as treating their depression." And Gabriëls, a psychiatrist, observes that "not being depressed does not imply happiness. In fact, some of the people I've treated for a major depression had been ill for so long that they were not happy at all when they finally had the clarity to realise what a mess their daily life had become." Maarouf is equally reserved: "Psychiatric cases are complicated. Can we really improve the life of these patients by using DBS?"

On a practical note, Stoutmeijer points out that treating an affliction as widespread as depression with DBS would entail huge costs. She also expects ethical issues to arise, since depression has a strong social component. Denys puts the discussion in perspective with a sobering figure: so far, only 50 people worldwide have received DBS for psychiatric purposes.

The discussions about PGD and DBS both led all present to realise that enhancement is not as straightforward a concept as it may seem. For one thing, many seeming enhancements prove to come at a cost. Gabriëls warns that memory enhancement, which is thought to be a potential effect of DBS, might in the longer run turn against the person, in that they may not evolve their natural learning capacity to the degree they might otherwise have. She also stresses that DBS has only been used on people with a severe condition. The effects of DBS on a healthy person are unknown.

Landeweerd, too, points out that some enhancements and 'disenhancements' may turn out to be communicating vessels. There is some evidence that a constantly improved mood may affect a person's cognitive skills; heightened intelligence may lower their social capabilities. Moreover, even unpleasant experiences can be useful, ter Meulen points out: "Nobody likes to feel guilty, but this emotion has great social value in making people conscientious." Deleting it, by whatever technological means, might be an enhancement from a short-term, individual perspective, but definitely not from a longer-term, social perspective.

The difference between therapy and enhancement can be extremely subtle. Blume gives the example of growth hormones: "In a short child, born to short parents, these would amount to enhancement, whereas the treatment would be a mere therapy if the child's parents are of average height." This is not to say that the difference should be done away with. Denys for one feels it is important to retain it, as does Schermer, both for medical and policy reasons. Ter Meulen on the other hand is "bothered" by the distinction, "the enormous watershed" as he calls it: "A lot of what is going on in the medical realm is really enhancement, especially when it comes to afflictions such as depression."

Might 'human enhancement' be a misnomer? Blume feels it is: "All technology is enhancement." Coenen agrees a more neutral term would be better, as "it would be less overshadowed by Superman fantasies". As a first suggestion, he offers 'personality-changing techniques'.

Human enhancement techniques enter our lives by the medical route. They first alleviate or cure some condition, thus legitimising their existence. Only afterwards do other applications arise which might be termed enhancement. Or they might not, for by redefining perceived human imperfections as medical problems, the use of a technique may be labelled therapeutic after all. This mechanism is called medicalisation.

As Landeweerd sums it up: "All except normalcy is a medical problem. And our definition of normalcy has become ever narrower."

Left unchecked, medicalisation can reach a point that would have been considered preposterous at an earlier stage. Stoutmeijer gives an example: "The Dutch Medicine Evaluation Board (CBG) recently discussed whether a Botox treatment should be recognised as a legitimate therapy for depression in people who feel their condition is caused by their wrinkles." Denys ironically offers an alternative treatment: "Why not send the depressed person on a holiday to Turkey?" Blume is not surprised: "Cosmetic surgery can easily be, and often is, justified by citing the patient's psychological suffering."

Once a technique is generally considered to be a therapy, new 'drivers' emerge. Media framing is one. Since reports tend to be long on impressively successful cases and possible future developments, but short on failures and psychological cost for the patient, media consumers get an overoptimistic idea of what therapies can achieve. And that is just reporting; marketing does its bit to convince potential clients (and physicians) of the technological wonders whose time has come or that are just around the corner.

All the information – some of it good, much of it not so good – has turned patients into very critical medical clients. "Some patients are very demanding," Gabriëls says. "They will put physicians under pressure to 'give them the chip', i.e. DBS, even if the diagnosis does not indicate the treatment."

This attitude can be seen as an excessive side effect of the strong, widely shared ideology of patient autonomy, which is in turn part of Western individualism. "In the case of human enhancement, this individualism is particularly strong," Asscher believes. "I think it is related to the historical eugenics trauma. That explains the strong qualms about selection you see in Europeans. As soon as you discuss what might be beneficial or not to the whole of society, you rub many people the wrong way."

Related to this, our society is obsessed with choice. "As soon as there is a choice," Landeweerd says, "the whole paradigm shifts and we feel everything should be chosen. The disappearance of 'fate' as something that just happens to occur puts severe pressure on the question of how to deal with life. At the same time, we underestimate how burdensome all these different options are."

Or maybe we just consider that 'burden of choice' as the price to pay for making the best of our lives. Blume quotes sociologists "who suspect that medicalisation is attractive to us because our society has become more competitive and more fragmented, with weaker social networks."

Once a technique has become a matter of routine, the opposite problem may arise: patients are no longer offered a neutral choice, but may be subtly channelled to accept what is being offered. For example, "Pregnant mothers in the UK often have to justify their decision when they decline prenatal screening," Williams says. There is agreement that pregnancy counsellors should be non-directive on this issue, and Knoers feels that, in the Netherlands at least, they are.

Hennen mentions another case of subtle pressure, with legal undertones: "Some doctors want women who refuse a test to sign a declaration to that effect, so as to pre-empt 'wrongful life' claims."

Does all of this mean that medical technology and especially its enhancement effects have such an unstoppable momentum that they will lead society down a slippery moral slope? "If you start enhancing humans your message is that human beings as they are now are in fact a mistake", Denys argues. And Gabriëls adds, "Moreover, you put people under pressure who do not want to be enhanced, but who feel they might need to in order to remain competitive."

"The slippery slope argument is seldom a strong one," Asscher asserts against this. "The first step generally doesn't imply the next." And "the argument assumes a specific direction, which is not necessarily correct," Landeweerd adds in support. "I hope you're right," Hennen voices his doubt.

Yet it would be false to think that patients are turning out in droves to benefit from every conceivable novelty, as the limited numbers of people opting for PGD show. Also, people refusing technological options do not seem to be ostracised: Knoers points out that a great number of people prefer not to have their unborn child tested for Down's syndrome, even though such prenatal screening has been possible for many years.

