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ICARUS' WINGS

Navigating Human Enhancement

Anton Dengg (ed.)

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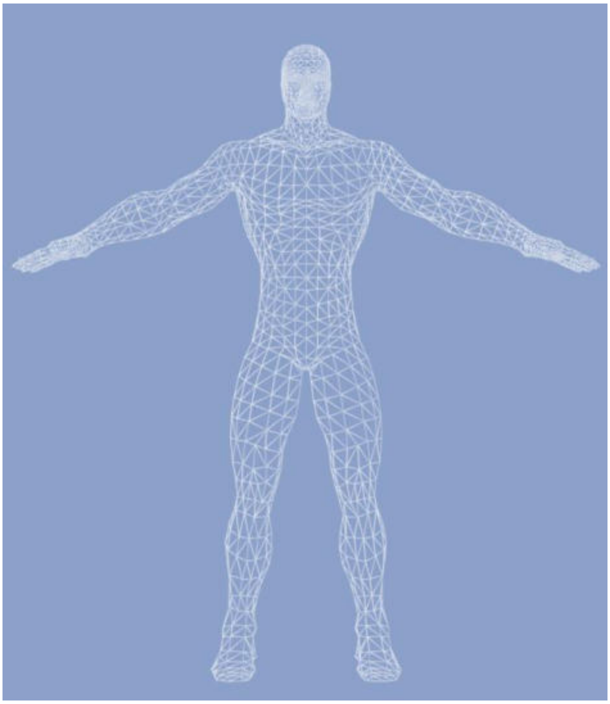

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Foreword

This publication presents a comprehensive study on the subject of human enhancement. For the first time, an interdisciplinary group of experts will shed light on their results from a project run by the Institute for Peace Support and Conflict Management (Institut für Friedenssicherung und Konfliktmanagement – IFK) at the National Defence Academy of Vienna (Landesverteidigungsakademie Wien – LVAk), focussing on the potential security policy effects of human enhancement developments.

As the commanding officer of the LVAk, I would like to thank the many contributors – especially the project manager, Colonel Dr. Anton Dengg – for their work on this project and their extremely positive internal and external cooperation. All of this guarantees the high quality of this scientific publication. I hope you, dear reader, find these insightful explanations engaging and enjoy exploring these thought-provoking ideas. The interesting insights – together with the many potential side effects (both positive and negative) resulting from human enhancement – are sure to surprise you, particularly in terms of the social and military prospects for the future.

Lieutenant General Mag. Erich Csitkovits
Commandant Austrian National Defence Academy

Acknowledgements

Following a challenging period caused by the COVID pandemic, the IFK project "Human Enhancement as a Security Policy Factor" had to be delayed by one year. This study focusses on a very complex matter. As this final publication of the Human Enhancement project shows, it could not have been completed without the exemplary cooperation of many employees.

My sincere thanks go to all those who were involved in the project, and especially to those team members who agreed to write an article for this book, in addition to carrying out their other tasks.

Special thanks go to two members of the team: Ms Elisabeth Saurwein, who was jointly responsible for the project preparation and the initial workshops, particularly in the early days of the project, and Ms Maria Lorena Isabel Schröder Campos, who supported the project in an exemplary manner, with great enthusiasm and ideas, both in the planning and implementation of the final conference and in the preparatory work for this publication. Thanks are also due to Simon Fischer, who was always available for proofreading.

Our three colleagues at the Institute for Peace Support and Conflict Management (IFK) at the National Defence Academy of Vienna (LVAk), who formed the organisational basis for the project, should not go unmentioned: Robert Romano, Karin Schlagnitweit and especially Werner Pack for his additional layout work.

Last but not least, our thanks go to the text-it Produktdokumentation GmbH company, which carried out the translation and proofreading work on behalf of the Austrian Armed Forces Language Institute (Sprachinstitut des Österreichischen Bundesheeres – SIB).

Finally, I would like to thank you, dear readers, for taking the time to discover the important, future-oriented subject of "human enhancement".

