D5.3: Methods for promoting ethics for human enhancement

[WP5 – The consortium's proposals]

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Abstract

This report presents methods for promoting ethics for human enhancement (HE). The main method that we present consists of ethics guidelines for human enhancement technologies (HET). In addition, we propose a research ethics framework for HE, we propose an international expert body to address the social, ethical and regulatory dimensions of HE, and we discuss the need to address the status of HE in the field of medicine. The proposals and guidelines that we provide cover key ethical issues in the research and development (R&D), as well as deployment and use of HET. Some of these methods, including the guidelines, were presented for consideration by stakeholders. In addition, the guidelines, as well as the proposal for the expert body, underwent public consultation. This report builds on earlier SIENNA reports on HE, and the methods and objectives fit within the broader SIENNA aim to provide ethical guidance for key emerging technologies. Finally, we offer some strategies for the implementation, dissemination and exploitation of the proposed methods beyond the lifetime of the project.

Document history

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V1	5 February 2021	First Draft		Reviewers
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Information in this report that may influence other SIENNA tasks

Linked task	Points of relevance
Task 6.1	The report on adapting methods for ethical analysis of emerging technologies will consider the successes and challenges presented by the methodology used to develop guidelines for HET.
Task 6.3	The process by which methods for the development and operationalisation of ethics guidelines are generalised utilise knowledge arising from this report.
Task 6.4	The process of obtaining buy-in for the codes from EU and international institutions will need to build on the guidelines and proposals developed in this report.

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Executive summary

This report presents methods for promoting ethics for human enhancement (HE) and human enhancement technologies (HET) and describes the processes used in the development of these methods. Our aim in these tasks is to ensure ethical issues are considered in the research and development (R&D), as well in as the deployment and use of HET. The foundation for this report can be found in D3.1 'State-of-the-art Review',[1] D3.4 'Ethical Analysis of Human Enhancement Technologies',[2] and D3.7 'Proposal for an ethical framework for human enhancement'[3], among others (see figure 2 below). This report thereby documents the process of proposal and discussion, engagement and consultation, and thus the context within which the methods we offer were developed towards a general ethical framework for HET.

The four main proposals offered in this report cover (i) Ethics guidelines for human enhancement; (ii) Proposals for engaging with research funding organisations to devise funding policies for (potential) HE research; (iii) Proposals for the creation of an expert body for HE; (iv) Proposals for medical organisations in relation to HE.

In **Chapter 1** we offer background to this document and the proposals and introduce the topic of human enhancement. In so doing we also provide some pertinent updates to the scholarship on human enhancement since D3.4 was published in 2020. We explain how disagreements and differences of opinion in HE continue to impact on work in these topics, and we also describe the scope, limitations, as well as objectives of this report. Then in **chapter 2** we cover our methodology. After this we describe our four proposed methods for promoting ethics in HET.

Chapter 3 describes the ethics guidelines for human enhancement (first method), offer some context to their development and outline some of the processes by which guidelines were proposed and selected. As a result of this process of review and refinement we offer ethics guidelines for human enhancement that combine stand-alone general ethics guidelines with reference to some particular topics/field examples, and with scope for further case-by-case ethical analysis/application (see Annex 1).

[1] Jensen, Sean R., Saskia Nagel, Philip Brey, Tanne Ditzel, Rowena Rodrigues, Stearns Broadhead, and David Wright, SIENNA D3.1: State-of-the-art Review: Human Enhancement (Version V1.1), 2018. Zenodo: https://zenodo.org/record/4066557#.X9yEOi2l1pQ

[2] Jensen, Sean. R., SIENNA D3.4: Ethical Analysis of Human Enhancement Technologies (Version V1.1), 2020. Zenodo: https://zenodo.org/record/4068071#.X9yDpi2l1pQ

[3] Kühler, Michael, Nils-Frederic Wagner, and Philip Brey, SIENNA D3.7: Proposal for an Ethical Framework for Human Enhancement (Version V10), 2020. Zenodo: https://zenodo.org/record/4275579#.X9yLoy2l1pQ

Chapter 4 focuses on research funding organisations, including scope for policies on funding for (potential) HE research (second method), i.e. as consistent with the ethics guidelines developed in chapter 3 and as contributing to socially desirable goals. In this chapter we examine how potential HE issues can be addressed by funding organisations, which includes by differentiating between research on human enhancement, research with foreseeable, potential HE impacts, research with unintended HE consequences, and research with long-term HE consequences. We then propose three stages to the tasks of ethical assessment. This includes during the calls for proposals, when screening and selecting proposals, and in follow-up on funded research.

Chapter 5 contains proposals for the creation of a European expert body to assess and guide social, ethical and regulatory aspects of human enhancement (third method). We suggest that this body would oversee and analyse trends in HE, assess moral and social consequences, and provide information and advice. This proposal builds on recommendation in a key STOA report on human enhancement (cited in chapter). In this chapter we outline some reasons for these proposals, some stakeholder views on the proposal, as well as information about the identity, aims, and objectives of the group.

Chapter 6 discusses the need to address the status of HE in the field of medicine (fourth method). On most definitions of medicine, HE is not considered part of it, since medicine is thought of as being concerned with the prognosis, diagnosis, treatment, and prevention of disease. Enhancement cannot easily be considered one of these activities. Still, many types of HE appear to involve medical procedures and interventions. This fact calls for a debate on the status of HE in relation to the field of medicine.

We offer some concluding remarks in **chapter 7** especially noting where points of agreement between stakeholders have enabled progress in the proposal of methods to promote ethics in these areas and list some general observations on these topics.

Finally, in **Annex 1** we provide the final draft of the ethics guidelines for human enhancement, as discussed in chapter 3. In **Annex 2** we acknowledge stakeholder contributions to key proposals in this document.

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List of acronyms/abbreviations

Abbreviation	Explanation
AI	Artificial Intelligence
HET	Human Enhancement Technologies
HE	Human Enhancement
INI	Implanted Neural Interface
R&D	Research and Development
REC	Research Ethics Committee
RFO	Research funding organisation
STOA	European Parliament's Science and Technology Options Assessment Panel

Table 1: List of acronyms/abbreviations

Glossary of terms

Term	Explanation
Human Enhancement	A modification aimed at improving human performance and brought about by science-based and/or technology-based interventions in or on the human body (D3.1)
Stakeholder	A relevant actor (person, group or organisation) who: (1) might be affected by the project; (2) have the potential to implement the project's results and findings; (3) have a stated interest in the project fields; and/or, (4) have the knowledge and expertise to propose strategies and solutions in the fields of genomics, human enhancement and artificial intelligence (D1.1)

Table 2: Glossary of terms

1. Introduction

1.1 Background

As noted in D3.7[4], human enhancement is a broad term which means that instead of identifying a specific technology or application, it instead captures a variety of interventions (processes and techniques) and technologies (including emerging and converging), that are directed towards the apparent *improvement* of a human person. The element of *enhancement* comes therefore from the aim to improve beyond what might otherwise be considered *normal*. It must be noted at this juncture that the term 'normal' is both contentious and deeply problematic for many reasons, not least those related to political and social positions on human identity. Some of which is already explored in D3.4[5] and D3.7. Where possible we can avoid concepts like 'normal' or 'natural', but there is no avoiding that all terms are complex and are loaded with political and social meanings and implications. Indeed, the idea of *enhancement* itself is unavoidably loaded (D3.4 and D3.7). That said, for our purposes here, human enhancement can be captured by descriptions that show where interventions and technologies, such as prostheses or drugs, can allow a person to *outperform, boost*, or otherwise *extend* their ordinary, everyday, or otherwise *typical* human capacities.[6] These might be beyond those capacities afforded by one's own biological limbs or cognitive capacities. In similar fashion, human enhancement also includes where an ordinary life cycle is extended or is considered to be improved, such as by providing immunity against aging, or by increasing longevity.

In recent years there have been rapid developments in many areas of biomedical engineering, including prosthetics, tissue engineering, genome editing, neurotechnology and nanomedicine (cf. D3.1[7] and D3.4). Because the boundary between therapy and enhancement is contested, some of this research could easily be used for therapeutic enhancements which, if proven to be safe and effective, could lead to subsequent non-therapeutic enhancements. This remains an ongoing concern for all six categories of human enhancement that were identified by SIENNA in D3.1, namely cognitive, physical, affective & emotion, moral, cosmetic and longevity enhancement. Since 2019, when SIENNA published its D3.4 report, there have been a number of additional developments that are worth briefly noting, especially regarding genetics, implants, and on the use of enhancements for military purposes.

Genetics: Human enhancement research that does not also have medical purpose (therapeutic or preventive) will usually not be covered by existing medical regulations and protocols and will not

[4] Op cited.
[5] Op cited.
[6] It is worth noting that 'typical' is not free of epistemological or ontological bias, even if is not saddled with the same kinds of historical prejudices and harms that plague terms like 'normal' and 'natural'.
[7] Op cited.

usually qualify for clinical trials. As such, most medical research ethics committees will not assess it.[8] In 2019 a paper was published that discusses how to implement clinical trials for human genome editing[9] while an article in *Science* called for 'global citizen deliberation on genome editing'[10]. In the same period, texts on ethical issues associated with genetic enhancement[11] and on CRISPR and human genome editing[12] were published. In the ethics guidelines we present in chapter 3 we address some of these issues and offer the proposal for safety and efficacy studies for research where clinical trials would be either inappropriate or impermissible. Such guidance may, and will likely, need to be updated in the light of further changes. In addition, the need to address the status of HE in the field of medicine (as outlined in chapter 6) is brought to the fore by these developments.

Implants: In SIENNA report D3.4, brain computer interfaces are discussed,[13] especially in relation to implanted neural interface (INI) technology, with the note that 'For now, however, it is unlikely anyone healthy would seek to use INI devices for enhancement'.[14] Since then, Elon Musk's 'Neuralink' seeks to do just that. Even if this technology is in its infancy, and even while the results are unproven, there remain high ambitions matched by substantial funding for such endeavours,[15] and thereby a requisite need to monitor such endeavours remains. D3.4 points out there is a very high testing standard for pharmaceuticals, especially before they enter the market, yet the authors add that 'testing standards may vary if enhancements are not regulated in the same way as clinical treatments'.[16] This observation is borne out by a recent investigation undertaken by an international group of journalists, published

[8] Note that legal issues, including human rights challenges related to human enhancement, can be found in Warso, Zuzanna and Sarah Gaskell, SIENNA D3.2 'Analysis of the Legal and Human Rights Requirements for Human Enhancement Technologies in and outside the EU', 2019. Zenodo: https://zenodo.org/record/4066617#.YDY9Oi2l1pQ
This document explores international, EU and regional laws and human rights standards on these topics.

[9] Nordgren, Anders, "Designing Preclinical Studies in Germline Gene Editing: Scientific and Ethical Aspects." *Bioethical Inquiry* Vol. 16, No. 4, 2019, pp. 559–570.

[10] Dryzek, John S., et al., "Global Citizen Deliberation on Genome Editing," *Science* Vol. 369, No. 6510, 18 September 2020, pp. 1435–37, https://doi.org/10.1126/science.abb5931.

[11] Anomaly, Jonathan, *Creating Future People: The Ethics of Genetic Enhancement,* Routledge, Abingdon, Oxfordshire, 2020.

[12] Baylis, Françoise, *Altered Inheritance: CRISPR and the Ethics of Human Genome Editing*, 1st edition, Harvard University Press, Cambridge MA, 2019.

[13] Op cited, pp. 68-9.

[14] Op cited, p. 92.

[15] Cf. Schneider, Susan, *Artificial You: AI and the Future of Your Mind*, Princeton University Press, Princeton, New Jersey, 2019.

[16] Op cited, pp. 83-84.

towards the end of 2018, that revealed there to be only soft controls as well as testing standards for implants, which they describe as pushed 'by a booming industry'.[17]

Military applications: In December 2020 it was reported that *Le Comité d'éthique de la défense* (French military ethics committee) gave approval to research on enhanced soldiers. The report is being described in many media outlets as a 'green light' for enhancement, with scope for *capacity enhancements* in a soldier's bodies such as implants to 'improve cerebral capacity' or to allow them to quickly differentiate between allies and enemies. Meanwhile, eugenic and genetic practices were considered impermissible, in addition to modifications 'that could jeopardise the soldier's integration into society or return to civilian life'.[18] While many projects and funders may seek to avoid or to reject proposals with military applications, or even with dual use potential, it's clear that not all potential HE applications are sufficiently acknowledged, recognised, understood, or predicted.[19]

It is important to note at this juncture that many fields still require significant advancements to be made in fundamental research before HE would be possible. In other words: HE in some areas is not going to develop in the very near future. Indeed, HE remains at a very early stage in the development cycle for many emerging technologies, and for some areas it has not moved past the R&D stage, despite many years of work. For example, implanted neural interfaces, though envisioned long ago, will not likely appear in products suitable for HE for at least another decade.[20] Exceptions includes areas like cosmetic enhancement, performance-enhancing drugs, and gene therapy with enhancement implications.[21] Nevertheless, ethics by design approaches require early thinking about ethical approaches, and as the examples above illustrate, developments can snowball, especially as a result of private or public funding boosts. For these reasons, the methods offered in this report centre on ethics instruments intended for early intervention: ethics guidelines, studies of social, legal and ethical aspects of enhancement (including the proposal of an expert body), research ethics, and a fundamental discussion of the status of HE in medicine.