At the same time, it is expected that the number of conditions that can be detected through PGD will increase. Many of these will be less serious than cystic fibrosis or Duchenne's disease, to name two typical targets of today's screening. Even familial breast cancer, for which screening is now allowed in the UK and the Netherlands, has a mortality of well under 100%. There is no obvious percentage that justifies or fails to justify PGD. In other cases, mortality is not even the issue. Knoers mentions non-hereditary mental retardation, some forms of which will soon be eligible for embryo screening.

Williams contributes yet another complication: it is possible to identify and select out embryos carrying a recessive gene coding for a disease, even though this individual will not express it, i.e. will not itself have the disease. Such a decision would effectively impact not only on this individual, but also on future offspring. Should parents be offered that choice, or is that sliding down the slippery slope? "Not necessarily," Knoers replies. "I do think it would have to be quite a serious condition. I feel it would not be warranted with, say, haemophilia."

'Human enhancement' is a catchall term for very dissimilar technologies and even future possibilities. The closer one looks at any single technology, the more diverse its promises and risks turn out to be. As Landeweerd puts it, "There's quite a difference between somebody aged thirty who dreams of enhancement for cycling uphill faster and parents who wish to determine what their children will be like through PGD."

Also, the fine line between therapy and enhancement will have to be drawn differently, case by case, for each enhancement technology, Blume believes. So differently in fact, that he feels 'enhancement' is hardly a meaningful category – "for policy-makers, it will be a red herring." Still, with a case-by-case approach, a difficult question will be to define what a case is. "Is ART (artificial reproductive technology) a case? Is PGD one? Or is every particular gene you screen for a case? If you define 'a case' narrowly, then with every new technology, there's new regulation needed." Or should PGD, alternatively, be considered as a part of the wider case of genetic testing, as Hennen suggests?

Some countries, such as Belgium, the UK and the Netherlands, are more liberal in their admission of certain new medical technologies than others, such as Germany, Austria and Ireland. Other technologies, some of them experimental, may not be controversial, but require so much investment in expertise and equipment that hospitals in some countries prefer not (yet) to acquire them.

One consequence of this is that patients have to travel from one country to another for treatment. Sometimes they are referred to a centre of expertise abroad by their own local health system. Probably more often, they try their luck elsewhere on their own accord. "In Cologne, we have quite a few foreign patients, from Europe and from the Arab world," Maarouf says. "These are people who can afford the expensive treatment."

This 'medical tourism' is not unproblematic. "I dislike it," ter Meulen says. "Who's going to pay for it if the patients don't have the means? And who is going to do the aftercare when they get back home, far away from Cologne or wherever they were treated?"

Gabriëls remembers a telling case: "A Belgian neurosurgeon had operated on an African Parkinson's patient. But when the battery of the patient's brain stimulator ran out, nobody in his country could replace it, and he was as miserable as he was before." Yet she doesn't object to medical tourism in principle. "The patient's local health system should do the aftercare. The expertise centre where the surgery takes place should teach medical centres elsewhere how to do that." The follow-up usually requires much less sophisticated skills than the initial surgery.

What sort of regulation is needed for human enhancement technologies (regardless of whether PGD and DBS potentially are such technologies)? Policy-makers have to strike a balance between two somewhat contradictory objectives, Asscher thinks: "Of course, you want the regulation to be effective and enforceable. At the same, you want it to be flexible enough as to allow for future technological developments. I think the way forward is to have little 'hard law' and on top of that a licensing system that deals with all the specific cases."

Hennen sees a risk with such a legal case-by-case approach, however: "With every new development, patients will immediately clamour for swift application. The burden of proof then rests with the authorities; they have to explain why it may not be a good idea to put this new technology into practice. France has dealt with PGD in a different way. French law states that this technology can only be used to prevent 'serious diseases', or words to that effect. It is then up to the patient, or rather to the parents, to prove that a particular condition meets that requirement. Of course, you still get discussion, and there should be, but this law creates different dynamics from a case-by-case approach."

In the case of technologies with a human enhancement potential, there is a role for professional self-regulation. Gabriëls explains how the major centres of expertise in Europe and the United States concerning DBS have co-operated to write common guidelines. Similarly, doctors in the UK and the Netherlands perform PGD under an agreed set of principles. For each new case, they establish an advisory committee.

Yet there is general agreement that self-regulation can only do so much, and not only because the reimbursement issue has to be solved by other actors, particularly national governments and insurance companies.

For one thing, self-regulation won't stop the 'cowboys', i.e. the practitioners who will cater to a patient's every wish as long as there is money to be made. "They do not care for the respect of their colleagues working in public hospitals," Denys says. This practice is common in cosmetic surgery, but could easily spill over into other 'medical industries'. Stoutmeijer feels that there is no point in banning private clinics for, say, DBS, as she believes this will merely lead to illegal practices. "I think peer pressure is much more effective than legislation." "I know these people," Denys replies, "and I doubt it." Dubiel feels the same way, and adds: "If you want to regulate these practices, you will have to be quite exact and specific."

Denys has other reasons to look to the state for regulation, above and beyond professional self-regulation. "What if a doctor routinely does DBS and after a while things start going wrong? For instance, it turns out there is a surge in suicides among patients? There will be public outcry, of course. I want public regulation to protect the doctors." Ter Meulen and Gabriëls argue similarly.

What political arena should we turn to in order "to politicise the big issues", Smits asks, the ones that go beyond the nitty-gritty work of regulating particular cases; issues concerning no less than the direction of society. Hennen would like to appeal to parliaments to take these up. "Among other roles, parliaments should be the liaisons between policy-making and the public. By discussing the issues, they can clarify what is at stake."

Another part of the answer to Smits's question comes in a short discussion about regulation as a concept. "The word always seems to point to the government,' Stoutmeijer says. "Therefore I would prefer a different term, since I feel we [i.e. the Ministry of Public Health] are not the only relevant regulator." It is generally agreed that the government is not the only actor responsible for regulation. Therefore, helpful alternatives such as 'governance' and even 'organisational trajectory' are offered, as these would express more clearly that all stakeholders are to be involved in the process.