Colonel Dr Anton Dengg,
project manager

Introduction

Anton Dengg

The Conflict and Threat Scenario Section of the Institute for Peace Support and Conflict Management at the National Defence Academy of Vienna (IFK/LVAk) has been conducting research in the field of hybrid threats (HT) since 2012. As of 2016, the focus has been on the technological manifestations of these diverse forms of threats. Priority topics, such as technology as a means of power, are being researched. In this regard, the influence of artificial intelligence (AI) is becoming increasingly significant, especially in combination with Big Data.

High-tech weapons and equipment systems place high demands on armed forces personnel. The more complex the systems are, the longer and more costly the training periods for soldiers have to be. Another aspect concerns the different characteristics of potential application areas. In conjunction with the effects of climate change, emergency personnel on corresponding missions are reaching their stress limits at an ever earlier stage. In order to be able to survive in operations, soldiers are therefore introduced to these stresses as realistically as possible so that they can withstand them during deployment. The result is that well-trained combatants are costly, and losses – apart from the human factor – are difficult to compensate for. The ageing populations of Western societies are also leading to a smaller number of citizens who are fit to bear arms. All of these challenges are forcing states to find innovative solutions to ensure that their armed forces remain fit for purpose. There are several approaches to this. On the one hand, autonomous weapon systems could serve as a replacement for troops. On the other hand, the use of human enhancement (HE) would be a variant for optimising human capabilities, therefore compensating for the lack of soldiers. The latter approach in particular is seldom noticed by the public, despite there being astonishing research results from the medical field with all of the opportunities and limitations that it entails. Possible options for differentiated areas of military deployment are only selectively discussed in specialist circles and are rarely incorporated into perceived threats. This publication aims to fill these gaps.

The opinions expressed in the individual articles do not reflect the opinions of the BMLV. Potentially controversial findings in the scientific contributions are certainly welcome. They highlight the wide range of challenges of HE.

The project

Since the IFK started studying the technological components of hybrid threats, AI has become an increasingly indispensable part of scientific research. During our thematic research work on HB, media reports about intentions for improving human performance came to our notice. There was research interest in transplanting microprocessors into brains. This awakened the interest of the IFK in Human Enhancement. In 2022, the "Artificial Intelligence (AI) as a future-decisive factor for increasing the efficiency of military task fulfilment with special consideration of human enhancement (HE)" project was initiated at our institute. Under the working title of "Human Enhancement (HE) as a Security Policy Factor", the project was launched as part of a research process and approved by a specialist committee of the Austrian Armed Forces (Österreichisches Bundesheer – ÖBH).

As early as 2013, the German Bundeswehr Office for Defence Planning addressed fundamental questions about HE and the threats posed by it. In its HE project, the IFK addressed these aspects and dealt with the matter in great detail. The expected technical, medical, ethical, social, legal and military challenges of HE were addressed, taking the fundamental value framework of our Western social system into consideration.