The backdrop of uncertainty, concern for innovation, yet with a commitment to proactive intervention emerges repeatedly in discussions with stakeholders on HE, and questions about finding a balance between promoting ethics while supporting, or at least not stifling, technological innovation regularly arise. Thus, the task is to present methods towards an ethical framework for R&D, deployment and

[17] International Consortium of Investigative Journalists, "Medical devices harm patients worldwide as governments fail on safety", 25 November 2018. https://www.icij.org/investigations/implant-files/medical-devices-harm-patients-worldwide-as-governments-fail-on-safety/
[18] BBC News "France to Start Research into 'Enhanced Soldiers,'" December 9, 2020, sec. Europe, https://www.bbc.com/news/world-europe-55243014.
[19] Cf. D3.4 and D3.7, both op cited.
[20] D3.1, op cited, p. 27.
[21] cf. D3.4, op cited.

use of HET that can be practically applied in research ethics, and thereby of practical relevance to many actors and organisations, including research ethics committees and other advisory and regulatory bodies. The report that we offer here documents the complex processes of proposal and discussion, engagement and consultation, and thus the context within which SIENNA arrived at the following four methods to achieve those ambitions:

i. Ethics guidelines for human enhancement which combine stand-alone general ethics guidelines with reference to some particular topics/field examples, and with scope for further case-by-case ethical analysis.
ii. Proposals for engaging with research funding organisations and research ethics committees to devise funding and approval policies for (potential) HE research, consistent with the ethics guidelines developed in (i) and contributing to socially desirable goals.
iii. Proposals for the creation of an appropriate body to oversee and analyse trends towards HE, assess moral and social consequences, provide information and advice, as recommended in the STOA report.
iv. Proposals regarding medical organisations and the need to address the status of HE in the field of medicine.

The first of these proposals, the ethics guidelines, were developed in conjunction with stakeholders who were asked to consider (1) whether ethics guidelines for human enhancement should be developed, and if yes then (2) what kind of guidelines could or should be developed. This task covered a broad range of HET, and in the context of practical questions such as how HET is addressed in research ethics, and crucially by research ethics committees (see also D3.4, including examples offered in the annexes, as well as in the soon to be published D5.1 report). It also covered how the guidelines might complement or add to existing or planned ethical and legal frameworks on HE and related technologies, as provided by advisory and regulatory bodies. While the guidelines we have developed cover the *research*, *development*, and *application* of HET and procedures at a general level, they offer scope for further development and deployment including as targeted for specific types of enhancement or on a case-by-case basis. In the discussions that led to these guidelines, consideration was given to both the pros and cons of different kinds of ethics guidelines, including discussion of whether guidelines should be: self-contained or general; self-contained domain- or field-specific; general or field-specific guidelines as incorporated into existing guidelines for e.g. medical, computer and engineering ethics.[22]

The second proposal, regarding research funding organisations, identifies some potential HE issues for funding organisations to consider, which includes ways to differentiate between research on human enhancement, research with foreseeable, potential HE impacts, research with unintended HE

[22] Cf. D3.7, op cited.

consequences, and research with long-term HE consequences. With potential HE issues that may be raised by research identified, we propose three stages to the tasks of ethical assessment that include during the calls for proposals, when screening and selecting proposals, and in follow-up on funded research.

The third proposal concerns the creation of a European expert body on human enhancement, which would oversee and analyse trends towards human enhancement; assess moral and social consequences; provide information and advice. In conjunction with stakeholders, the proposal is based on the observation that human enhancement is expected to be an area of research and development in the near future, and because it presents society with significant social, ethical and regulatory challenges. The rapid pace of developments since our last report bear this out. Yet currently, there is no policy-oriented body at the European level that tracks these developments and makes policy recommendations for the ethical and regulatory guidance of human enhancement research, development and deployment. The proposal offers guidance on the identity of the working group, primary activities, and explains their role in fostering oversight, including with ethics instruments like the guidelines we describe above.

The final proposal, regarding the need to address the status of HE in the field of medicine aims to put the status of HE on the agenda for the field of medicine, and for science policy. On most definitions of medicine, HE is not part of it, since medicine is thought of as mainly concerned with the prognosis, diagnosis, treatment, and prevention of disease, and enhancement is none of these activities. Still, many types of HE appear to involve medical procedures and interventions. This fact calls for a debate on the status of HE in relation to the field of medicine. Our proposal is that relevant organisations need to take up this debate or risk a situation in which HE will evolve without proper institutional and regulatory embedding or oversight.

These proposals fit within step 6 of SIENNA's methodological approach, described in D1.1[23], and noted below:

[23] Rodrigues, Rowena, Stearns Broadhead, Philip Brey, Zuzanna Warso, Tim Hanson, Lisa Tambornino, and Dirk Lanzerath. SIENNA D1.1: The Consortium's Methodological Handbook (Version V0.6), 2018. Zenodo: https://doi.org/10.5281/zenodo.4247383

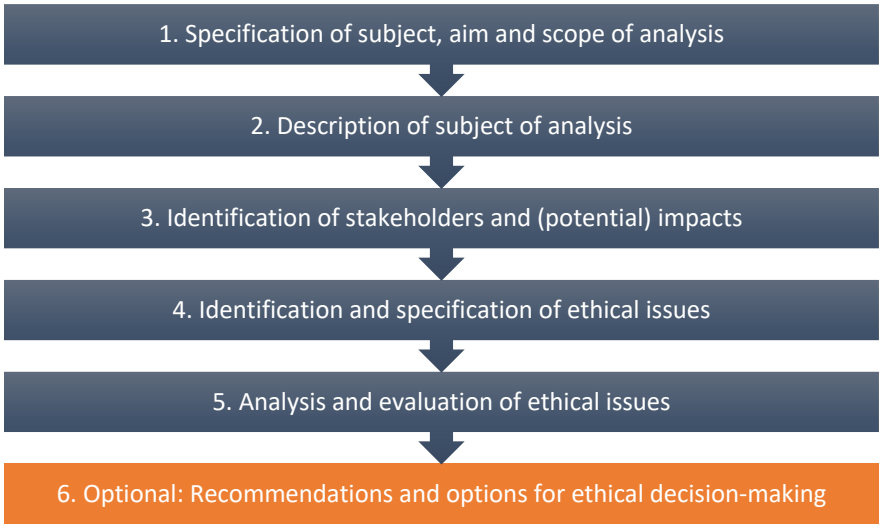

Figure 1: Overview of the SIENNA approach to ethical analysis

1.2. SIENNA's approach to human enhancement

As noted in previous deliverables, especially D3.4 and D3.7, it is difficult to draw clear lines between what counts as enhancement, and what can instead be considered purely therapeutic. Moreover, technologies described as one can often be considered useful or relevant for the other. Marketing claims that rely on these grey areas only further muddy the waters. Since HE does not refer to a specific technology or application, but a wide field of interventions and technologies, unpicking what is considered typical and expected is essential in drawing these distinctions. For instance, prostheses may under certain circumstances outperform natural limbs, drugs may boost cognitive capacities beyond typical, average, or 'normal' range, and genetically modified humans might become immune to certain diseases. Drawing an enhancement—therapy distinction means drawing a line between a treatment that makes someone *well* (therapeutic) and where it makes the person *better* (described in D3.4 in terms of being 'better than well'), yet this requires that we can be clear about the baseline *below or above* which distinctions are drawn.

In D3.4, methods for categorising HE included by function, e.g. cognitive, affective, physical, etc., or by technique or field, e.g. genetic, tissue engineering, etc. (see descriptions of each HE in the sections below). HE is also distinguished by applications that are internal to the body and those external to it, and reversible vs. irreversible. The latter category includes particular associated risks, and these vary by function and technique, for instance, implanted neuroprostheses can fundamentally change how a brain works which distinguishes it from the wearing of a prosthesis that can be externally connected and removed. In addition, HE can arise as a by-product of therapeutic innovations, e.g. prostheses that replace a limb can provide improved usability or function of that limb. If HE is not necessarily *medical*, then normal principles of biomedical ethics may not apply to it, or at least not in a straightforward way; medicine is commonly defined as the science or practice of the prognosis, diagnosis, treatment, and prevention of disease and has centred around therapy rather than enhancement.

Alongside these considerations we note that HE remains a polarising topic with strong advocates for and against. Among the advocates that take a strongly pro-enhancement position are transhumanists. Among the 'enhancement critics' who advocate against it, are those who are sometimes called bioconservatives. Some transhumanists argue that human enhancement should be an individual choice and emphasise the potential benefits to the individual and society. Enhancement critics tend to emphasise health risks, risks to equality and risks to well-being, and often take a principled stand, with some arguing that human enhancement amounts to 'playing God' or subverting human nature. Some of the risks and ethical concerns that are raised may be associated particularly with enhancements that are irreversible and internal to the body – for example, a permanent neural implant that permanently alters the workings of the brain evokes more questions than a prosthesis that can be externally connected and removed.

It is important to recognise that the above labels do not capture an homogenous group of people with uniform perspectives. A binary presentation of these positions can obscure the fact that there are many stakeholders in this conversation, and not all will hold singular views on the topic of human enhancement. For instance, a person may be very willing to consider the positives that come from cosmetic surgery but be uncomfortable with drugs that change brain states or behaviours. Someone else may not have strong opinions about types of human enhancement but may be particularly concerned about the longevity or reversibility of an enhancement. Taking this complexity of positions and perspectives into account needs to be at the heart of proposals that offer methods for the promotion of ethics in these areas.[24]

1.3 Objectives

The objections of this deliverable are as follows:

- To offer four methods, including proposals and guidelines, for the promotion of ethics for human enhancement.
- To provide an account of the processes by which these proposals and guidelines have been devised and developed in conjunction with stakeholders.
- To consider options for the development and implementation of the proposed methods, including policy options to support ethical guidance for human enhancement.
- To consider the implications of these proposals for a range of interrelated areas, including research and development (R&D), as well as deployment and use of HET.
- To describe the methods for stakeholder inclusion in all of the above, for instance in workshops and consultations, including resulting agreements and amendments.

[24] For further discussion on this topic, cf. Buchanan, Allen E. *Beyond Humanity?: The Ethics of Biomedical Enhancement*, Oxford University Press, Oxford, 2011.

- To provide strategies for the implementation, dissemination and exploitation of these proposals beyond the lifetime of the project, including recommendations for further development.

1.4 Structure of the report

The report is structured with the theoretical underpinnings at the start, including methodology, definitions, and so on, followed by the practical outputs in the four main chapters. The report concludes with some recommendations for further work. In the introductory chapter, we present the objectives, scope and limitations of this report, and explain its background. In chapter 2, we outline the methodology used for this report. In chapter 3, we discuss the process of development of ethics guidelines for HE. In chapter 4, we cover research ethics for human enhancement. Chapter 5 concerns the proposal for an expert body, and chapter 6 concerns the need to address the status of HE in the field of medicine. We conclude with some reflections on the processes and methods that are detailed in the report.

1.5 Scope and limitations

This report outlines some methods for the promotion of ethics for human enhancement. To that end, the task includes consideration of key ethical issues in the development, deployment and use of HET. Given that our stakeholder engagement has indicated a need for an ethical framework for HET, the report is also tasked with considering how the methods we describe, including proposals and guidelines, can be used in more targeted ways. This includes in research ethics and by research ethics committees as outlined in D3.7. Accordingly, this document builds on the ethical frameworks proposed in D3.7, while providing additional insight on the kinds of methodologies that may be useful for promoting ethics in human enhancement. Finally, the task includes consideration of how advisory and regulatory bodies can address ethical issues in human enhancement, for instance by adopting an ethics instrument such as the guidelines we have developed.

Some limitations of the proposals that we offer here were already identified in D3.4. These include (1) that general ethical issues captured by guidelines will not neatly overlap for all types of HET (2) that the field of HET is *emerging*, so applications may be partly in use, partly anticipated, and the timescale can be difficult to surmise, and (3) that the breadth and variety of the 'field' means that the likelihood of disagreement among experts is high, including regarding definitions of key terms, not least 'enhancement' itself. Other limitations arise as a result of cultural differences, as identified in SIENNA's D3.5 'Public views of human enhancement technologies in 11 EU and non-EU countries'.[25] This report offers some insight into both similarities and differences in perspectives on human enhancement within different countries and cultures. These studies, carried out in EU and non-EU countries, offer

[25] Prudhomme, Marie, SIENNA D3.5: Public views of human enhancement technologies in 11 EU and non-EU countries (Version V4), 2020. Zenodo: https://zenodo.org/record/4068194#.YDZiXS2l1pQ

useful observations on, among other topics, the level of awareness on HET among different publics. Although it is SIENNA's role is to develop ethical frameworks in, and primarily for, the European Union, our aim is that these methods may prove useful beyond this scope, and to that end, D3.5, as well as D3.6,[26] can be used as a roadmap for future work. This would include further development and application of these proposals and guidelines. Such efforts would accordingly need to take into account the variety of views on HET in diverse communities and populations. Our hope would be that even in cases where standards differ, the methods we propose may provide a framework to begin the process of such targeted instruments.

The application of enhancement technologies to non-human animals is not explored in this report, but this could be considered at the next stage of research. We also do not consider augmented reality explicitly, though it may be implicitly referenced in some of the topics that we cover.

[26] Kantar (Public Division), SIENNA D3.6: Qualitative research exploring public attitudes to human enhancement technologies (Version V3), 2019. Zenodo: https://zenodo.org/record/4081193#.YDZxTi2l1pQ

2. Methodology

The primary aims of this report is to offer proposals that contribute to an ethical framework for human enhancement. We seek to do this by capturing key elements of a code of responsible conduct for researchers relating to human enhancement. To that end, the proposals and guidelines that we offer have been developed in the light of research and analysis offered in previous SIENNA reports on HET, including D3.1, D3.4, D3.5, D3.6 and D3.7 among others (see figure 2). These were used, and guidelines were developed, in line with D1.1, the consortium's methodological handbook. In it, SIENNA's methods for theoretical and methodological approaches are outlined, including for research and analysis, as well as approaches to developing the guidelines and other proposals found in this report. Key to SIENNA is stakeholder engagement, and to that end the proposals offered here were developed in line with methods for societal acceptance and awareness also detailed in D1.1.