Returning to Smits's question about politicising the big issues, Schermer suggests "what is really needed is raising public opinion. Of course, regulation is a good thing for practical matters, but for the major questions like 'where society should be heading' regulation is just no option."

*In the course of the discussion, a series of regulatory gaps and wastelands are identified where rules are needed. These include the following:*

(i) Trans-boundary medical care: under what conditions should citizens of one country get their medical costs reimbursed if they travel to another country for medical treatment? Asscher feels this question is one for the EU, especially as "it is practical and not as value-laden as many others. I feel the 27 member states should be able to come to agreement." Moving from cost to care, it is recommended that centres of medical expertise which serve a large geographical area should train staff elsewhere, so that patients will receive adequate follow-up treatment not too far away from their homes.

(ii) Practical requirements: treatments should be organised according to specific requirements. "For instance, it should be compulsory to have at least a neurosurgeon and a psychiatrist to handle a case," Denys says. "These two should work together and communicate properly. They should follow a particular education programme where the surgeon learns to implant the electrode correctly and the psychiatrist learns to assess this particular group of patients. All of that should be regulated."

(iii) Registration: Gabriëls is convinced that "there are clinics that do not follow up on their DBS patients, and consequently do not report any problems that might pop up some time after the operation." She would like to see a "central registry where physicians would report on each and every one of these patients." Such a registry would facilitate a structured build-up of experience that is now lacking.

(iv) Orphan technology: some medicines are effective for treating such small groups of patients that companies cannot make a profit on marketing these so-called orphan medicines. This is probably equally true for certain applications of DBS, Schermer points out. European regulation should make sure these applications become available even though they are not profitable in economic terms.

(v) Specialisation: according to Maarouf, patients will be better off if fewer hospitals offer highly complicated treatments. "In Germany some 30 medical centres offer DBS treatments," he says. "This means that some surgeons have very few DBS patients each year, which is risky, for it is a truism that the more experienced surgeons operate more safely." Specialisation is therefore an objective that regulators should seek to achieve.

(vi) Suffering: there is much to be said for the conventional approach of defining conditions under which it is appropriate to perform a certain kind of procedure, Blume feels, adding, however, "that this should be coupled with a valid claim that the treatment targets a patient's suffering. We shouldn't just assume that, or ask the patient; we should look for some sort of proof." "The concept if suffering is important," ter Meulen agrees. "Maybe it should be left to committees made up of both professionals patients to discuss it."

(vii) New domains: human enhancement technologies are likely to be used in the military and maybe other non-medical domains, according to Gabriëls. Since these do not fall under medical regulations, special regulations are needed.

***The following challenges to regulation were discussed:***

(i) National differences: an important obstacle, as with so many European regulation issues, is the member states' variety in both their values and their institutions; their health care systems, in this case. Of course, European regulators have enormous experience in making arrangements that somehow allow for institutional differences. As for the value gap, ter Meulen points out that the British have a somewhat more gung-ho attitude to human enhancement than the slightly more wary continent. Still, he feels common ground can be found, based on shared values such as justice and solidarity.

(ii) Serendipity: the case of DBS clearly shows how new treatments with enhancement potential are stumbled upon in the course of standard therapeutic treatments, Schermer points out. While it is possible to regulate research projects, serendipitous discoveries cannot, by definition, be ruled out by whatever law or regulation. "

And is natural for scientists to want to follow up on their interesting findings." It is up to the medical-ethical committees, who already watch over DBS research, to look closely into whether such fundamental further research is justified.

(iii) Non-compliance: there is a twofold risk of rules not being observed: within the system, and outside it. Blume remembers how the Dutch Health Council recommended that the number of centres of expertise for cochlear implants be extended from two to four. However, since all academic hospitals wanted to be one of those two additional centres, every one of them started performing these implants, without waiting for government permission. A year later, the minister could only acknowledge that she was incapable of regulating which hospitals should be centres of expertise for this technology. The risk of non-compliance outside the system, which refers to the 'cowboys' mentioned earlier on, is of a different order. It will lead to unequal access to expensive treatments (though some participants take a more pragmatic view on this than most others) and may have spectacularly unsuccessful results. Prompted by the latter risk, chairman Frans Brom (Rathenau Institute) asks poignantly, "Do we really need to stop stupid people with too much money from buying ineffective dangerous things?" the 'ineffective dangerous things' being unproven medical or even enhancement treatments. Schermer describes these potential treatment consumers as "very rich and very bored. Some may even want to try out DBS, and not all physicians will be ethical enough to deny them the experience." After some discussion about Brom's question, the prevailing view seems to be that, for the sake of consumer protection, an attempt should be made to regulate all practitioners, including those outside the public medical system. Some participants add to this that such regulation also protects the ethical professionals against the reputation damage the 'cowboys' could do to novel therapies.

(iv) Acceptance of constraints: apart from non-compliance by the professionals, there is also a risk of non-acceptance by the public. Blume wonders, "What constraints on our free choice do we accept?" Apart from the invasiveness of many techniques, which could be considered an inherent constraint, there is the obvious cost factor: not all treatments are affordable for a public health insurance system. (Though some expensive treatments, such as selecting against embryos with genes coding for disorders, may in the long run be cost-effective, Asscher points out.) But is society capable of imposing constraints on individual choice for the good of the collective? Patients' claims, or parents' claims in the case of PGD, predominate in discussions on any medical progress, which makes it very difficult to impose constraints. The historical eugenics trauma adds to this. Yet certain constraints on what we can purchase might be both sensible and acceptable, Blume thinks. He draws a parallel with organ transplantation. While this is an almost universally accepted technology, most people draw a line at selling and buying organs. In principle, therefore, we do not feel that every technology that saves a person without harming anyone else is morally acceptable.