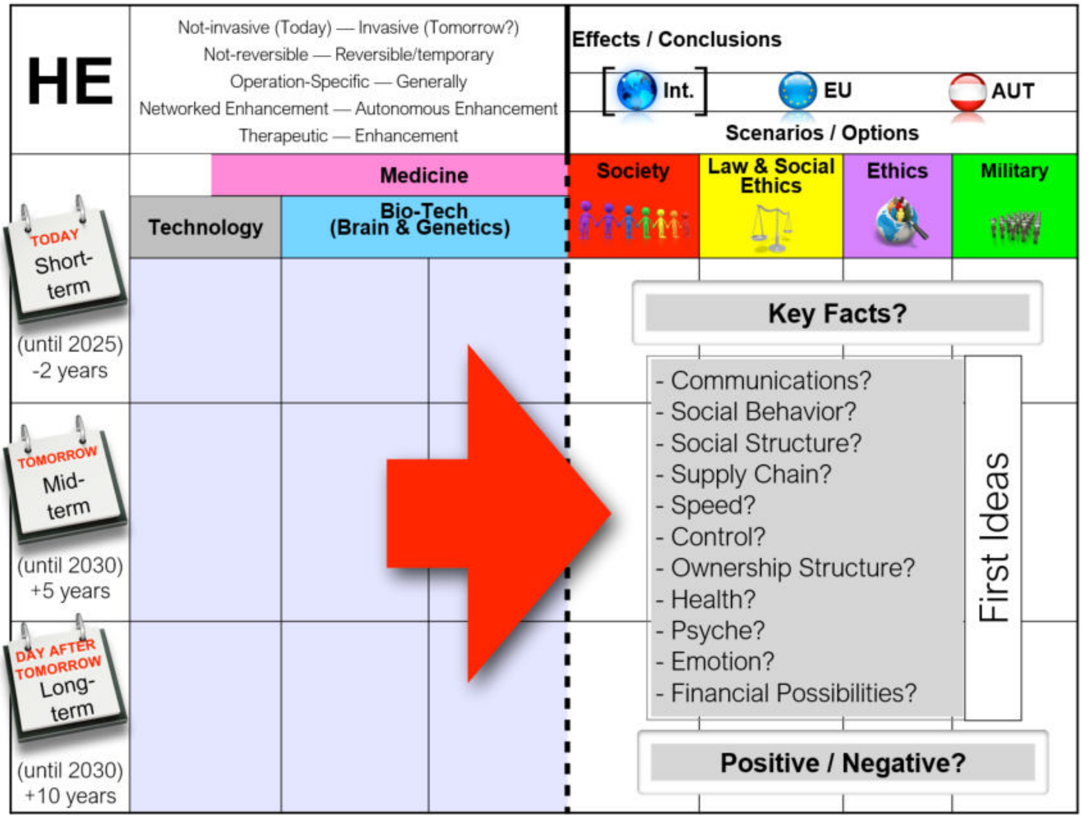
The goal of the HE project was to highlight security policy challenges and possible implications that could arise from HE and constitute part of hybrid threats. It therefore represents a contribution to the perceived threat with regard to opportunities and risks for and by armed forces or security forces in general, with particular emphasis on Austria, the Austrian Armed Forces and the resilience of the EU.

The hypothesis was that within Europe, HE innovations in the medical field were the starting point for social change. The main focus was therefore on HE technology development in medicine and the performance limitations in humans caused by illness, accidents, etc. and the restoration of original functionality. Particular interest was taken in expanding human capabilities beyond the normal level. The replacement of missing body parts (prosthetics) was only of research interest if artificial limbs were coupled with nerve pathways. An invasive connection between man and machine only exists in cases such as this. Even sensory perceptions can currently be perceived with such "man-machine interfaces". A breakthrough appears to have been made in bionic reconstruction, which will be the driver behind higher-quality HE technology changes in the future. Tremendous advancements are being made in this research field, and rapid technological developments with extreme HE creations can be expected. Utopias are more and more becoming reality. Once positive medical achievements have been anchored in society, there is a strong possibility that these successes will be extended to other sectors such as the economy or security forces (e.g. enhanced fitness criteria). Modern preliminary stages, such as prosthetics, were therefore taken into account for the project.

Improving performance capability is always a goal of the military. However, not every human intervention for optimisation purposes necessarily constitutes an improvement. The project team therefore decided to replace the term "improvement" with "extension".

Methodology

It has been widely reported in the media that Elon Musk intends to transplant a computer chip into a human brain. If the experiments and research are successful, the idea is that the findings will also find their way into military applications. The first step in the project planning phase was to outline the approach:



A qualitative research method was applied for the initiated research project, and key research fields were identified. A research exposé was prepared, and possible experts were named. A kick-off workshop took place at the LVAk (National Defence Academy), during which the project planning was presented for discussion to various internal and external experts who work with the ÖBH. Additional research interests and complementary research questions raised by the experts were included in the project draft. The technologies were divided into the categories of invasive/non-invasive, permanent/non-permanent, reversible/irreversible for further focus.

The main aim of the project was to address the individual subject areas using the most comprehensive approach possible, given the complex nature of human enhancement and its area of application. For that reason, it was decided to form an interdisciplinary group. Experts were appointed as PoCs (Points of Contact), and each of them was responsible for a sub-aspect of HE or a cluster.