Figure 2: Outline of tasks and deliverables

Accordingly, the report builds on the first five steps already undertaken in this process (see figure 1, above): preparatory work, including scope, aims, state of the art, and stakeholder identification (steps 1-3 as located in D3.1 and D3.4); identification and analysis of ethical issues (steps 4 and 5 in some of D3.4, but primarily D3.7). In this report we present work connected to step 6, namely recommendations and solutions to the ethical challenges previously identified. In this way the research and analysis previously undertaken offer a guide to the judgements that inform our work here, such as topics to be included, and about the kinds of ethical issues to consider.

Stakeholders in SIENNA are defined in D1.1 as those who '(1) might be affected by the project; (2) have the potential to implement the project's results and findings; (3) have a stated interest in the project fields; and/or, (4) have the knowledge and expertise to propose strategies and solutions.'[27] Also as described in D1.1, stakeholders were involved with this process so as to help ensure that ethical issues have not been overlooked, to help arrive at ethical propositions, and to find solutions to ethical issues. This included by participation in workshops, webinars, and online consultation processes that have provided valuable feedback and content for further research and analysis (see Table 4 in Annex 2 below), and via public engagement (cf. D3.5 and D3.6).

D1.1 notes a number of challenges with this process of stakeholder involvement, including how to find the balance between taking into account many (sometimes disparate) views, while avoiding an outcome where feedback is dominated by strong (especially singular) preferences by stakeholders. It is impossible to avoid bias in normative analyses, yet our aim was to ensure that the proposals and guidelines were driven by care for specific values as outlined in each proposal. These were evaluated discursively, and agreement was sought wherever possible. A second challenge is that human enhancement covers a very broad range of topics, fields, technologies and industries. Individual stakeholders may have a similarly broad range of expertise, or they may be focussed on narrow areas in HE. The task was therefore to balance judgments about key ethical issues and the enhancement potential of various technologies and techniques, while taking into account the varieties of expertise, interests, and competencies. Development of such methods in HE is particularly hampered by, on the one hand, the low volume of research that is officially characterized as HE research, and on the other by the fragmented nature of HE research, which involves many different techniques, applications and domains.

[27] Op cited, p. 23.

3. Ethics guidelines

3.1. Background to the guidelines

This section offers ethics guidelines for research in as well as development and application of human enhancement technologies and procedures. As outlined in D3.4 and D3.7, this is the first time that extensive guidelines for human enhancement have been proposed. The guidelines, which can be found in Annex 1, aim to be international in scope, though they are currently located primarily within a European context. The guideline document consists of seven sections in which guidelines are presented (sections 1–7). These are preceded by a preamble that defines scope and key terms, describes the status of human enhancement as a new type of practice, and provides moral and legal foundations for the guidelines. The guidelines are followed by a section which discusses the use and implementation of the guidelines (section 8). A glossary follows at the end.

The guidelines are intended for researchers, developers, and (para)medical practitioners that work in areas in which human enhancement could be an objective or unintended consequence. These include fields in biomedicine, biomedical engineering and human-machine interaction. The guidelines could also have utility for other stakeholders, for instance for policy makers and research funders. It is recommended that these guidelines are incorporated in ethics guidelines and research ethics protocols for relevant fields. These guidelines have been developed as a result of extensive analysis and consultation with stakeholders, including academic experts in the fields of ethics, biomedicine, biomedical engineering, computer science, and social science, and stakeholders from industry, government, and civil society. The guidelines build on extensive prior studies of human enhancement in the SIENNA project. See especially D3.1, D3.4, and D3.7, in which the ethical implications of human enhancement were considered, and the lack of substantial policy and guidelines were discussed (D3.4), and then some methods for promoting ethics were considered, evaluated, and proposed, including the proposals guidelines (D3.7). The aim of the guidelines we propose here is to ensure that there is a systematic inclusion of ethical values and principles in the design and development processes of human enhancement, as per the *Ethics by Design* approach promoted by SIENNA. Our proposals for these guidelines were distributed to stakeholders in advance of a workshop where they would be considered, which opened our consultation process on the document.

3.2. Consultation processes for the guidelines

The first draft of the guidelines was circulated to stakeholders in advance of the SIENNA workshop, 'Ethics Guidelines and Actions for Human Enhancement'. This event was fully digital (because of Covid-19) and was held across two afternoons (of 4 hours each) in October 2020. It was hosted by the University of Twente. Nineteen invited stakeholders attended, including from academia, industry, government and civil society. This included participants from the European Network of Research Ethics

Committees (EUREC), the European Patients Forum, The Age of No Retirement/Encore Fellows UK[28], and policy makers from the European Commission and from the Panel for the Future of Science and Technology (STOA) in the European Parliament. Stakeholders in the workshop were given the following aims: to consider what role there might be for ethics guidelines for human enhancement research, as well as other actions to support ethical development and use of these technologies, such as policy options. Questions that were considered therefore included whether guidelines would be welcome, needed, or considered premature, and what other methods could be employed to promote ethics in human enhancement.

Stakeholders in the workshop were presented in advance with a number of options regarding the development of ethics guidelines for human enhancement. These four options, with sub-options, were:

Option	Reasoning
Option 1: No ethics guidelines:	The option not to develop ethics guidelines at this time was offered with the following reasons: human enhancement may not have evolved enough yet as a field (or a family of fields), so ethics guidelines may be premature; they may be difficult to develop in the absence of established R&D aims, practices and products for human enhancement. Counterarguments against these claims were considered in D3.7, with the caveat that stakeholders should nevertheless be offered this option.
Option 2: General ethics guidelines	These would include ethics guidelines that would apply to human enhancement as a whole, rather than to particular types of human enhancement. Next to such general guidelines, however, guidelines could be included that pertain to specific types of enhancement.
Option 2a: Stand-alone general guidelines	This option covered the proposal for stand-alone general guidelines for HE and took into account a number of options for content and guiding principles. These included: general positions on the moral desirability of human enhancement; general ethical constraints on human enhancement; issues regarding possible dual use. On top of which, the role that general ethics guidelines could play in the development of guidelines for HET were considered, for instance on: informed consent; clinical trials; risks and benefits; priority of therapy over enhancement.

[28] The Age of No Retirement is a Community Interest Company which aims to challenge age related barriers and stereotypes for an 'intergenerational and age inclusive future'. Encore Fellows is a group with similar aims, including challenging generational assumptions and fostering opportunities for people beyond retirement, especially in the social sector.

Option 2b: Incorporation of general guidelines into existing guidelines	Instead of stand-alone guidelines the option here was to incorporate the sections with guidelines for HE into existing ethics guidelines and international treaties (see list immediately below this table)
Option 3: Field-specific guidelines	This option would be to develop ethics guidelines for human enhancement for individual fields only. The rationale behind this option is that human enhancement is not a coherent field, but rather an overarching label for different activities that play out in different fields. Human enhancement has different meanings in these different fields and should therefore be regulated by field-specific sets of ethics guidelines.
Option 3a: Stand-alone field-specific guidelines for enhancement	Option 3a was for stand-alone guidelines to be developed for specific fields. We consider more about that option below.
Option 3b: Incorporation into existing field-specific guidelines	For this option, we reviewed the extent to which: established ethics guidelines existed for the different fields discussed above, or to which they covered enhancement, and whether inclusion of HE issues in them, if not already present, could make a good fit. Our search for established guidelines was been restricted to guidelines issues by international organisations and to guidelines published in English.
Option 4: Dual strategy (general plus field-specific guidelines)	This option was to have both general ethics guidelines as well as field-specific guidelines for human enhancement. These could be either stand-alone or as incorporated into existing documents.

Table 3: Ethics guidelines options

During the above discussion, and especially for option 2b, we considered a number of existing ethics guidelines that cover at least some of the relevant medical research and practice, including:

- The World Medical Association (WMA) Declaration of Helsinki.[29]
- WHO Standards & Operational Guidance for Ethics Review of Health-Related Research with Human Participants.[30]
- Oviedo Convention[31] - Protection of Human Rights & Dignity of the Human Being with regard to the Application of Biology & Medicine.

[29] WMA, Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, 9 July 2018 https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/

[30] WHO, Standards and Operational Guidance for Ethics Review of Health-Related Research with Human Participant, 2011 https://www.who.int/ethics/publications/9789241502948/en/

[31] Council of Europe, Oviedo Convention and its Protocols, Oviedo, 1999. https://www.coe.int/en/web/bioethics/oviedo-convention

- International Ethical Guidelines for Health-related Research Involving Humans.[32]
- The Charter of Fundamental Rights of the European Union,[33] especially on the human body (Article 3): as a source of financial gain (3.1c); and prohibition of reproductive cloning of human beings (3.1d).
- Universal Declaration on Bioethics and Human Rights,[34] prepared by UNESCO.
- Report of the IBC on updating its reflection on the Human Genome and Human Rights,[35] by the International Bioethics Committee.

Included in the proposals sent to participants were draft guidelines under the above headings, which the group were invited to accept, reject, modify, or recommend for further study or consultation.

To the main question of whether there ought to be ethics guidelines for HET, stakeholders in the workshop agreed that:

1. ***There should be general ethics guidelines for HET.***

This agreement hinged on the following conditions being met:

Content: stakeholders expressed that such guidelines would need to be sophisticated, nuanced, and more detailed than just general statements about ethical values. The question of what type of guidelines hinged on the relative merits and pitfalls of each. For instance, a systematic case-by-case approach was considered to afford flexibility to adapt with the technologies as they develop, yet it was acknowledged that a mere 'collection of cases' would not necessarily fulfil the requirements of guidelines, i.e. with scope for broader applicability. Similarly, while a set of precedents may not always amount to practically applicable guidelines for future developments, general guidelines that are *too* general, may have limited utility. The support for general ethics guidelines took into account that such formats are already common for a range of technologies, and in related areas such as The Oviedo Convention for medical fields.[36] In practical terms, guidelines were considered especially necessary for RECs, especially so as to aid in decisions about the approval of publicly funded projects.

[32] CISM, International Ethical Guidelines for Health-related Research Involving Humans, Geneva, 2016. https://cioms.ch/wp-content/uploads/2017/01/WEB-CIOMS-EthicalGuidelines.pdf
[33] European Parliament, Council and Commission, Charter of Fundamental Rights of the European Union, 2000. https://www.europarl.europa.eu/charter/pdf/text_en.pdf
[34] UNESCO, Universal Declaration on Bioethics and Human Rights, 19 October 2005. https://en.unesco.org/themes/ethics-science-and-technology/bioethics-and-human-rights
[35] UNESCO, International Bioethics Committee, Report of the IBC on updating its reflection on the Human Genome and Human Rights, SHS/YES/IBC-22/15/2 REV.2, Paris, 2 October 2015. https://unesdoc.unesco.org/ark:/48223/pf0000233258
[36] Op cited.

Consensus: It was agreed that key to developing guidelines would be to ensure broad ethical consensus, which itself relies on ensuring that discussion includes a wide range of professional and lay stakeholders. In addition, it was considered that the guidelines should not be so restrictive as to stifle innovation, nor should they neglect where enhancement may be desirable to many stakeholders.

Accordingly, and to the question of what type of guidelines should be developed, stakeholders in the workshop agreed that:

2. General guidelines could be supplemented by more specific guidelines e.g. on techniques.

Discussion included on the value of different types of guidelines, for instance that guidelines for HET need to be sufficiently flexible so as to adjust to a dynamic field, and how supplementation to the general guidelines, for instance with case-by-case examples, can aid this flexibility.

Accordingly, the dual strategy was adopted, with potential to see how both the general ethics guidelines could provide a platform for further endeavours, including for case-by-case approach, and for targeting existing conventions.

A number of proposals were considered at the workshop, including those discussed and presented in the European Parliament's 'Science and Technology Options Assessment' (STOA) report from 2009.[37] For instance, the group considered five policy options for HE:

i. A total ban on any technology that alters 'human nature';

ii. A laissez-faire approach;

iii. A reasoned pro-enhancement approach;

iv. A reasoned restrictive approach; and

v. A systematic case-by-case approach.

Fitting with the recommendations of the STOA panel, the (v) systematic case-by-case approach was most popular with stakeholders, though this was closely followed by (iv) and (iii) in popularity. This was additionally supported by results obtained in SIENNA public opinion surveys (D3.5) and citizen panels (D3.6).

[37] Coenen, Christopher, Mirjam Schuijff, Martijntje Smits, Pim Klaassen, Leonhard Hennen, Michael Rader and Gregor Wolbring, Human Enhancement, EU Parliament, STOA, May 2009. https://www.europarl.europa.eu/stoa/en/document/IPOL-JOIN_ET(2009)417483 [accessed 10 October 2020].

Stakeholders also considered principles examined in the STOA report and attributed to Roberto Mordacci. These state that a technology or treatment aiming at human enhancement is only permissible if it 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; and
- Violate the equal dignity of individuals, in other words, generate discrimination or unfairness.

Of these, only the second (restricting breadth of desire) and third (impairing rationality) were considered suitable for further development, so proposals inspired by these were written in the draft of the guidelines found in this document.

A number of key issues arose in discussion of the guidelines. For instance, the issue of whether HET is something that should be a subject of public funding at all. In this way, the decision whether to fund, or not, R&D of HET would need to be carefully weighed, taking into account the public good. Key questions considered here included on how to gather consensus from a broad range of stakeholders, as well as the impact on prospects for transparency, regulation, and equality that come with either private or public funding. One example considered here concerns HET for soldiers, whether publicly or privately funded, and whether ethics guidelines would be sufficient to tackle an issue of this nature. Yet, it was considered that without guidelines it can be difficult, in practical terms, to determine if something should be publicly funded or not (more discussion on these issues can be found in chapter 4).

As a result of this first state of consultation on the guidelines we revised the document as ethics guidelines for human enhancement that combine stand-alone general ethics guidelines with reference to some particular topics/field examples, and with scope for further case-by-case ethical analysis/application.