***Our Conclusions***

Two questions appeared to be particularly relevant:

Firstly, what is the added value of the concept of human enhancement when reflecting on issues of regulation and EU policy? In the discussion, we observed a peculiar contradiction of the fruitfulness of the umbrella term 'human enhancement' for addressing social issues. In terms of the cases, 'human enhancement' did not appear to be the most fruitful concept when discussing moral issues that arise at the level of the case. At that level, designer babies and mood enhancement do not make any sense. In other cases, however, such as Ritalin™, we see that enhancements have become a reality. But at the same time we agreed that there are big issues that transcend the level of the cases, such as medicalisation, equity, changing norms about normalcy, and the kind of society we want. When we discuss the specific cases, it appears difficult to get these broad, cultural and moral issues into view. We are in danger of losing sight of those broader issues if we focus only on the cases and dismiss the overarching concept of human enhancement. If so, how do we keep the big questions in vision?

Secondly, which regulatory wastelands are there to note, and what should be done about them? We can distinguish two types of wastelands, one of which emerges when discussing the cases: we talked about the uneven accessibility of the techniques, their risks, medical tourism, the agenda setting and funding of research, the relationship between professional and political standards – should not the professional standards be informed by public discussion? The other wasteland seems to be the lack of political arenas where we can politicise the big questions and bridge the gap between public opinions and the views of practitioners. How can we encourage those bridges, what kind of instruments are there? It was suggested to propose the establishment of a multidisciplinary working group on human enhancement, and the relevance of reflection on social issues in research funding (like in the funding programme on nanotechnology) was emphasised.

## 1.4 Our Conclusions of Both Meetings

In sum, participants of both expert meetings agreed that human enhancement is a real phenomenon, although it is not always, if at all, useful to label technologies or cases as "HET" or "human enhancement". However, similar or the same questions that transcend the individual cases can be recognised through all of the cases. These questions connect the cases to the Meta- or trend-level of human enhancement. The transcending questions are so far unanswered. The big, unanswered questions deal, for example, with our common understanding of normalcy, happiness and solidarity.

As with any other social trend, policy-makers should monitor and try to grasp what is going on in society with regard to human enhancement, so that, if necessary, a policy to respond to or prevent problems can be undertaken in good time. They should also be in a position to assess whether or not a reaction from the European or national parliaments is necessary. In the following, we list some reasons why we feel the EU should respond to the developing HET and present some ideas for action and with regard to strategic options.

To a certain extent, HET are already being developed and used today. They potentially have a huge impact on society, but the main questions relate to the health care systems that are regulated on the micro-level (and per case) by the member states. At the moment, there is no unity in the regulations across the EU, because every country forms its own regulation. Given the European Internal Market (especially the free movement of people and the freedom to provide services) and the new directive on cross-border health care that is being prepared, this means that the national health care systems will be put under pressure to allow what is allowed elsewhere, or that people will travel to another country to be "treated" or "enhanced". This will force up health care systems costs. It also puts strains on solidarity if such "treatments" or "enhancements" are only accessible for the rich.

Moreover, the EU is already funding a lot of research on potential HET, some of which could lead to undesirable consequences. Such R&D should not be uncritically funded, and the role of far-reaching promises and expectations, which have created a kind of vicious circle in research policy, should be discussed more intensively. Guidelines and criteria are needed on what to fund and what not. Research proposals need to serve socially desirable goals, and this also requires, as participants of both expert meetings emphasised, broad (European) deliberation and reflection on the regulation of possible HET and on the fundamental normative and societal aspects. At the moment, however, we do not even have a clear picture of how Europeans think about "human enhancement".

## 2. The STOA Workshop in the European Parliament

The STOA workshop "The New You: Smarter, Stronger, Faster and Better? A European Approach to Human Enhancement" took place in Brussels at the premises of the European Parliament in Brussels on 24 February 2009. The workshop was held to conclude the Science and Technology Options Assessment (STOA) project on the influence of human enhancement in the EU and to discuss policy options that the EU could take towards human enhancement. The workshop addressed reasons why the EU should address human enhancement, as well as policy options for EU involvement. Around forty participants attended the meeting, representing various research institutions, universities, advisory councils, non-governmental organisations and government bodies, including the European Parliament and the European Commission. The workshop was organised by the Institute of Technology Assessment and Systems Analysis (ITAS) and the Rathenau Institute.

### Introduction

Dorette Corbey, Member of the European Parliament (MEP) and Member of the STOA Panel, welcomed participants to the meeting. She highlighted the many controversies surrounding human enhancement, and the need for a consolidated EU approach.

Martijntje Smits, Rathenau Institute, provided an overview of the issue. "Human enhancement," she said, "isn't new in itself. Humans have been enhancing themselves since prehistoric times. What makes human enhancement different today is the wide variety of *technologies* that are used to *enhance* many different aspects of human functioning."

These technologies, as she pointed out, range from psychopharmacology and other pharmaceutical agents to cosmetic surgery, and from pre-implantation genetic diagnosis to gene therapy and cybernetics.

Generally speaking, human enhancement is aimed at four different domains: cognitive enhancement, mood enhancement, bodily enhancement and life span enhancement. "Human enhancement is not directed at improving society, education or social systems," Smits emphasised, "but it is aimed at enhancing the individual body. That explains both the hype and the controversies surrounding the issue."

While most technologies come up within the reign of the medical world, some are not intended as medical treatments, but as instruments to 'go beyond the normal'. Smits cited the example of Ritalin™, a drug prescribed for attention deficit hyperactivity disorder (ADHD), which is sometimes used by 'healthy' people to enhance their concentration and cognitive performance. Similarly, deep brain stimulation, a treatment used for Parkinson patients, could also be effective as mood enhancement. Smits: "Most examples of human enhancement have these two different faces." Acceptance is increasing, while taboos are disappearing quickly, for instance in the case of cosmetic surgery. Many of these developments take place outside of the traditional medical domains.

Human enhancement, as Smits pointed out, is not driven by traditional biopolitics, but rather by individuals' sense of self-determination. As Western society is based on liberal principles, people are entitled to make their own sovereign decisions. However, from a social stance, human enhancement raises collective concerns as well.