The LVAk's Central Documentation Centre (ZentDok) created its own internal cloud solution with password access, in which the experts shared or presented their knowledge and initiated discussions about it. ZentDok also provided comprehensive research on HE for a cloud query. During workshops (WS), six subject clusters (see figure above) with PoCs were formed. These had the opportunity to add additional experts to their clusters in order to provide the required specialist knowledge.

The individual challenges addressed in the clusters were presented and discussed at subsequent events. The working groups presented their findings in panel discussions at a final conference. A selected audience was given the opportunity to ask questions or make comments. The input from the conference has been considered in the written articles in this final project publication.

Human enhancement. A question of definition

The term "human enhancement" is often used in the professional world, which indicates the complexity of the subject. In a nutshell, it is about reinforcing existing human capabilities.

China's perspective on the issue shows that Western terminology is not used. China initially referred to the subject of HE as "man-machine cooperation" or "brain-machine interface". In late 2021, the term changed to "human-machine integration" or "cloud-brain control". In addition, the literal translation of the Mandarin word for AI is "common body".[1]

Challenges pertaining to terminology particularly arise because of the many facets of HE. The countless definitions of terms in scientific articles, analyses etc. explain this versatility. At the beginning of the project, the various terms

[1] See Vogl, Doris: Human enhancement with Chinese characteristics – AI as a factor for China's military modernisation with special consideration of human-machine teaming. As a case example in this publication.

were introduced to the participants and put up for discussion. Since the definitions that were presented proved to be unsatisfactory for the project group, a separate method was chosen to find an operational definition. During a kick-off meeting, the following **operational definition** was established, using specific expert expertise in conjunction with ChatGPT suggestions:

> Human enhancement refers to the use of technologies, methods or substances for expanding the capabilities (physical or cognitive) of humans beyond what is normal and considered natural.

When dealing with the topic of HE, the question of distinguishing between optimisation and enhancement soon arises. In the project, the experts reached the following decision: Optimisation brings humans closer to their biological performance limits, whereas enhancement exceeds these limits.

In addition, the term transhumanism was always used during the analyses, which itself raised a question of differentiation. Again, several (unsatisfactory) definitions were put forward. Therefore, the ChatGPT survey method was employed once more. The experts established the following definition from a series of suggestions:

> Transhumanism is a philosophical movement aimed at enhancing human psychological and physical capabilities through advanced technology. By viewing the mind and body as systems to be optimized, it challenges conventional notions of human nature. Transhumanists aspire to transcend biological limitations, envisioning a future where technology improves human life and capabilities. Unlike traditional approaches to human enhancement, which focus on improving existing functions or addressing medical conditions, transhumanism seeks to fundamentally transform human existence – extending lifespan and advancing traits far beyond current human potential.

General considerations

Societies are becoming increasingly reluctant to accept casualties in their armed forces. Difficult conditions in operational areas also make missions more challenging. In addition to climatic conditions, this includes an increasing number of different combat-ready actors, which reinforces the desire for "super soldiers".

That which is fascinating about HE is its game-changing potential, particularly with regard to security policy. Anyone who is pioneering in this field of research will have global power constellations and dominance turn in their favour. This is illustrated by the statement of Chinese author Chen Wehui: "... the one who wins the platforms wins the world ...".[2] Even Russian President Putin, who is partly isolated internationally due to his war of aggression against Ukraine, toyed with the idea of HE at the World Festival of Youth.

> "Genetic engineering will open up incredible opportunities in pharmacology, new medicine altering the human genome if a person suffers from genetic diseases. All right. This is good. But there is another part to this process. It means, we can already imagine it, to create a person with the desired features. This may be a mathematical genius. This may be an outstanding musician. But this can also be a soldier. An individual who can fight without fear or pain. You are aware that humankind will probably enter a very complicated period of its existence and development. And what I have just said may be more terrifying than a nuclear bomb."[3]

Decision-makers must therefore be confronted with future technological aspects such as HE technology issues for armed forces. The need for collaboration in the field of HE due to its complexity is revealed in the following statement by Yang, Qiong and Gao, Xiaoyu: 'The field of human enhancement technologies requires multi-stakeholder collaboration and joint response'.[4] The EU is no exception to this.