The second draft of the guidelines was then circulated in November 2020, and we received substantial feedback from more than 30 stakeholders. The guidelines were then amended in the light of that feedback and prepared for public consultation in January 2021. The process of public consultation opened with a webinar in December 2020, which sought to introduce the field of human enhancement, to explain why guidelines have been deemed necessary, and to cover specific cases from the SIENNA guidelines. The webinar was recorded and hosted on the SIENNA site and was shared widely, including on social media. By fostering public discussion on these issues, the webinar sought to promote the consultation and encourage participation. The public consultation process also included sharing the guidelines with SIENNA stakeholders via newsletters, emails, and social media including Twitter and Facebook. The process was also advertised via academic lists (e.g. Philos-L), and via blogs on the SIENNA website. Feedback from the public consultation indicated broad support both for the guidelines as well as for the proposal for an expert body to oversee trends and developments in HE,

and the feedback from that process helped to shape the final versions of those documents as detailed below (see Annex 1 for the guidelines, and chapter 5 for the expert body proposal).

A central ambition in SIENNA's is to ensure that codes developed in the project achieve maximum impact. For T5.3 this involves liaising with EU and international organisations so as to ensure that the guidelines will be used. In January 2021 we began these strategies for implementation, dissemination and exploitation of our outputs, which included the process of 'buy in' for the guidelines. These included meetings with stakeholders from a range of fields and areas, including Industry, The Organisation for Economic Co-operation and Development (OECD), The Institute of Electrical and Electronics Engineers (IEEE), and the European Commission. To further achieve buy-in, plans for dissemination and exploitation of the guidelines have been developed as part of WP6. This task will also leverage the networks of the members of the project's professional organisations boards to ensure that the codes are practically implemented. The codes will also be publicised within academic and research networks. This includes a presentation of the guidelines in relation to a case study (cognitive prostheses) at the Augmented Humans Conference in February 2021.[38]

[38] Information about the presentation can be found here: https://augmented-humans.org/sessions/

4. Guidance for research funding and research ethics assessment

4.1 Introduction

In this chapter we consider proposals and offer guidance regarding funding HE research by research funding organisations and regarding how research ethics committees may approach research proposals that implicate HE. Our intentions are that (1) their actions are guided by the ethics guidelines as outlined in chapter 3, and that (2) HE research that is funded and assessed positively should contribute to socially desirable goals as outlined in previous SIENNA documents and as listed above. Also as we describe above, HE is not a field of research in itself and there is no HE research program *per se*, but many HETs are developed through classical biomedical research. In other words, even a research program that does not highlight HE can have potential HE implications. It is thus to be expected that research funding organisations and even some research ethics committees may not have full awareness regarding the impact of their actions in terms of HE. However, given the importance of HE ethical issues and the probable extension of HET in the near future, it is part of the responsibility of organisations to assess their contribution to HE.

HE issues are not only a matter of research ethics in the narrow sense, for instance in relation to scientific integrity, and causing no harm during the conduct of research. It may also be a matter of what kind of future we want to enable through biomedical and technological research, and where we want research to lead society. As a consequence, existing procedures might not be sufficient to raise awareness of HE issues and to tackle them at the most appropriate levels. We identify research ethics committees and research funding organisations as groups for whom awareness of HE issues will be essential for responsible decision-making about research that may have broad societal impacts.

Research ethics committees (RECs) affiliated with academic and research institutions are commonly charged with evaluating the integrity and ethical standing of particular experiments and research designs. However, these committees are usually intended to address common ethical pitfalls, prompt the redesign of unnecessarily risky research, and protect human research subjects. Some such committees may be well positioned to weigh the potential risks and benefits of HE research, but others will not be prepared for this. Furthermore, RECs are not likely to be prepared to assess the societal impacts of potentially disruptive technologies such as HET.

Research funding organisations (RFOs) include governmental agencies, international bodies, or private foundations. Most RFOs already have ethical commitments, and laboratories or research facilities in which the funded research projects are to be conducted are also committed to ethical engagements. For instance, research engaging with human participants is systematically reviewed and assessed by local RECs. Compliance with the national legal framework is also required before any research project can be launched. One of the challenges is that an RFO can expect an ethical assessment to take place but may not have an in-house REC, especially where there is an intention to avoid the duplication of ethical review.

Both RECs and RFOs face a basic challenge regarding HE research. On the face of it, many HE projects have valuable aims and would pass the scrutiny that RECs and RFOs standardly apply to candidate research projects. However, as ethical inquiry regarding HET shows (see especially D3.4), these technologies raise a host of novel and potentially disruptive ethical issues that are of great importance for individuals and society. Furthermore, since the potential advantages of HE remain controversial, RFOs may be hesitant to proceed with HE research, especially if public funds are involved. So, on the one hand, there is the risk of approving and funding HE projects without sufficient ethical oversight about potential HE issues. On the other hand, awareness and anxiety about the ethical issues with HET may result in unfair or unnecessary quashing of legitimate or valuable research, with either potential (or even imagined) HE implications. Neither of these extremes is entirely satisfactory.

Hence, we offer more nuanced guidance, aimed at helping organisations to devise a policy regarding HE research—whether to engage in it at all, and if so, to what extent and under what conditions. In the same spirit as our approach to ethics guidelines above, our guidance here, while preferring to err on the side of diligence and to be more cautious then might sometimes be needed when it comes to safety, is intended not to be so restrictive as to stifle innovation, nor to neglect areas where enhancement may be desirable to many stakeholders.

4.2. Identification of (potential) human enhancement issues

Because virtually any advance in basic medicine has some conceivable relationship to the development of enhancement technology, it is important to be clear exactly how close the relationship is. Part of the ethical reflection prior to research is to identify whether the planned research or funding programme contains, in one way or another, HE issues or not. An additional question is: at what stage are these issues likely to be raised? We have identified in particular two project types that would require assessment. These are:

- Projects in which human enhancement is an explicit aim, either through research intended to facilitate human enhancement applications, or through the development of products or techniques intended for human enhancement.
- Projects that have a potential “dual use” application, by which is meant that research and/or development is undertaken for therapeutic or other non-enhancement purposes, but the results of the project also have a clear potential for human enhancement.

We can break these down further into four cases, ordered from the case in which HE is most directly implicated to that where it is most distant.

i. *Research on human enhancement:* In this case, (part of) the explicit focus of research is human enhancement. Either the research is aimed at healthy participants with enhancement as a primary goal or it is a project with both therapy and enhancement as explicitly defined aims. This may include early-stage research explicitly directed toward developing fundamental techniques for enhancement, for example, searching for compounds that induce rapid muscle growth in humans. It may also include more directed research, developing or testing novel products intended for HET, for example, developing or testing a particular implant to increase the maximum frequency one can hear.

For this case, a specific HE ethical assessment should be conducted. Strong benefits should be expected for individuals and for society, and risk must be minimal for participants in non-clinical trials such as safety and efficacy studies. Where such research is aimed at interventions in the body, and especially if these are irreversible, approval should only be provided if it can be shown in advance that the research is likely to be able to adhere to ethics guidelines (such as those provided in this report), and that a risk/benefit assessment for recipients, and a social/ethical impact assessment for society, have a positive outcome.

ii. *Research with potential, foreseeable short-term HE consequences:* In this case, the primary goal of the research is not human enhancement, but the research project has foreseeable enhancement applications, more or less immediately. In such cases, the research results in a product or process design with immediate functionality for human users, and that human enhancement can be among its uses. Alternatively, the research may result in new techniques explicitly intended for use in particular products or processes that could introduce new functionality for human enhancement. For example, as noted in D3.4 and D3.7, a drug that heightens attention can be a cognitive enhancement even if the research protocol includes only patients with conditions who would benefit from the drug as a therapeutic intervention. It can therefore reasonably be expected that the drug could, and will, be used as a cognitive enhancer by healthy persons once available on the market. The difficulty in such cases is that the research may not be motivated by HE, and yet its HE consequences are more or less inevitable.

We propose that, in this case, a specific HE ethical assessment should be conducted, and it is then the responsibility of the decision makers to assess the project in terms of both its intended aims and its HE potential. Even in the case where RFOs do not intend to engage in what can be considered HE research, they nevertheless have to produce clear safeguards against problematic HE applications of the research that they fund.

iii. *Research with potential and uncertain HE consequences:* In this case, HE may be an unintended consequence of the development of the research programme, or of the work that follows from it in future projects. Researchers might not have considered any HE implications of their research, and research funders may also struggle to detect these implications in the research projects they assess. However, a very careful assessment, especially one that includes foresight analysis, could highlight HE consequences: Either functional products or processes are produced that, with significant modification or improvement, could be used for HE. Or techniques are produced that could conceivably be implemented in products or processes that result in functionality that could then be used for HE purposes. This raises the question of whether all research projects would need to have such detailed screening for potential HE application, and how careful this assessment should be.

For this case, we offer only general guidance. For smaller projects or particular studies, we recommend flagging any potential HE consequences that are noticed, with flexibility to apply the requirement for the project to undergo foresight analysis and associated ethical analysis, or to recognise where the potential for HE is very unlikely and where such foresight analysis

would likely be too burdensome given the limited potential for HE. We do however recommend that before instituting funding programmes, especially in biomedicine or human-machine interaction, RFOs carefully assess potential HE applications.

iv. *Research with potential long-term HE consequences:* In this slightly different case, HE consequences are foreseeable, but would likely only occur in the long-term. For instance, contrary to 'smart drugs,' neural implants or implanted neural interface (INI) technologies are not likely to offer HET potential in the next few years, given that brain surgery is still a heavy procedure with many risks, not least in terms of permanent scarring. However, proponents of animal/clinical research on INI often hold that neural implants will be used as HET in the future. More generally, many areas of fundamental biomedical research have clear long-term impacts for HET. For example, research into the determinants of aging have clear applications to longevity enhancements. How could RFOs decide their engagement in such research and how to assess it? One option is to be extremely cautious and to object to any research project that has potential HE implications. Another option would be to balance such risks against opportunities for treatment against current disease, and here again, detailed guidance on levels of assessment for HE may be necessary.

In this case, our recommendation is similar to the previous case. For particular research projects, we recommend flagging potential HE consequences, but with careful assessment before making a decision on the need for exhaustive foresight analysis. There may also be scope to forego this in cases where the likelihood of HE outcomes in the long-term offers likelihood for future assessment. This could be the case where foundational or basic research would not yield HE outcomes, and where future research based on this foundational research would itself be subject to further ethical scrutiny. We recommend that RFOs, especially but not only those in biomedicine or human-machine interaction, should assess potential HE applications before instituting funding programmes, and maintain oversight of such potential in the light of new research in these areas.

These case types are based on distinctions among various research possibilities. The most obvious distinction is between an enhancement that is intended and one that is not. If HE is the explicit goal of research, then it should be assessed as such and with specific tools (e.g. with the guidelines proposed in this report). Another is the likelihood in the short or long-term of HET developments in the research. Stakeholders, including researchers and RFOs, can envision HET that are going to be developed in the next few years (short-term) or in the decades to come (long-term). A third dimension would be that HE consequences of a research project could be expected or unexpected, that is, whether a reasonably equipped researcher or member of an REC/RFO could be expected to foresee the HE consequence of a project. If HE consequences are foreseeable, then they should be taken into consideration. But whether the application could be realistic in the short or the long term requires assessment by someone with sufficient expertise. We note this because some HE consequences and applications may not in fact be obvious to all stakeholders. It is in the best interests of researchers and other stakeholders, as well as RFOs and RECs, to avoid unrealistic expectations and to avoid being taken by surprise by an emergent HE capability. Similarly important therefore is the ability to distinguish between real HE impacts and *hype*. HE optimism can sometimes block the progress of clinical research,

especially where research is described as having HE implications whereas these can in fact be quite remote, uncertain, or even highly unlikely. HE can also be subject to the same kinds of hyperbole adopted by researchers in all fields where research funding is competitive. In such cases it is important for RFOs to be aware of rhetoric regarding unrealistic potential benefits and claims regarding HE, as detailed in D3.4, and especially where this can introduce a distortion in the allocation of funding resources. 'Unrealistic expectations' can result in 'poor investment decisions, misplaced hope, and distorted priorities and can distract us from acting on the knowledge we already have about the prevention of illness and disease.'[39] As a consequence, it is of utmost importance to have a fair, balanced, and carefully weighted assessment of HE impacts, neither overlooking HE impacts of research projects nor overstating them.

4.3. Procedures to deal with (potential) human enhancement issues

Once the potential HE issues raised by research are correctly identified to the greatest extent possible at that time, the task of ethical assessment remains to be completed. The ethics guidelines offered in chapter 3 above and in Annex 1 below provide a framework for that process. There is however more that RFOs and RECs can do. This includes increasing awareness of HE issues, how to identify HE potential, as well as how to assess research projects for potential HE impacts. In this section, we consider how to tackle ethical issues. This includes thinking about when the assessment should occur and who should be responsible for it.

To test for potential HE outcomes RFOs could pose the following two questions to researchers, as well as to the evaluators of project proposals:

1. Is the research partially or wholly directed at developing, testing or doing enabling research for techniques, processes, products, materials or methods aimed at supporting interventions in or on the body that result in the augmentation of human physical or mental capabilities or qualities beyond typical, average, or 'normal' levels?

   Example: The project is directed at developing new pharmaceuticals for healthy individuals to increase their ability to concentrate and perform cognitive tasks.

   Example: The project is directed at developing (techniques for) exoskeletons for the augmentation of human strength, with their use by healthy individuals in the workplace as one of the intended applications.

2. Is the research partially or wholly directed at developing techniques, processes, products, materials or methods that could be used, without significant additional R&D, for the

[39] Nightingale, Paul and Paul Martin, "The myth of the biotech revolution," *Trends in Biotechnology,* Vol. 22, no. 11, Nov 2004, pp. 564-569.

augmentation of human physical or mental capabilities or qualities beyond typical, average, or 'normal' levels?