Many of these are as of yet unknown, said Smits, but they will likely relate to health budgets, accessibility of health systems, solidarity between citizens, a shift in the boundaries of what is 'normal', and a shift from free choice to moral duty.

"Why should the EU bother?" asked Smits. "Currently, the EU has no platform for monitoring and discussing human enhancement. At the same time, these issues touch upon matters that have relevance at the EU level, such as health budgets, research policies, and economic issues. Difference between member States will likely pose problems in the future. In short, there is a need for an EU-wide normative framework for human enhancement issues."

Smits outlined the five potential approaches proposed by ITAS and the Rathenau Institute, ranging from a total ban to a *laissez-faire* approach. "These two extremes are neither realistic nor manageable," said Smits. In practice, as she concluded, the best option will likely be one of the other three: a reasoned pro-enhancement approach, which implies that the EU should fund human enhancement research; a restrictive approach, with the precautionary principle as guidance; and a case-by-case approach.

### Keynote Presentations

Andy Miah, University of West Scotland, elaborated on the implications of a reasoned pro-enhancement approach. "The myth is that approaching human enhancement equals accepting every technology," he said, "and spending all day thinking about how to enhance ourselves. In fact, the way I see it, we are moving from a position of a 'genetic lottery' to 'we can affect our lives by choice'."

Miah acknowledged the ethical difficulties of examples such as Ritalin™, PGD and anti-depressants. "Certain conditions are indeed being medicalised, and certain societal developments take place out of the reach of the scientists involved. But the distinction between medical and non-medical cases can certainly be refined."

Human enhancement, he suggested, can lead to the transformation of social categories and concepts, and change people's ability to participate in activities or social processes. "I envision a shift from disability to enhanced ability," he said. "Previously 'disabled' people will be able to participate in the regular Olympics, rather than the Paralympics. Some prosthetics already allow amputees to run faster than people with legs."

Miah identified three categories of human enhancement technologies. First, there are those for which a reasonable case can be made for their use. These technologies aim at engineering resilience, enabling us to live in the world we are in. Second, there are technologies of contested value, such as certain types of cosmetic surgery. And third, there are radical human enhancement technologies, which aim to extend the upper limits of human characteristics, such as height, health span and life span.

However, as Miah cautioned, this division is not as straightforward as it may seem. PGD, for instance, is a technology that can fall within more than one of these categories. If we are trying to eradicate certain serious, hereditary diseases, the technology may be in the first category, but it may also be used to select for traits that are unrelated to disease. In that case it may be a third-category case.

PGD, said Miah, may ultimately become PGS: pre-implantation genetic selection. It may not only be used for selecting out genetic diseases, or even for selecting for preferred characteristics, such as sex. It may become a means of selecting healthier embryos, for instance with a better lung function. And the final step, as Miah speculates, could be to create transgenetic or chimeric embryos, combining DNA from different species.

"We are beings who pursue the accumulation of biocultural capital by means of exercise, diet, fashion," concludes Miah. "Adopting a principled approach to permitting human enhancement would mean allowing people, as far as possible, to enhance their biocultural capital. It would mean to view the human body as an unfinished work. The challenge lies in developing effective mechanisms of generating and fostering public confidence, promoting an increased level of upstream engagement in the topic, and dispelling some of the myths on what human enhancement may involve."

Roberto Mordacci, Università Vita-Salute San Raffaele, Italy, discussed the implications of a reasoned restrictive approach, drawing an outline of a conceptual framework to address human enhancement in a normative way. "In practice, there may not be all that many differences between the three approaches," he noted, "but my position will look rather more restricted."

He challenged participants to think of human enhancement in the perspective of public reason. This means first of all, as he pointed out, that human enhancement is political rather than metaphysical: "It is about the way we *do* things, not about the way we *are*. It is a practical perspective." Secondly, human enhancement is aimed at improving the human *condition*, not human *nature*. It can be regarded as a question of equality, ensuring freedom and integrity of individuals.

Finally, it can provide a framework for 'justice as fairness' in health issues, which is already commonplace in political and moral debates in philosophy.

Mordacci then elaborated on the human condition and the principle of respect. He cited the philosopher Kant, who identified what people, ultimately, desire most: to live meaningfully and treat each other with respect. "But what do we *mean* by respect, and by meaningful? What practices make respect effective, and how and when must people be defended against 'instrumental use'? Isn't respect also to help people in fulfilling their goals?"

In the case of human enhancement, as he explained, this would entail considering people's goals as valuable to them, and asking if and when human enhancement can be an act of mutual respect. "To do that, we need a common, not-definitive but general understanding, a framework, of the human condition."

As a starting point for such a framework, Mordacci highlighted five dimensions of the human condition which we tend to consider fundamental for our self-respect and mutual cooperation:

- a recognisably human body;
- a naturally unrestricted desire: there is no limit to what we can desire, only to what we can achieve;
- a complex theoretical and practical rationality, which distinguishes us from most animals;

- freedom of the will, although this is disputed at the practical level; in political and ethical issues we start from the premise that we are free and we cherish that freedom; and
- equal dignity

Based on these five dimensions, Mordacci argued that a general principle for assessing human enhancement might be that a technology or treatment aiming at human enhancement can be permitted if does not:

- intentionally disfigure the human body;
- intentionally restrict the width of human desire, for instance create a person whose only desire is to run;
- impair the exercise of human rationality, for instance by limiting our ability to consider different aspects of an argument;
- impede the human ability to choose freely; or
- violate the equal dignity of individuals, in other words, generate discrimination or unfairness.

Tsjalling Swierstra, Universiteit Twente, The Netherlands, discussed the principles and practicalities of a case-by-case approach. "Any approach," he stated, "should start from the perspective of techno-moral change. Technology and morality influence each other. Technology is not predestined, but influenced by things such as values."

Europe, as he underlined, should not passively follow the trajectory defined by the most powerful technology actors, nor should it impotently protest moral change. "Europe should aim for techno-moral learning," Swierstra suggested. "Answers influence each other."

The most important requirement, he continued, is to accept contingency. In a technological world, there are fewer and fewer natural 'givens'. Technological progress, for instance, is not a given, so the perception that 'it is no use protesting' is invalid. "Morality is not a given either, although it is pragmatically reasonable to be on the conservative side."

The answer to the question how to proceed lies in experimentation, according to Swierstra. Europe could create niches for (reversible) techno-moral experimentation. Local experiments could induce global experiences. He said legal regulation is to be expected on so-called HES values: health, environment and safety values. "There is also the issue of negative freedom," noted Swierstra, "for instance if my employer forces me to enhance myself."

"There is a gap between blueprint technology and technology-in-practice," he continued. "Expect unexpected costs, such as health costs." The debate, he argued, is as much a political struggle as an ethical debate. He favoured moratoria rather than absolute bans. After all, as soon as the technology improves, some side-effects can perhaps be avoided, and the technology deserves to be re-evaluated.

Swierstra pleaded for thought experiments to enhance discussion and decision-making. "Stimulate the techno-moral imagination by providing rich descriptions," he said. "Science fiction should be complemented by 'morality fiction': what is a good life? What is a good society?

How much responsibility or accountability is good for a human being or for society?" To promote this kind of discussion, Swierstra suggested organizing deliberative forums including 'pro' and 'contra' voices.

In conclusion, Swierstra dismissed the notion of regulation on good life issues, and said defining 'the good society' is in the end a political issue. "In any case, the basic arguments underlying diverging positions should be communicated widely."

### Discussion

In the ensuing discussion, participants addressed various moral issues regarding human enhancement, including the justification for the current efforts to stimulate debate and develop policy, and human enhancement in relation to issues such as tolerance and acceptance.

"I have a moral question," said one of the participants. "How can Western civilisation justify driving the science agenda in this field while there is still hunger, and basic diseases aren't treated? Why not make pills that stimulate compassion, and diminish greed and selfishness?" Another remarked that many of the controversies stem from current societal practices. "If we were more cooperative, acceptant and tolerant, there wouldn't be any 'problem' with people who are 'different', and human enhancement would not be so problematic. Accept diversity!" It was also noted that it makes a profound difference if one is forced by social pressure to opt for human enhancement, or if one chooses human enhancement on an individual basis to widen one's own "space of possibilities and experiences".

Tsjalling Swierstra acknowledged the validity of these interventions, but noted that human enhancement *is* happening, and *is* touching upon fundamental values. He said that this creates the need to address the issue now, at the political level. "And several efforts have already been made to make the agenda more social," he added. "But do we really want to make people less greedy and more compassionate? If we can, we can also do the reverse! In the end, the question is how to deal with accountability."

Martijntje Smits elaborated on why human enhancement should be on the EU's political agenda at all, and why now. "Human enhancement is not just some goal of radicals, but it is already a trend that is here now, with all the ethical and moral issues involved," she stated. "Cases such as Ritalin and PGD are already shifting the borders of what is normal and what is healthy. They already put a pressure on health systems. At least we need to take a look at the developments, and identify the patterns and categories of human enhancement."

Andy Miah also underlined this need, citing a quote from Mahatma Gandhi: "First they laugh at you, then they ignore you, then they fight with you, and then you win." One of the bigger challenges, as he noted, is how to develop a culture of experimental research in the field of enhancement. "And part of that is trying to develop a value of acceptance of enhancement," he said. "The difficulty is that there is currently no cooperation on this issue. Perhaps this will change if the accessibility of scientific literature increases, for instance if more journals become open-access, and if we develop the value of sharing research in general."

One participant highlighted a recommendation issued by the US National Science Foundation, which was 'launch and learn', in other words, these issues should be talked about in schools and universities. This would be the only way to mobilise a larger part of society to develop informed opinions. Another participant drew attention to a Swedish report on the public opinion on human enhancement. "In general people were pretty sceptical," he said, "but when they were asked whether they supported human enhancement if it were used to help others, like helping doctors to perform better, acceptance suddenly increased."

It was noted that the discussion seems to be grounded in rationality, albeit from an ethical and philosophical point of view. Isn't the actual debate on human enhancement also driven by emotion? "Ration and emotion are intimately intertwined," answered Roberto Mordacci. "We elaborate our views at the cognitive and intellectual level. Even when taking decisions that are emotion-driven, we always require some understanding and background. But the ability to perceive the desire and rationality of the other is of course relevant. Desire and rationality are a mix, however, not separate spheres."

Discussion also centred on the need for a better definition of human enhancement. "We all know that we are not *really* talking about coffee or aspirin here," said one participant. "We need to address that issue before we can talk about regulation. What do you want to regulate?" Another, however, felt that ten years of research have yielded many insights into what human enhancement is, and now the time has come to regulate it. "That is why we need this kind of experimentation now," he said. "It is not about cups of coffee, but about defining 'selves'. The real challenge is to have some kind of common biopolitics."

Participants also addressed whether a recognisably human body is really needed for someone to have self-respect. Mordacci responded that 'a recognisably human body' is a vague principle. "Respecting each other as humans does not mean that we won't respect each other if we *don't* look like humans," he said. "Scientists involved in human enhancement, however, are responsible for the fact that people can still recognise *themselves* as human."

## Plenary Debate

In the afternoon, participants engaged in a more in-depth discussion of the issue. This debate was moderated by Jan Staman, director of the Rathenau Institute.

### *Human dignity*

Jorgo Chatzimarkakis, Member of the European Parliament and Member of the STOA Panel, introduced the discussions. His starting point was that there is a need for and an interest in a European policy framework. He also called for increased public involvement in these developments, and for better communication between science and policy. "We politicians need to know what is possible, if we want to be able to make valid decisions," he said. "Do we want enhancement tourism? Is there a red line beyond which we should not tred? And if so, is there a basis for that red line? Are there certain European values that we have to respect? Is there a toolbox? What is ethically possible on the basis of our European values?"