Example: The project is aimed at developing a new type of cochlear implant that will, if appropriate settings are applied, allow users to also hear sounds beyond the typical human range.

Example: The project is directed at developing a new type of exoskeleton for use by people with physical impairments, which can however also be used by healthy individuals to increase their physical abilities.

Where a project can answer at least one of these questions affirmatively, we recommend that they are then required to take the following general steps in their project proposal and ethics self-assessment:

(1) They should identify human enhancement as an ethical issue that will be analysed and mitigated in the project. This would include indicating in which task(s) ethical assessment and mitigation will take place, and doing a preliminary assessment of potential ethical issues, and how they can be mitigated. It should also be determined if the project potentially raises ethical issues with human enhancement that would be prohibitive for the project to proceed in its envisioned form. In that case it may be that the project design can be modified until the objection has been resolved, and that adequate staffing for the ethical assessment and mitigation is ensured so ethical oversight is assured through the lifetime of the project.

(2) Upon inception of the project, an extended assessment of the ethical issues with human enhancement in the project should be carried out, and a mitigation strategy developed. Carrying out the mitigation strategy should be the responsibility of the project consortium as a whole, and it must be clear that researchers who contribute to research on human enhancement, or with human enhancement as a likely application, should be actively involved in the assessment and mitigation process.

(3) Researchers should be required to monitor, over the course of the project, whether the mitigation strategy is carried out successfully, and intervene if needed. This may include carrying out periodic ethical assessments, especially as new research tasks are started and new results come in, with modifications to the mitigation strategy as needed.

All of the above fits alongside the SIENNA ethics guidelines for HE, which are themselves based on key ethical principles (well-being, informed consent, autonomy, justice and equality). These principles are shared by existing guidelines on which RFOs and RECs currently rely for assessing research projects, as are typical requirements of ethics guidelines for research on human subjects (e.g. scientific validity, independent ethical review, informed consent, among others). Accordingly, the proposed HE guidelines as well as the guidance in this chapter are intended to extend and complement existing ethical instruments and frameworks.

We have identified the following three stages at which questions such as those noted would be beneficial:

i. *Calls for proposals:* If HE is the goal of the research programme, it should be clearly stated. Transparency dictates that an RFO should not engage in secret HE research under the cover of clinical research funding. RFOs that want to fund HE research programmes must follow strict ethical rules and a strong benefit/risk analysis, as well as stating clearly their position on HE in the call for proposals.

ii. *Screening and selection of proposals:* In the case of biomedical research with *potential* HE impacts (no HE component in the call for proposals), what should RFOs do with proposals including or claiming HE applications? In the case of hype, RFOs should be not be unduly influenced by potentially unrealistic proposals. Conversely, RFOs need to take care not to deny research projects that have potential but unlikely HE impacts. To aid these judgements, it may be useful for applicants and assessors alike to have an explicit framework for measuring HE potential, such as we outline above. This will ensure transparency and parity in the preparation and assessment of applications. Application of such a framework would also need to consider whether RFOs will have their own process of screening for potential HE consequences of research proposals, and the implications of this decision either way.

iii. *Follow-up on funded research:* Once a research project is selected and funded, it is expected that research proceeds should accord to certain ethical standards, which might include guidelines for HET as offered in this report. Key questions to consider would therefore include how HE issues can be monitored so as to ensure ethical issues are kept to the fore, and with what instruments, as well as the question of who is responsible for this monitoring (whether RFOs or RECs) so as to ensure ongoing compliance.

5. Proposals for a European expert body to assess and guide social, ethical and regulatory aspects of human enhancement

For every emerging technology that has significant ethical and human rights implications, it would be beneficial to have a European expert body at the intersection of scientific research and policy that is able to assess arising ethical, social and regulatory implications and to advise on policies for addressing them. Such expert bodies would ideally not exist for only a brief period, but instead they should have sufficient scope so as to track and advise on emerging technologies over a longer period. This should include the full time needed until the technology is sufficiently entrenched and institutionalised, such that it requires less study and guidance.

It is possible that existing bodies can take on such tasks, such as the Directorate-General for Research and Innovation (DG RTD) or related commission departments responsible for EU policy on research, science and innovation such as the Directorate-General for Health and Food Safety (DG SANTE) and the Directorate-General for Communications Networks, Content and Technology (DG CONNECT). Although DGs can institute such a body, we recommend that it is composed not of members from the European Commission, but of experts that represent a variety of stakeholder groups, as is the case in EC-commissioned High-Level Expert Groups. High-Level Expert Groups only have a limited existence period, however, and as we made clear, we recommend an expert body for HE that can exist for a longer period of time. An alternative arrangement for the expert body is that it is funded and supported separately from the EC, by a conglomerate of research performing and policy organisations.

The topic of HE is unusual in that HE is not located in, and does not emerge from, a single field. Instead, it can be considered rather as a 'family' of R&D activities related by some common purposes, especially where these intersect with the enhancing of human capability through interventions in or on the body. For this reason, it is also conceivable that HE is included in the mandate of other expert bodies, particularly expert bodies in the areas of health and medicine, and of digital technologies and AI. This choice to group HE with these other areas brings a risk that any specific attention on HE may be watered down or even scattered over multiple agencies and expert bodies that each take a too narrow perspective on HE.

In the SIENNA project, we gauged support for an expert body for HE among stakeholders and the general public. Concerns included how effective it might be, as well as noting a risk that it could indirectly justify inaction, for instance if a body were created (thereby ticking a box for oversight) but given insufficient power or resources to undertake concrete tasks or actions. Where support was offered for such a body, reasons for this included where the lack of oversight results in a subsequent lack of transparency about technology developments in relation to HE, or in the perpetuation of existing problems with transparency. There were also suggestions that a body might help to ensure greater representation of a range of stakeholder views in high-level discussion on HE issues. Stakeholders further suggested that an expert body could offer scope for orientating research and

innovation around societal values, that it could help to raise awareness, and also open dialogue and promote debate on key topics in HE.

Earlier in the project, SIENNA undertook an international survey of 11,000 members of the public, including 7,000 from EU countries, on topics of HE. In those results we find support for the creation of an expert body for HE. Here are some quotes from the report:[40]

> Respondents across all countries surveyed were asked who they thought should be most responsible for ensuring the safety of human enhancement technology. There was no consensus, with around a fifth of respondents selecting each of the four options displayed.
>
> Respondents across all surveyed countries most selected scientists (26%) and the government (24%), closely followed by companies that make and sell the technology (18%) and individuals or organisations who use the technology (15%). Responses were similar when looking at the average across all surveyed EU countries, with respondents also thinking that scientists should be most responsible for ensuring the safety of human enhancement technology (31%). This was followed by the government (24%) and companies that make / sell the technology (15%).
>
> Views about who respondents thought should be most responsible varied between countries, with six of the countries surveyed thinking that scientists should be most responsible and four thinking that it ought to be the government. Only in the United States did perceptions differ, with more respondents thinking that individuals who use the technology should be most responsible (24%).

Countries where more respondents thought that scientists should be most responsible were: Greece (48%), Spain (35%), Poland (34%), France (31%), Germany (29%), Brazil (27%). Greece stood out as being the only country having a near majority selecting this answer. In these countries, the government or companies that make or sell relevant technology came as the second most selected answer.

We also ran one-day panels of citizens in five EU countries in the SIENNA project, in which viewpoints were elicited on several emerging technologies, including human enhancement (D3.6). These were five panels with a total of 300 citizens, 60 per panel, in the countries of Spain, Greece, France, Poland and Germany. One comment from D3.6 lends further support for an expert body: 'For all HET areas, regulation was thought to be necessary. Although participants were not sure what this should look like beyond the creation of an independent committee made up of various experts and parties to ensure that all views are considered in the development of this regulation'.[41] However, specific

[40] D3.5, op cited, p. 46.
[41] D3.6, op cited, p. 11.

recommendations and discussions later reveal that they seemed to be talking about a committee to make decisions about the appropriateness of HET measures *for particular cases*: 'participants believed that the creation of regulations around emotional enhancement technology should be driven by medical professionals as well as independent organisations'.[42] In conclusion, there was some support for an expert body for HE with a task of providing guidance for HE, but with a somewhat different scope than that of the body that we are proposing here.

We offer the following proposal based on the observation that human enhancement is expected to be an area of research and development in the near future, and because it presents society with significant social, ethical and regulatory challenges. There is no policy-oriented body at the European level that tracks these developments and makes policy recommendations for the ethical and regulatory guidance of human enhancement research, development and deployment. This may be problematic for a number of reasons, especially as HET's unusual definition and positioning, including in terms of its purpose and the normative concept of *enhancement*, means it is not tied to any particular kind of technology. This can make it difficult to gather expertise under a singular heading, with a shared focus, motives or aims, particularly if those involved with a technology do not consider its HE potential. Where gatherings of experts divide by subfields, like nootropics, etc., opportunities for cross-disciplinary dialogue on the broader issues we note here are lost. For these reasons, convening a body that would ensure representation across the multiple subfields of HET as well as manage opposing views within each subfield seems suitable for filling a niche that may not otherwise be filled.

Given the above analysis, it is considered essential that the identity of the working group should include sufficient breadth of expertise to tackle the widest possible range of HE technologies, procedures and techniques. Accordingly, expertise should come from academia, industry, civil society, and policy makers. The latter in particular would have the particular role to ensure accuracy, efficiency and concrete outputs from the tasks they undertake, as well as to ensure the ongoing efficacy of proposed methods for the promotion of ethics for human enhancement. It is also important to ensure diversity in cultural and geographical representation, as well as in terms of gender and ability/disability, so as to achieve a broad variety of perspectives on HE issues. The expert body could also serve Member States, which could however choose to create their own national expert bodies as well.

We envision that the primary activities of the expert body would include at least the following tasks:

- **Propose methods for ethical approaches to human enhancement.** This includes in policy proposals, and in relation to ethics frameworks and guidelines, such as noted in this report. These should be at European and national levels, as appropriate. New methods and guidance

[42] Op cited, p. 48.

should be added in response to new developments, and existing proposals should be kept up to date.

- **Provide support and guidance** to individuals, to national bodies, as well as to EU-level institutions, bodies and agencies. This list includes researchers, developers, and (para)medical practitioners in human enhancement fields, as well as policy makers, research funders, regulators, and other interested stakeholders, both public and private.

- **Evaluate developments in human enhancement technologies, especially in relation to core values.** These include, but are not limited to well-being, autonomy, informed consent, equality, justice, and (moral and social) responsibility.

- **Survey key and related human enhancement fields**, including literature reviews, data collection, and updates to existing policy documents. This material should be used alongside ethics guidance and frameworks with a view to maintaining records of relevant research, and the development and application of human enhancement technologies in national as well as cross-European contexts.

- **Engage with national and EU authorities** in matters concerning the regulation of human enhancement technologies, including on topics related to health, safety, and risk. Risk needs to be considered and assessed not only for individuals and recipients of enhancement, but also for families, groups and communities, for workers, employees, and students, and for society more generally.

- **Develop methods to sustain ongoing stakeholder participation.** This will help to ensure knowledge sharing, cross-disciplinary and industry dialogue, and public engagement, as well as to help facilitate best practice participation among new and established human enhancement communities, both public and private.

We recommend that the expert group should propose or endorse ethics guidance and frameworks on HE, and we offer the SIENNA ethics guidelines as a foundation for their work in this area. In the case that an instrument of this kind were adopted by the group, we recommend oversight so as to ensure that the instrument is:

- revised periodically so as to remain relevant, including for additional ethical issues that arise from new and emerging developments in human enhancement technologies, and with new guidance added where relevant;

- incorporated in national as well as cross-European ethics guidelines and research ethics protocols for relevant fields;

- incorporated in ethics guidelines and research ethics protocols for the field of biomedicine;

- instrumental in new or updated regulations, policies, protocols and procedures for human enhancement research, development, applications, and funding. Where possible the aim

should be to ensure consistency and harmony between those documents and the adopted instrument.

The proposals we offer here complement and build on proposals as recommended in the STOA study, which proposed the creation of 'A European Body on Human Enhancement Technologies'. In that study they describe the aims of that body to 'develop a normative framework for human enhancement that can guide the formulation of EU policies in this field,' including for regulation. They recommend representation that ensured 'European cultural diversity', a range of expertise, and scope for public consultation.[43] They list the purpose of the 'normative framework' to evaluate human enhancement technologies in terms of (1) effectiveness and risks, (2) impacts related to 'political, ethical, legal, societal, cultural, political, safety, security, and health aspects', (3) scope for EU funding, especially where technologies disrupt social norms, or European 'values', (4) research gaps, and (5) parameters for national regulation. The aims were noted as being to (6) avoid 'undesirable (side) effects as well as inequalities, e.g. in healthcare, (7) prepare groundwork for policy human research funding, and (8) to 'stimulate a social dialogue' on these topics. On the identity of an expert group, the STOA study notes a need for broad expertise, including on 'Social, ethical, technological, natural-scientific, medical, and policy expertise'.

[43] Op cited. See especially pp. 148-150.

6. Proposals for debating the status of human enhancement in relation to the field of medicine

On most definitions of medicine, HE is not part of it, since medicine is usually thought of as being concerned with the prognosis, diagnosis, treatment, and prevention of disease, and enhancement is none of these activities. Still, many types of HE appear to involve medical procedures and interventions, and HE is sometimes featured in codes and guidelines for medical ethics and in publications in medical journals. There appear to be three options for a decision on the status of HE in relation to medicine:

1) HE is part of medicine. This would require an expansion of the standard definition of medicine;

2) HE is not part of medicine, and should be assigned a status wholly outside the institution of medicine. This means that HE R&D should not be carried out by medical professionals or in medical schools, HE journals and textbooks should not cover HE (except in demarcating the field of medicine), regulations for medicine should not cover HE, and HE should also not be covered in ethics codes and guidelines for biomedicine;

3) HE overlaps with the field of medicine. It is neither completely separate from it, nor wholly contained in it. This implies that a complex arrangement is made in which HE R&D and deployment can operate in part within medicine and in part without it.