Roberto Mordacci drew attention to the EU Charter of Fundamental Rights, which includes provisions on bioethics and the values of medicine and biomedicine. "This declaration is useful in this regard," he said. "In any case, human dignity, autonomy and integrity are definitely shared values in the European tradition. Frame these concepts in policy, not in the metaphysical question of what is human." Bert-Jan Heusinkveld, Lindeboom Institute, The Netherlands, disagreed, arguing that the metaphysical question should be on the agenda, not so much as to be discussed, but rather to make clear that everyone starts from a particular philosophy of life: "Although there are shared values, the normative framework we need is one that gives criteria, which can be valued differently, depending on the various philosophies of life."

"Suppose I'm a lorry driver," said Jorgo Chatzimarkakis. "I have problems concentrating on long hauls. What I need is a chip in my brain to keep me alert. Otherwise I suffer in my job. And that is against my dignity." But what *is* dignity, he added immediately. Where is the limit?

Human dignity, replied Mordacci, depends on one's self-perception and the perception of others. "We often assume that we judge people with dignity regardless of how well they perform in their job, or how they look. But of course there are certain cultural and social conditions that create the basis for discrimination."

"If we look at the case of the lorry driver," said Klavs Birkholm, Danish Council of Ethics, "there may be another issue. If he gets his chip, his employer would say: then the other lorry drivers should also have a chip. And perhaps the lorry drivers with chips in their heads would get more pay. Social and economic pressure is one of the ethical dilemmas." And then there's the question of privacy, he said, for instance relating to technologies that allow people to see through things.

Marcel Zuijderland, philosopher and publicist, questioned the need for a definition of dignity. "Isn't it more important that every individual has his or her own notion of dignity, and is allowed to pursue that?" Apart from that, as he said, social pressure isn't necessarily a bad thing. Our society as a whole depends on certain kinds of social pressure, such as the pressure to learn how to read. Reacting to this argument, Roberto Mordacci said: "See, now you have given a definition of human dignity: the ability to make a choice for yourself."

Other participants joined Zuijderland in his question of whether it is necessary to define human dignity. Participants debated defining human dignity in terms of human conscience instead, given the fact that 'dignity' may vary with cultural and other circumstances. "When looking for red line, this could be important," said Marc Roux, guest editor of *Re-public*, Athens. "Human conscience may be something more universal."

Anders Sandberg, Oxford University, said this values discussion should be supplemented with additional scientific facts, calling for increased long-term research into the potential consequences of human enhancement.

***A red line?***

Antonio Francesco Maturo, University of Bologna, expressed concern that human enhancement will lead to individualisation of social problems.

"Obesity, for example, is now linked to certain genetic factors," he said, "and solutions are offered along these lines. But according to sociologists, obesity is a socioeconomic problem: poor people are the ones that are more likely to become obese." In addition, as he highlighted, corporations tend to influence the public perception of what is normal versus what is pathological, often out of economic interest. "The enhancement rhetoric should not divert our attention away from social problems. Science should be used to combat inequalities, rather than reinforce them. Moreover, today's enhancement might become tomorrow's disease of tomorrow, and what is perceived as a plus today may be seen as compulsory tomorrow."

Tsjalling Swierstra said he has little hope for establishing a red line. "Past experiences do not necessarily guide us into the future," he said. "Let's look at the case of the lorry driver again. When you introduce new technologies, you redistribute responsibilities. The sleepiness may have been caused by the driver's chair being too comfortable. Or perhaps he himself is to blame for the sleepiness? Or is it the employer who makes him work too hard? In fact, there is a risk that chip will take social responsibility away from the employer and/or from the driver. Do we really want to do that?"

Miriam Leis, TNO – Innovation Policy Group, noted that there already seems to be considerable public interest in products with enhancing effects. Many products, especially ones with natural ingredients, are advertised with enhancement properties, although much of it is not scientifically evaluated. She proposed a more practical approach: drafting regulation "that avoids unsafe procedures and fraud and allows for standardisation, scientific evaluation and controls of technologically and naturally derived products." In response, Mordacci again drew attention to principles that EU member states have already agreed upon in their Charter of Fundamental Rights: mutual respect, dignity and autonomy. "Discussion on particular issues is of course needed to give meaning to these values. What is at stake when we allow this technology to be generally available?"

The red line, as Jorgo Chatzimarkakis pointed out, might change, as dignity is a changing concept. "Take, for instance, cosmetic or reproductive technology. These used to be an absolute taboo. Nowadays we look at these issues from a different angle. Therefore a fixed normative system will not work. The only solution, in my view, is a case-by-case approach with minimal standards, for instance for testing, validation and admission procedures."

Tsjalling Swierstra called for caution. "The danger in having a red line is underestimated. When you draw a red line, you involuntary send a message that everything else is unproblematic and does not warrant debate. That is not the case! You need to establish on a case-by-case basis what these technologies mean."

***Participation***

Thomas Laursen, Danish Council of Ethics, also favoured a case-by-case approach, but underlined the need for "public readiness to discuss these things". He suggested that extra efforts be made to reach out and engage different sides of society in the debate. "Sometimes I feel like there is not enough democratic room for debate on technological alternatives for the future. What kind of society do people want to live in? What *is* a good life? We should not be afraid to discuss these issues, in society as well as in politics, but we need tools and an institutional framework to be able to do that."

Following this intervention, participants discussed the possibility of establishing a committee or working group to monitor the developments in the world of human enhancement, reach out to citizens in all member States, and give feedback to the European Commission and member States. Jorgo Chatzimarkakis noted that similar initiatives already exist for other issues, but that their scale may be too small. "We need a broader discussion, and we need a normative framework. Yes, we need a red line. That does not mean that no discussion is needed up until that line – it only means that what lies beyond the line is taboo. Up until the red line there should be discussion on a case-by-case basis."

Maurizo Salvi, Science Officer for Bioethics Research at the European Commission, pointed out that this potential future body cannot focus on a single red line of human enhancement, because there are multiple ones. After all, there are many cases of 'dual use': some technologies may be admissible in some cases, while they are off-limits for others. Participants discussed the implications of such dual use technologies – such as implants – being discovered by big industries. "This is already happening," said Jorgo Chatzimarkakis, "in the form of most health and lifestyle products, including Viagra and vitamins. The global industry for these products quadruples each year."

Ursula Naue, University of Vienna, expressed concerns with citizen participation. "Who is setting the agenda, and framing the problem?" she said. "Is it really participatory and representative? Examples from the past have shown that citizen panels are a problematic factor in the political process. In the end it is always the experts who decide. But then, who are the 'experts'?"

Participants also discussed how to address governmentally supported and socially desired goals for society in the context of human enhancement. They agreed that in any case, human enhancement should not cause any suffering, and governments have a role to play in facilitating participatory stakeholder discussions, for instance through the internet and through meetings. Permanent contact, they felt, is necessary.

Antonio Francesco Maturo, however, cautioned that the success of public involvement depends on whether or not the public has a sufficient knowledge base. "Public opinion can be easily influenced. And the average man on the street has no idea about these issues."

The media can play an important role in this regard, as many agreed, but on the other hand the media can misrepresent information, whether intentionally or not. "Take the news coverage of the discovery of an 'obesity gene'," said Maturo. "Now people think: so that is why I am fat. It is not my fault: I need pharmaceutical intervention. This will lead to social inequality."

Klavs Birkholm argued that the committee should comprise "people who don't call themselves experts, but who are amateurs". Experts, he said, always ask certain questions that are sure to result in certain answers, rooted in beliefs that people already have. These beliefs date back to times when these technologies weren't available yet. For this reason, the political system in itself is not yet able to face the questions that are really the most important questions of the twenty-first century. "Divisions in the political system evolved on the basis of economic issues," said Birkholm. "The division lines on the basis of bioethical beliefs would be quite different. Therefore we should put these questions back to the public. The political decisions should not be expert choices, but public choices."

***Way forward***

Pieter Bonte, Free University Brussels, invited participants to look at the issue from an entirely different angle. "Take eugenics, for instance. We now associate eugenics with the practices of Nazi-Germany, but in the eighteenth and nineteenth centuries, many people were part of eugenics movements. Julian Huxley, the founder of Unesco, invented the term transhumanism and can be regarded as a eugenicist. The principle itself is not necessarily wrong; it all depends how you apply it. The same holds true for transhumanism, which is in fact liberal eugenics."

Nowadays, just like in the discussions surrounding traditional eugenics, debate focuses on defending human nature, or human dignity. Bonte: "But is human dignity a defence, or an attack on movements that seek a new diversity? Do we always want to maintain the *status quo*? Is human nature as it is now, how it should be and how it should always be? If we answer yes to those questions, we are in fact *status quo* eugenicists: we decree that the *status quo* of nature now is the norm for everybody. That is not necessarily beneficial to humanity, nor to human dignity. Perhaps it's time to reshape the moral fields."

Marcel Zuijderland argued that the EU should keep in mind its competitiveness relative to other parts of the world. "If one country is taking the lead, other countries will soon follow, perhaps too soon," he said. "In order to keep up with developments, Europe should create a culture of experimental research in which we can safely look for methods of enhancement. This culture will make it easier to combat illegal markets."

Andy Miah cautioned against the tendency of policy to criminalise enhancement practices, for instance in the case of doping in sports. Enhancement and crime, in his opinion, are two separate domains. "We should be careful not to create entire populations of criminals. Yes, we do need to address how to treat breaches with policies, but if we approach it from a criminal point of view, we create problems, such as underground practices that are even harder to monitor and control."

Tsjalling Swierstra offered an optimist view on the matter. "The discussion on human enhancement gives rise to more general reflection on human suffering and human imperfections," he said, "and in the end that might be the actual gain, more than the technology itself. We will reconfirm our society as one in which everyone can be who they want to be. We have to trust the natural reaction patterns."

Jorgo Chatzimarkakis suggested that a solution lies in making people more health literate. "Health education is the key," he said. "That might be our best approach to enable people to come up with their own solutions and enhancement." In any case, Chatzimarkakis supported the idea of establishing a participatory body to monitor developments and formulate policy advice. "In my opinion this committee should also have high-level participation to speed things up. The process is continuing."

Malcolm Harbour, Member of the European Parliament and Member of the STOA Panel, held a brief concluding address. He underlined the importance of informing a broader public, noting that the issues at hand pertain to society as a whole. Citing the example of the debate on stem cell research, he said EU member States have very different views, and debate is already ongoing about the role of the EC.

In the case of stem cell research, the EU has adopted a position whereby it allocates funds to this research in countries that allow it, thus supporting the technological development while leaving intact the sovereignty of individual Member States. Harbour: "Perhaps that is the route we ought to choose in the case of human enhancement as well."

Harbour also made observations about quality of life issues. "One of the biggest challenges today is human dignity and old age," he said. "We already have a significantly prolonged life expectancy. Imagine what it means for society as a whole if elderly people could spend a longer time in their own domestic environments. That would be a major enhancement of their dignity and quality of life. It is time for a broad debate about this kind of notions." Harbour said the European Parliament will keep this issue under review.

Brief Summary of the Discussions on the Three Approaches

In general, participants agreed that human enhancement can have far-reaching implications both for individuals and for society, and therefore also for the EU. An EU-wide policy is thus much-needed, especially as human enhancement technologies are already a reality. The developments cannot be stopped.

Participants generally felt that they *should* not be stopped either. Despite the real and serious risks, human enhancement also presents valuable opportunities that should be further explored. However, there is a strong need for a coherent normative framework.

Overall, taking into account the wide range of risks and opportunities, participants seemed to favour a case-by-case approach. Potential technologies should be evaluated on an individual basis, based on shared European values and beliefs and on the latest insights into technology, society, and philosophy.

In order to facilitate this reasoned case-by-case approach, participants proposed the establishment of a European committee on human enhancement, comprising experts and politicians, as well as civil representatives. Such a committee should ensure that all aspects – technological, political, societal – are taken into account in any future evaluation or decision-making process relating to human enhancement.