The purpose of this section is merely to put this issue on the agenda for science policy. Institutional actors involved in science policy, particularly those involved in science policy for medicine, need to address this question. The risk, otherwise, is that HE will have an ambiguous status in relation to medicine, and it will be unclear what standards, regulations, institutional arrangements and professional and moral responsibilities and norms will apply to it. Relevant actors that could address this issue include science academies, professional organisations in medicine, national ministries of health, international medical agencies, NGOs, such as patient groups or activist groups of disabled people, science policy organisations, research funding organisations, and others.

HE has at least three fundamental types of relations to medical practice, whether it is required for it or not. First, therapeutic enhancement necessarily has a strong relation to medicine, since it is an intended or unintended by-product of medical therapy. This class of enhancement obviously has the strongest relationship to medical practice and presents the best case for not conceiving of HE as completely separate from medicine. Second, non-therapeutic enhancement that is invasive to the body and uses medical procedures and products to realise enhancement also has a strong relationship to medical practice, which needs to be considered. Third, and finally, nontherapeutic enhancement that is not invasive to the body may or may not make use of medical technologies and practices. It often relies on research in the field of wearables, based on research in digital technologies, human-media interaction and AI. For this class of enhancements, the best case can probably be made that it is not part of the field of medicine.

To conclude, we propose that the above issue becomes a matter of institutional debate and results in informed, reasoned decisions regarding the status of HE in relation to medicine. Such decisions should also be open to revision as research in HE progresses, but it is proposed here that decisions on this matter at an early stage will prevent harms and inefficiencies that may result from HE having an unclear institutional status.

7. Conclusion

Human enhancement is a vast field, covering many topics, yet we can offer some interesting results as well as some consensus on a number of issues and proposals arising from our research.

The methods that we present in this report arose from previous SIENNA research, as well as from ongoing discussions and agreements with stakeholders. Accordingly, the report outlines four methods for promoting ethics for human enhancement, including the processes by which we arrived at, and tested these methods. With the aim to ensure ethical issues are front and centre of R&D, as well in as the deployment and use of HET, we have presented (i) Ethics guidelines for human enhancement; (ii) Proposals for engaging with research funding organisations to devise funding policies for (potential) HE research; (iii) Proposals for the creation of an expert working group for HE; (iv) Proposals for medical organisations in relation to HE. The content of this report feeds into additional tasks and deliverables in SIENNA, notably D6.1, D6.3 and D6.4. These contain our strategies for the implementation, dissemination and exploitation of the proposed methods, including as generalisable methods, beyond the lifetime of the project.

On key proposals outlined in this report, especially the ethics guidelines, we found some consensus from stakeholders, though with some qualification. First, that ethics guidance for human enhancement can be useful so long as there is sufficient specificity and flexibility, with the recognition that this is not easy to achieve. Second, that we need research funding organisations and research ethics committees to be equipped to devise funding and approval policies for (potential) HE research, especially if we want that research to contribute to socially desirable goals.

Other results relate to what we can expect from stakeholder views on these subjects. Our engagement and consultation processes demonstrated that while human enhancement remains polarising, and indeed there remain strong advocates for and against (including those who are pro-enhancement and those who are 'enhancement critics'), yet discussion also brings many overlaps. There are many people who can be more rightly located centrally or along different parts of the spectrum depending on the specific topic, and the context in which HE is considered.

Regardless of where people fall on a spectrum of positions, we found broad agreement on some key issues. This includes on the value of early ethical thinking, as well as on there being a role for guidance in some form or another. Individual choice was central to many people's concerns, with emphasis firmly on the importance of transparency and of autonomy so as to ensure each person can assess, judge and make decisions regarding potential benefits and risks of HE. Similar concern was shown for others who are not direct users of an enhancement. For instance, the impact on society, or on those affected either directly or indirectly by an enhancement (e.g. in terms of access) arose frequently in discussions. The same is true for the topic of discrimination, and many people were concerned about the ways in which HE could either reduce or exacerbate existing inequalities, or indeed create new ones. While it may not be easy to resolve the tensions that can arise between the needs of individuals with the needs of groups, communities, and broader society, stakeholders tended to agree that such discussions remained essential and of ongoing value.

How risks and benefits were measured and judged, and who should make such judgements were also issues of concern for many stakeholders. Such questions tended to arise in terms of health and well-being (albeit not always with the same terminology). Ethical concerns in these areas tended to relate to whether a HET was irreversible or not, with associated questions about the long-term implications for the person who is enhanced, and for those around them. The same is true for the technology itself, which includes taking into account the lifecycle of the technology, as well as any update requirements and accessibility of data, and how all of this can affect potential users.

In all these discussions it became clear that labels rarely capture homogenous groups of people with uniform perspectives, and indeed we noted with interest whenever those who presented themselves as 'tech optimists' nevertheless offered plenty of reservations about the impact of technologies on the environment or vulnerable groups, while those who were generally concerned with risk also shared some optimism on the role of technology to improve the lives of those who might otherwise suffer or be disadvantaged. Binary presentations of singular positions obscure the fact that stakeholders tend not to have a single set of views on the topic of human enhancement. Views shift depending on the specifics of a technology or enhancement, and depending on perceived risks/benefits, positives/negatives, and the scope for impacts on individuals/society. From the consultations it became clear that taking the complexity of positions and perspectives into account needed to be at the heart of any proposals that we offer regarding methods for the promotion of ethics for HE, and this is what we have attempted to provide in this report.

Annex 1: Ethics guidelines for human enhancement

This document offers ethics guidelines for research in and development and application of human enhancement technologies and procedures. This is the first time that extensive guidelines for human enhancement have been proposed. The guidelines aim to be international in scope. The guideline document consists of seven sections in which guidelines are presented (sections 1–7). These are preceded by a preamble that defines scope and key terms, describes the status of human enhancement as a new type of practice, and provides moral and legal foundations for the guidelines. The guidelines are followed by a section which discusses the use and implementation of the guidelines (section 8). A glossary follows at the end.

These guidelines are intended for researchers, developers, and (para)medical practitioners that work in areas in which human enhancement could be an objective or unintended consequence. These include fields in biomedicine, biomedical engineering and human-machine interaction. The guidelines could also have utility for other stakeholders, for instance for policy makers and research funders. It is recommended that these guidelines are incorporated in ethics guidelines and research ethics protocols for relevant fields.

These guidelines have been developed as part of the European Union-funded SIENNA project, which aims at ethical and human rights assessment and guidance of emerging technologies.[44] They are the result of extensive analysis, and extensive consultation with stakeholders, including academic experts in the fields of ethics, biomedicine, biomedical engineering, computer science, and social science, and stakeholders from industry, government, and civil society. The guidelines build on extensive prior studies of human enhancement in the SIENNA project. See especially SIENNA D3.1 'State-of-the-art Review',[45] D3.4 'Ethical Analysis of Human Enhancement Technologies',[46] and D3.7 'Proposal for an

[44] The SIENNA project, 'Stakeholder-Informed Ethics for New technologies with high socio-ecoNomic and human rights impAct', aims at ethical and human rights assessment and guidance for human genomics, human enhancement, and artificial intelligence & robotics. SIENNA is funded under the European Union's H2020 research and innovation programme (grant agreement No 741716). This document and its contents reflect only the work of SIENNA and does not intend to reflect views of the European Commission. The European Commission is not responsible for any use that may be made of the information it contains.

[45] Jensen, Sean R., Saskia Nagel, Philip Brey, Tanne Ditzel, Rowena Rodrigues, Stearns Broadhead, and David Wright, SIENNA D3.1: State-of-the-art Review: Human Enhancement (Version V1.1), 2018. Zenodo: https://zenodo.org/record/4066557#.X9yEOi2l1pQ

[46] Jensen, Sean. R., SIENNA D3.4: Ethical Analysis of Human Enhancement Technologies (Version V1.1), 2020. Zenodo: https://zenodo.org/record/4068071#.X9yDpi2l1pQ

ethical framework for human enhancement'.[47] A description of the process by which these guidelines have been developed can be found in deliverable D5.3 'Methods for promoting ethics for human enhancement'.[48]

Preamble

Definitions and scope

- *Scope:* These guidelines apply to the following practices:
    - Clinical, pre-clinical and non-medical applied research and development for which human enhancement is its central aim or one of its aims;
    - Applied research and development that is directed at or results in medical or non-medical devices, drugs or medical treatment regimens that can be used for human enhancement with few or no modifications. For this type of research and development, the guidelines prescribe that if such products and processes are likely to violate these guidelines, mitigating actions should be taken either to develop them in a different way, to help prevent them from being used in unethical ways, or to consider not developing them at all if these other remedies are not likely to work;
    - The deployment of products and processes in or on the human body with human enhancement as the central aim or one of the aims.
- *Human enhancement:* Human enhancement does not refer to a specific technology or application, but a wide field of interventions and technologies that aim at improving human beings beyond what is considered typical, or as sometimes problematically referred to as 'normal.' Human enhancement is defined in SIENNA as 'a modification aimed at improving human performance and brought about by science-based and/or technology-based interventions in or on the human body' (D3.1). Examples of possible (future) human enhancements are prosthetic limbs that outperform natural limbs, drugs that boost cognitive capacities beyond usual range, and genetic modification of age-related genes that allow people to become 150 years old. The possibility of enhancement for animals is not explored in this document.

[47] Kühler, Michael, Nils-Frederic Wagner, and Philip Brey, SIENNA D3.7: Proposal for an Ethical Framework for Human Enhancement (Version V10), 2020. Zenodo: https://zenodo.org/record/4275579#.X9yLoy2l1pQ
[48] Erden, Yasemin J. and Philip Brey, D5.3: Methods for promoting ethics for human enhancement, forthcoming [i.e. this report].

- *Enhancement versus therapy:* Human enhancement is often contrasted with therapeutic interventions (see also p. 2 below). In SIENNA therapeutic enhancement indicates those interventions 'that are often performed to return an individual's health/performance to their baseline but may also increase health/performance beyond the baseline' (D3.4). It needs to be taken into account that the distinction between enhancement and therapy remains problematic. How should the line be drawn between a treatment that makes someone *well* by removing a disease, injury or other health problem (therapeutic), and enhancement, which involves adding to or improving the abilities of an otherwise healthy person? This depends on how terms like 'healthy', 'normal' or 'average' are defined and applied, which can be done in different ways. It is important to note that systemic power disparities also influence the definition and application of these terms.

- *Types of human enhancements:* Human enhancements can be classified and defined in a number of ways.[49] The following are distinctions that stand on their own, but which have particular ethical significance, and so are important to highlight here:

    1. *By area, application or function.* The following types of enhancement can be distinguished in this way: **cognitive** (interventions that enhance cognitive function, such as intelligence or memory); **affective and emotion** (interventions that improve and/or provide greater control over a human's affective states, such as one's mood or disposition); **physical** (interventions that improve physical abilities or introduce new ones, including for performance or endurance), **moral** (interventions that modulate or foster attitudes and behaviours that are considered morally or socially acceptable), **cosmetic** (interventions that improve the cosmetic appearance or traits of a human being) and **longevity** enhancements (interventions that improve durability and that extend the lifespan). Not that these categories may not be mutually exclusive. For instance, a medication could result in both affective *and* moral enhancement.

    2. *By reversibility.* A distinction can be made between those enhancements that are reversible and those that are irreversible and cannot realistically be removed or undone.

    3. *By relation to the body.* A distinction can be made between enhancements internal to the body (e.g. neural implants) and those external to it (e.g. wearables that enhance ability), although this distinction is not always clear in some technologies or techniques.[50]

[49] Cf. Categories and definitions in D3.4, op cited.
[50] Cf. European Group on Ethics in Science and New Technologies, "Ethical aspects of ICT implants in the human body," *Jahrbuch für Wissenschaft und Ethik*," Vol. 10. No. 1, 2005, pp. 501-525.

4. *By relation to therapy.* A distinction can be made between therapeutic and nontherapeutic enhancements. Therapeutic enhancement covers cases in which treatment of unhealthy persons is performed to a degree beyond what might be considered average or 'normal', i.e. statistically usual or typical health; whereas non-therapeutic enhancement covers cases in which people considered and designated 'healthy' undergo modifications with the explicit aim to improve certain of their characteristics or capabilities.

5. *By field or technique.* Enhancements can also be categorised by the scientific field that they stem from or the technique that is used. For example, one can distinguish genetic enhancement, neural enhancement and prosthetic enhancement.

Status of Human Enhancement

- *Relation of human enhancement to medicine:* In this document we define medicine as the science and practice of diagnosis, prognosis, treatment, and prevention of disease, which encompasses the promotion of health. Human enhancement is not necessarily concerned with any of these goals and would therefore seem to fall outside the scope of medicine. That is, unless the definition of medicine is changed. In practice, some human enhancement technologies are developed as a by-product of therapeutic innovation (as a kind of 'dual use'), whereas others are developed in nonmedical settings. Where its relation to medicine is unclear, it will also be unclear whether the laws, institutional requirements, conventions and ethics guidelines that apply to medicine would also apply to human enhancement.

- *Human enhancement as a morally controversial practice:* Human enhancement is a polarising topic, with strong advocates for and against. Among the advocates that take a strongly pro-enhancement position are those who are sometimes called transhumanists. Meanwhile, those who advocate against it are 'enhancement critics', sometimes called bioconservatives. Some transhumanists argue that human enhancement should be an individual choice and emphasise the potential benefits to the individual and society. Enhancement critics tend to emphasise health risks, risks to equality and risks to well-being, and often take a principled stand, with some arguing that human enhancement amounts to 'playing God' or subverting human nature. Some of the risks and ethical concerns that are raised may be associated particularly with enhancements that are irreversible and internal to the body – for example, a permanent neural implant that permanently alters the workings of the brain evokes more questions than a prosthesis that can be externally connected and removed.

  It is important to recognise that the above labels may not capture homogenous groups of people with uniform perspectives. A binary presentation of these positions can obscure the fact that there are many stakeholders in this conversation, and not all will hold singular views on the topic of human enhancement. For instance, a person may be very willing to consider the positives that come from cosmetic surgery but be uncomfortable with drugs that change brain states or behaviours. Someone else may not have strong opinions about types of human enhancement but may be particularly concerned about the longevity or reversibility of an enhancement. Taking this complexity of positions and perspectives into account needs to be

at the heart of any discussion about guidelines for human enhancement. In any event, given that human enhancement is morally controversial, and could lead to applications that cause harm to humans, its potential benefits should be proven before research and development is to proceed (e.g. societal value, beneficence, and/or nonmaleficence).

- *Human enhancement as a new practice*: Ambitions to improve human abilities are not new. Potential enhancement through prostheses, cosmetics and performance enhancing drugs have been around for a long time. However, contemporary tools and techniques have now led to new types of enhancement and have vastly extended the scope and success of enhancement technologies. Because of its novelty, these new practices and applications may end up in grey zones – professionally, institutionally, legally, and morally. Human enhancement research that does not also have medical purpose (therapeutic or preventive) will usually not be covered by existing medical regulations and protocols, will not usually qualify for clinical trials, and most medical research ethics committees will not assess it.[51] It is important to note that that many fields still require significant advancements to be made in fundamental research before human enhancement would be possible. Indeed, HE remains at a very early stage in the development cycle for many emerging technologies, and for some areas it has not moved past the research and development stage, despite many years of work.

Moral foundations for ethics guidelines

The ethics guidelines that follow are based on six key values with universal appeal: well-being, autonomy, informed consent, equality, justice, and (moral and social) responsibility. These values have been put forward based on a combination of considerations: their recognition in philosophical ethics and in international declarations and treaties such as the *Universal Declaration of Human Rights*[52] and the *Charter of Fundamental Rights of the European Union*[53], their relevance to ethical assessments of human enhancement, and their support for inclusion in these guidelines by stakeholders, as provided in the various consultation rounds for this document.

Other moral values that are sometimes proposed in relation to human enhancement, such as liberty, bodily integrity, human dignity, and privacy, are not explicitly referenced in these guidelines, because

[51] Note that legal issues, including human rights challenges related to human enhancement, can be found in Warso, Zuzanna and Sarah Gaskell, SIENNA D3.2 'Analysis of the Legal and Human Rights Requirements for Human Enhancement Technologies in and outside the EU', 2019. Zenodo: https://zenodo.org/record/4066617#.YDY9Oi2l1pQ
This document explores international, EU and regional laws and human rights standards on these topics.

[52] United Nations, *Universal Declaration of Human Rights*, 1948. https://www.ohchr.org/EN/UDHR/Documents/UDHR_Translations/eng.pdf [accessed 15 November 2020]

[53] European Union, *Charter of Fundamental Rights of the European Union*, 26 October 2012, 2012/C 326/02, article 3.2.d. available at: https://www.refworld.org/docid/3ae6b3b70.html [accessed 12 October 2020]

stakeholders held that the key ethical issues in human enhancement did not revolve around these values. To some of these values, there is indirect reference; e.g., liberty is indirectly referenced in autonomy and informed consent. Note, finally, that most of these values have a strong basis in human rights law in many countries, including informed consent, equality, justice, and, to a lesser extent, autonomy. Well-being, or welfare, is not explicitly referenced in human rights law, but its promotion is a central policy objective in many countries.

Ethics Guidelines

The ethics guidelines are structured in eight sections. Four of these, Sections 1 to 4, are structured around ethical principles and moral values (well-being, informed consent, autonomy, justice and equality). Section 5 covers research plus safety and efficacy studies for human enhancement. Section 6 focuses on the application of human enhancement in society, while Section 7 covers ethical issues specific to genetic enhancement. Finally, Section 8 briefly discusses the use and implementation of these guidelines. The principles are not listed in order of priority. Instead they should be read and understood collectively, and as holding equal priority.

1. Human Enhancement and Individual Well-Being

- The well-being of the recipient of an enhancement should be paramount. Enhancements, especially those that are irreversible, should provide a clear benefit to the individual's life, with a likelihood that their overall well-being is increased not just in the short term, but over their lifespan. This includes being clear about if a treatment is irreversible and why, and what potential there is for an alternative, reversible enhancement that would serve the same or similar purpose. It also requires a careful weighing of potential benefits and harms to the recipient over an extended period of time, taking into account the unique characteristics and circumstances of the recipient, their own perspectives and wishes, as well as any potential changes in their circumstances and life choices over time.

- Assessments of the risks and benefits of human enhancement for the recipient, especially those that are internal to the body and irreversible, should be extensive and based on empirical studies. They should include consideration of side effects beyond the medical domain, including psychological and social consequences, such as potential loss of identity and of self-esteem, addiction, and social stigmatisation. Where the enhancement is directly or indirectly related to, or impacts on children, future risks must be considered. This includes, for instance, any loss of future privacy due to the need for long-term monitoring of an enhancement. Ensuring well-being may need to include taking into account any required support systems, e.g. as technology develops, and how support may be offered over the lifetime of the enhancement. Such foresight is considered essential for responsible innovation. For enhancements that require continued support services, there should be clarity regarding the availability of those services.

- Assessments of the risks and benefits of human enhancement for the recipient should take into account any unique characteristics and circumstances of the recipient that pertain to membership of a vulnerable group. This includes the recipient's physical and psychological features, cultural background, health, social network, and occupation.

- A high ethical benchmark needs to be applied to cases in which an enhancement causes, or risks causing, the loss of necessary biological human function, or has a risk of causing substantial or serious side effects, such as harm to health, chronic pain or other harms, especially if the enhancement is irreversible.

- A high ethical benchmark needs to be applied to cases in which an enhancement affects emotions and affect, cognition and other mental capacities. It needs to be taken into account that these capacities are interrelated, and that they are related to a person's values, beliefs, judgements, and personality, so that changing one element will also affect some or all of the others.

2. Human Enhancement and Informed Consent

- Human enhancement requires informed consent. Recipients should be informed about the nature, significance, implications, benefits and risks of the enhancement, and then make a free and unconstrained choice. Ideally, intended recipients (groups and individuals) of an enhancement should be involved early in the decision and planning processes for the design and development of technologies and procedures.

- In order to guarantee proper conditions for informed consent, human enhancements should only be administered by organisations and individuals with the professional background and required knowledge and training that enables them to properly assess and communicate risks and benefits and to verify that decisions by recipients are taken freely.

- A very high threshold must be applied to the enhancement of children (paediatric enhancement) and of individuals unable to give informed consent, all of which must be in conformity with national law. Enhancements for these groups should only be considered if the enhancements have already proven to have clear benefits and minimal risks for adults capable of informed consent and have become widely accepted for them, and if empirical studies confirm that a similar benefit-risk ratio would apply to recipients unable to give informed consent. Paediatric enhancement must take into account the UN Convention on the Rights of the Child, in particular it must observe the principle of a child's best interests, as well as a child's needs and rights more generally.

3. Human Enhancement and Autonomy

A technology or treatment aiming at human enhancement is only permissible if it does not limit a person's ability and freedom to make their own choices, and to have the full range of cognitive,

affective and conative states that underlie human autonomy. This includes taking into account contemporary or future legal implications regarding the ownership of human enhancement technologies, e.g. licencing of software, or hardware that could become indivisible from the user, and how these matters impact on autonomy. This includes taking into account the risk from unwarranted interference by external parties, ensuring that such risks are minimal, and that there is informed consent for all remote access to an enhancement. Especially where these could impact the enhanced individual's mental processes, emotional state, or behaviour, among other outcomes. Excluded are interventions that:

- Impair the potential and capacity for human rationality and independent thought, for instance by limiting a person's ability to imaginatively, critically, and autonomously engage with arguments and ideas, and to reflect on and amend their own position;
- Deprive a person of their scope for broad and complex human desires and emotions, for instance, by inhibiting all but singular desires that fit the needs of governments or market forces, or by restricting empathy and conscience for the purposes of dispassionate law enforcement or for military applications;
- Change the personality of an individual in a way that either distorts or limits their potential to maintain existing control over their identity. This includes, for instance, where an enhancement impacts on an integrated conception of self, i.e. as a self that persists in time (past and present), and as located in one person, or to a person's potential to live authentically, so that their actions are congruent with their beliefs, desires, and memories. Ordinary changes to personality and identity, as occur through a person's life, happen within a framework of decisions and actions, interpersonally and via introspection, and human enhancement should not disrupt this.

4. Human Enhancement, Justice and Equality

It needs to be recognised that human enhancement could diminish existing inequalities but can also cause new inequalities by providing individuals and groups with superior abilities not possessed by others. It may also exacerbate existing social inequalities as well as engender new ones by creating new social identities and challenging or reifying existing conceptions of identity, including what is considered 'normal' or typical, unusual or deviant. It may put pressure on unenhanced persons to enhance themselves. Human enhancement therefore should:

- Avoid the perpetuation or exacerbation of existing inequities or inequalities between groups and communities. Whether enhancements are likely to do so can be established via social or ethical impact assessments;[54]
- Avoid promoting or perpetuating discrimination of either enhanced or non-enhanced persons by anticipating and mitigating where possible these kinds of outcomes;
- Not propagate harmful stereotypes pertaining to *average versus disabled bodies,* or standards of beauty or presentability that rest on prejudicial stereotypes, for instance about gendered, racialised or ethnic identities or other protected characteristics;
- Take into account where the abilities bestowed by the enhancement are amongst those abilities considered most important for having success in life, such as intelligence, memory, self-confidence, strength, dexterity, and endurance, among other qualities. In the case where such enhancements are made available, then they should be equally accessible to all people who want them.

5. Human Enhancement Research and Safety and Efficacy Studies

Preclinical research will usually not be aimed at human enhancement but may involve enhancement, for instance, of human cells and tissue. The below ethics guidelines are aimed at clinical research. For pre-clinical research, ethical requirements will be more liberal, since that research is not typically applied to humans. New biomedical or behavioural interventions are tested out in clinical trials, in which their efficacy and safety are studied by trying them out on human participants. Clinical trials are highly regulated in most countries.[55] In most countries, it will be difficult to attain permission for clinical trials for enhancement interventions that do not also have a medical (therapeutic or preventative) purpose. As currently defined clinical trials could only be performed for therapeutic enhancement research and not for non-therapeutic enhancement research. For therapeutic enhancement, clinical trials will be a moral and legal necessity. For non-therapeutic enhancement, equivalent safety and efficacy studies will be necessary.

[54] For social impact assessment, see European Commission, EUR 21702 – *Assessing the Social and Environmental Impacts of European Research*, Report to the European Commission, Directorate-General for Research, 2005, at https://op.europa.eu/en/publication-detail/-/publication/f5bed899-225c-44c9-8864-39a59cc94a9b. For ethical impact assessment, see the standard developed in CEN working document CWA 17145:2017-2, 2017, retrievable at https://satoriproject.eu/media/CWA17145-23d2017.pdf.

[55] In the European Union, they are regulated by Directive 2001/20/EC and new Regulation 536/2014.

- Human enhancement research aimed at new interventions internal to the body require safety and efficacy studies to take place before the new intervention can be applied in society.
- Clinical trials for human enhancement are morally and legally required if the intervention that is studied is primarily therapeutic, and in addition has a possible application towards enhancement.

6. Human Enhancement and Society

Human enhancement could have serious implications not just for recipients, but also to the institution of medicine and other social institutions, to families, communities, and other social groups, and to society as a whole. Therefore, social responsibility should be paramount in research, development and deployment of human enhancement.

- Human enhancement research and development should be preceded and accompanied by social and ethical impact assessments that do not just consider benefits and risks to individuals, but also implications for other stakeholders and for society as a whole. These assessments should include the possibilities of misuse and dual use. They should, in addition, involve relevant stakeholders (both those that are directly and indirectly affected) and it should be ensured that there is enough support from stakeholders for research and development to proceed.
- Public funding bodies should decide after consultation with stakeholders whether enhancement research should be publicly funded. If so, then such public funding, specifically research aimed at interventions in the body, should only be provided if it can be shown in advance that the research is likely to be able to adhere to these ethics guidelines, and that a risk/benefit assessment for recipients, and a social/ethical impact assessment for society, have a positive outcome.
- The commercial market for human enhancement should be regulated so as to ensure that the interests of recipients, as well as those of society are paramount. Products should meet the requirements set out in these guidelines, relevant product safety guidelines, and GDPR, and it should be assessed per product category whether commercial advertising should be allowed, and if so, what restrictions it is subjected to. Advertising should not lead consumers to believe that certain enhancements are necessary for their well-being and success or for them to fit into society, or that not acquiring the enhancement causes them to be deficient.
- Human enhancements that are internal to the body or are irreversible should not be specifically developed to be applied in the workplace or in education. This includes normalising human enhancement for employment prospects, career progression and development, or education, and thus creating undesirable social pressure for it to be used. There should not be work requirements or educational requirements that directly refer to, or indirectly rely on, the presence of human enhancement.

7. Genetic Enhancement

Genetic enhancement is the introduction of changes into a genome or epigenome in order to modify and improve nonpathological human traits. Whilst genetic changes occur naturally all the time, genetic enhancement involves the introduction of genetic changes through an artificial process. Genetic enhancement can take place in three ways: through germline modification (germline genetic enhancement), embryo selection and somatic genetic modification.

Germline genetic enhancement is the genetic engineering or modification of sperm or egg cells or very early embryos in order to produce enhanced human traits that affect offspring and are heritable. Genetic enhancement through embryo selection is a second way in which offspring can be generated with enhanced features. Embryo selection is a process in which embryos are genetically profiled prior to implantation through pre-implantation genetic diagnosis. In embryo selection for human enhancement, embryos are selected that have genomes that are expected to result in superior traits. Both germline genetic enhancement and embryo selection for enhancement are controversial procedures that are outlawed in many countries. Germline genetic enhancement is often prohibited as part of a more general prohibition of germline genetic modification. Embryo selection is allowed in most countries, but only to avoid implantation of embryos with serious defects that could result in serious disease or mortality. It is rarer that selection on the basis of other characteristics is allowed. [56]

Both germline genetic enhancement and embryo selection are controversial because they could be done for eugenic purposes, i.e., for apparently improving the genetic quality of a human population by excluding people and groups judged to be inferior and promoting those judged to be superior. There are therefore important moral reasons to be cautious, so that the equal dignity of all humans is respected. Further issues include the risk of creating a lack of diversity among humans, and the risk of creating designer babies that are shaped to accommodate the desires and preferences of parents and of society. Germline genetic enhancement is also controversial because it does not allow for informed consent by descendants, and because there may be unforeseen risks to modification of the germline.

Somatic genetic enhancement involves the genetic modification of bodily cells other than sperm or egg cells in order to enhance the functionality of tissues and organs. It is also morally controversial, although less so than germline enhancement. It is controversial because it involves medically permanent alterations to healthy human tissues and organs that are medically unnecessary, and because it could be used to biologically reengineer human beings to make them have desired traits,

[56] See Bayefsky, Michelle J., "Comparative preimplantation genetic diagnosis policy in Europe and the USA and its implications for reproductive tourism", *Reproductive Biomedicine & Society online*, Vol. 3, 2016, pp. 41-47. https://doi.org/10.1016/j.rbms.2017.01.001.

which could be understood as a type of eugenics. Somatic genetic engineering for therapeutic and preventative purposes is much more widely accepted, unlike germline genetic engineering for these same purposes. Because of the unclear boundary between enhancement, therapy and prevention, scenarios are therefore likely to ensue in which somatic gene editing undertaken for therapeutic or preventative purposes is seen to amount to human enhancement.

For the time being, the above objections to genetic enhancement justify stringent ethics guidelines. Since both genetic engineering and our moral attitudes concerning it are still evolving, it is however conceivable that a more permissive approach can be taken at some point in the future.

- Germline genetic enhancement should not be undertaken, nor should clinical research be undertaken with the aim of facilitating this kind of procedure.[57]
- Genetic enhancement for non-medical reasons through embryo selection should not be undertaken, nor should clinical research be undertaken with the aim of facilitating this kind of procedure.
- Somatic genetic enhancement should not be undertaken, nor should clinical research be undertaken with the aim of facilitating this kind of procedure. Precautions should be taken that somatic genomic editing techniques used for therapy and prevention are not used for enhancement.[58]

8. Incorporation of these Ethics Guidelines

Many existing fields can yield innovations for human enhancement. The following are among those most likely to lead to such innovations and applications, but the list is not exhaustive: artificial intelligence; augmented reality; biomaterials; exoskeletons; genomics; human-machine interaction; information and communication technologies; nanomedicine; neural engineering and neurotechnology; pharmaceutics; prosthetics; tissue engineering and bioprinting. Given the likelihood for enhancement innovations, these guidelines may have particular relevance for people working in

[57] Note that germline genetic engineering, whether therapeutic, preventative or enhancing, is currently prohibited in many countries. The European Oviedo Convention, art. 13, states: 'An intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants.' (Council of Europe, *Convention on Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine*, European Treaty Series - No. 164, 1999 (http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/164).). The EU Charter has a clause which specifies 'the prohibition of eugenic practices, in particular those aiming at the selection of persons,' which appears to rule out germline modification (European Union, *Charter of Fundamental Rights of the European Union*, 26 October 2012, 2012/C 326/02, article 3.2.d. available at: http://data.europa.eu/eli/treaty/char_2012/oj

[58] Note that article 13 of the Oviedo Convention also prohibits somatic genetic enhancement.

the above fields, including where there could be unintended potential for human enhancement applicability.

It is recommended that these guidelines are incorporated in national as well as cross-European ethics guidelines and research ethics protocols for relevant fields, particularly identified in the preamble of this document, as well as in ethics guidelines and research ethics protocols for the field of biomedicine. Since human enhancement is currently not an institutionalised practice, it is moreover recommended that new regulations, policies, protocols and procedures for human enhancement research, development, funding, and application are developed that are consistent with and supportive of these guidelines.

These guidelines will require periodic revision. To that end, it is recommended that an international expert working group is set up to assess when and how the guidelines should be amended, including in editing the guidelines listed above, and by adding new guidelines as appropriate. This group will need to have sufficient breadth of expertise so as to ensure the accuracy and efficacy of the guidelines, and to ensure they are relevant for both contemporary as well as near future issues that can arise as a result of new and emerging developments in human enhancement technologies. The group will also need to consult relevant stakeholders prior to any update to the guidelines.

We propose that this body will oversee and analyse trends in HE; assess moral and social consequences of developments in human enhancement; and provide information and advice for the tasks that are generated by the above guidelines. This expert working group fits with a proposal in the STOA study on human enhancement technologies, which proposed the creation of 'A European Body on Human Enhancement Technologies'. The study describes the aims of the body as being to 'develop a normative framework for human enhancement that can guide the formulation of EU policies in this field,' including for regulation. They recommended representation that ensured 'European cultural diversity', a range of expertise, and scope for public consultation.[59]

Until the establishment of such a working group, the guardian of these guidelines is the University of Twente, in casu prof. dr. Philip A. E. Brey and dr. Yasemin J. Erden. For inquiries about these guidelines, contact dr. Erden at y.j.erden@utwente.nl.

[59] Coenen, Christopher, Mirjam Schuijff, Martijntje Smits, Pim Klaassen, Leonhard Hennen, Michael Rader and Gregor Wolbring, Human Enhancement, EU Parliament, STOA, May 2009. https://www.europarl.europa.eu/stoa/en/document/IPOL-JOIN_ET(2009)417483
See especially pp. 148-150.

Glossary

Affective and emotional enhancement: interventions that improve and/or provide greater control over affect and/or emotion. This might be related to social norms and values, and/or the pathologising of certain behaviours and tendencies.

Autonomy: self-governance or self-determination. It is the ability to have one's own thoughts and to construct one's own goals and values, and the freedom to make one's own decisions and to perform actions based on them. Connected with this are terms such as 'relational autonomy', which seek to show how interpersonal relationships feed into autonomy, and how disparities, for instance in power, can affect a person's autonomy, sometimes unjustly.

Clinical Trials: while there is no worldwide accepted definition of 'Clinical Trials', for the purposes of these guidelines these are understood to be trials: on drugs or medical devices; involving human beings outside these fields e.g. surgery, neurology etc.; with identifiable data; or with stored biological material of human origin.

Cognitive enhancement: interventions that improve cognitive abilities, including pharmaceutical cognitive enhancement (PCE), implanted neural interface (INI) & brain-computer interface (BCI), neuro-stimulation & neuromodulatory techniques, virtual & augmented reality (VR/AR) and memory enhancers. These may impact personal identity, for instance by altering someone's moods, cognition, behaviour, and basic personality traits.

Cosmetic enhancement: interventions that seek to alter or 'improve' the cosmetic traits of a human being, including as associated with norms of beauty and of societal expectations.

Genetic enhancement: enhancement achieved through genome editing or embryo selection. It can be practiced on somatic or germline cells. Somatic genetic enhancement involves the genetic modification of bodily cells other than sperm or egg cells in order to enhance the functionality of tissues and organs. Germline genetic enhancement involves the genetic modification of sperm or egg cells or very early embryos in order to produce enhanced human traits.

Informed consent: processes and procedures to ensure that participation in studies and trials is entirely voluntary. Researchers must be proactive in seeking consent, ensure that participants are adequately informed and understand all salient details about the research before consent is given (e.g. aims, methods, implications, benefits, risks, data handling and management, right to refuse or withdraw, procedures for incidental findings etc.). Processes for consent differ for vulnerable people, including children or adults with limited mental capacities. In such cases, informed consent must be obtained from a legally authorised representative, alongside assent from a participant wherever possible, and it is incumbent on the researchers to ensure that they have sufficient information to enable the representative to provide consent on behalf, and in the best interests, of the participants.

Longevity enhancement: interventions that extend a human's expected lifetime, whether as preventative, e.g. vaccines, or to improve one's senescence or durability, e.g. stopping or slowing the aging process or improving one's ability to survive or recover from harm or damage.

Moral enhancement: interventions that modulate or otherwise allow a person to improve their moral bearing. These may offer scope to 'correct' behaviours considered deviant in one's society, or which greatly alter or allow for the modulation of moral deliberation. These can include drugs that prevent problematic sexual behaviour, or drugs that reduce implicit bias.

Physical enhancement: interventions that improve or introduce new physical abilities, such as performance, endurance, or the addition of new abilities (additive).

Annex 2: Stakeholder contributions

Table 4: List of stakeholders and workshop facilitators[60]

Name	Affiliation	Role
Prof. Dr.med. Elmar Doppelfeld	Chair, EUREC	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)
Dr. Dr.phil. René von Schomberg	European Commission	HET stakeholder workshop (October 2020) - stakeholder
MEP Lina Galvez Muñoz	European Parliament	HET stakeholder workshop (October 2020) - stakeholder
Dr. Teresa Summavielle	Universidade do Porto	HET stakeholder workshop (October 2020) - stakeholder
Christopher Coenen	Karlsruhe Institute of Technology	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)
Dr. Alex McKeown	University of Oxford	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)
Prof. Dr.phil. Matthias Kettner	Witten/Herdecke University	HET stakeholder workshop (October 2020) - stakeholder
Dr. Anders Sandberg	University of Oxford	HET stakeholder workshop (October 2020) - stakeholder
Dr. Tara Mahfoud	University of Essex	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)
Asst. Prof. Laura Y. Cabrera	Michigan State University	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)

[60] The names listed here are those who contributed *and* who agreed to be acknowledged. There have also been contributors who did not give explicit permission for acknowledgement, and so we offer general recognition of those participants in this footnote.

Prof. Dr.Ir.P.H. Peter Veltink	University of Twente	HET stakeholder workshop (October 2020) - stakeholder
Prof. Jackie Leach Scully	UNSW/Newcastle University	HET stakeholder workshop (October 2020) - stakeholder
Prof. Dr. Saskia Nagel	RWTH Aachen University	HET stakeholder workshop (October 2020) - stakeholder
Prof. Abhay Pandit	National University of Ireland	HET stakeholder workshop (October 2020) - stakeholder
Lesley-Ann Daly	CyborgNest	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)
Prof. Dr. Anita Arsovska	University Ss Cyril and Methodius	HET stakeholder workshop (October 2020) - stakeholder Stakeholder feedback to guidelines V1 (December 2020)
Deborah Gale	The Age of No Retirement / UK Encore Fellows	HET stakeholder workshop (October 2020) - stakeholder
Dr Michael Kühler	Karlsruhe Institute of Technology	HET stakeholder workshop (October 2020) - Workshop facilitator
Dr Anais Resseguier	Trilateral Research	HET stakeholder workshop (October 2020) - Workshop facilitator
Dr. Anna Drozdzewska	University of Twente	HET stakeholder workshop (October 2020) - Workshop facilitator
Prof. Dr. Mark Coeckelbergh	University of Vienna	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Francisco Lara	University of Granada	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Bartha Maria Knoppers	Mcgill University	Stakeholder feedback to guidelines V1 (December 2020)
Assoc. Prof. Benjamin Capps	Dalhousie University	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Dr. Allen Buchanan	Duke University	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Roger Brownsword	King's College London	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Dr. Armin Grunwald	Karlsruhe Institute of Technology	Stakeholder feedback to guidelines V1 (December 2020)
Dr. Guillaume Durandau	University of Twente	Stakeholder feedback to guidelines V1 (December 2020)
LL.D. Santa Slokenberga	Uppsala University	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Bernd Stahl	De Montfort	Stakeholder feedback to guidelines V1 (December 2020)

Dr. Marion Dreyer	DIALOGIK	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Dr. Tracy J. Trothen	Queen's University, ON	Stakeholder feedback to guidelines V1 (December 2020)
Prof. Miguel Moreno Muñoz	Uni Granada	Stakeholder feedback to guidelines V1 (December 2020)
Jukka Koskelo	Dopinglinkki, A-Clinic Foundation	Stakeholder feedback to guidelines V1 (December 2020)
Guido Gorgoni	University of Padova	Stakeholder feedback to guidelines V1 (December 2020) Public consultation feedback - respondent
Jan Deckers	Newcastle uni	Stakeholder feedback to guidelines V1 (December 2020)
Diane Whitehouse	The Castlegate Consultancy	Stakeholder feedback to guidelines V1 (December 2020)
Dr. Cansu Canca	AI Ethics Lab	Stakeholder feedback to guidelines V1 (December 2020)
Dr. Maria Alexandra Ribeiro	National Ethics Committee for Clinical Research, Brazil	Stakeholder feedback to guidelines V1 (December 2020)
Stephen Rainey	The Oxford Uehiro Centre for Practical Ethics, University of Oxford	Public consultation feedback - respondent
Dr. Franc Mali	University of Ljubljana - Faculty of Social Sciences	Public consultation feedback - respondent
Robert Tarnacki	Kancelaria Radcy Prawnego Dr Robert Tarnacki	Public consultation feedback - respondent
Kai Jensen	Intector	Public consultation feedback - respondent
Association Française Transhumaniste - Technoprog	Association	Public consultation feedback - respondent
Leonardo Souza-García	NODUS	Public consultation feedback - respondent

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