HE as a form of performance enhancement does not have entirely positive connotations. The many facets raise several questions on several levels, ranging from technical to medical, social, judicial and military areas, with a particular focus on philosophical/legal aspects. The issue of limits, for example: When does a human being stop being a human being, and what effects would exceeding limits have in the future?

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2 See Vogl, Doris: Human enhancement with Chinese characteristics – AI as a factor for China's military modernisation with special consideration of human-machine teaming. As a case example in this publication.

3 President Putin at the World Festival of Youth, Sochi, Russia, October 21, 2017, Source: Joosten, Peter: Festival of Youth - What Vladimir Putin Thinks About Genetic Engineering. Via YouTube. 2021. https://www.youtube.com/watch?v=WnlaAIKPjAw.

4 See Vogl, Doris: Human enhancement with Chinese characteristics – AI as a factor for China's military modernisation with special consideration of human-machine teaming. As a case example in this publication.

Social questions include whether HE also contributes to promoting equality. Does technology "compensate" for human dysfunction in any way? We could find ourselves facing these and similar philosophical/military concerns sooner than expected. This is also the case when HE is used by security forces, for example. This applies both to our own defences and those of our opponents. How far can, should or must the development of HE technology advance?

Current high-tech developments rely on non-invasive human-machine connections such as headsets or pilot helmets equipped with electrodes. If we look at the progress in prosthetics, the next logical step would be to invasively network future products. Other research interests, such as transporting computer components (chips) via the bloodstream or transplanting electronic components into the brain, are on the verge of a breakthrough. The initial research ideas are ushering in a new technological and medical age.

If these developments initially serve primarily to improve human deficits, future use in the armed forces can be expected. Even NATO is thinking seriously about the potential of HE:

> "Human enhancement technologies also present defence and security risks against which Allies and NATO must safeguard, including strategic competitors and potential adversaries enhancing their forces, or otherwise seeking to degrade Allied forces by exploiting cognitive, physical or technological vulnerabilities, to achieve military advantages."[5]

Critical "side effects" cannot be overlooked in this kind of research. If we intervene in the mind of an individual, the door is wide open for comprehensive manipulation – and in the case of mass application, the influencing of entire societies.

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[5] NATO: Summary of NATO's Biotechnology and Human Enhancement Technologies Strategy, 2024. https://www.nato.int/cps/en/natohq/official_texts_224669.htm#:~:text=Human%20enhancement%20technologies%20also%20present,physical%20or%20technological%20vulnerabilities%2C%20to,%20accessed%2013%20August%202024, accessed 13 August 2024.

Technology

The pursuit of technical superiority is the fundamental goal of a number of countries – albeit with different intentions – including the USA. "My biggest concern right now is the overall erosion of our Technology superiority...," says Frank Kendall, Under Secretary of Defense for Acquisitions, Technology and Logistics.[6] Efforts in this regard are unlikely to deter a number of states, especially authoritarian ones, from carrying out unrestricted human enhancement developments. Governments, such as those of China and Russia, also have a strong interest in technological advancement because it forms the basis for political, economic and military power.

AI has been on everyone's lips ever since the introduction of ChatGPT. Visions of the future, especially of changes brought about by new technologies, stimulated the imagination. The initial curiosity and positive expectations of AI were followed by potential fears. Quantum leaps in AI have been achieved through increased computing power and improved chip designs – smaller, better, lighter and faster – making AI suitable for everyday use. The application possibilities are also increased by high storage capacities. New areas of application, such as science, medicine and the military, make aspirations become reality. Creativity knows virtually no boundaries.

Because of that, AI has been hailed by experts as *THE* new technology that will impact almost all areas of everyday life and radically change our daily lives. AI lays the foundations for HE. This means that the desire to artificially expand human capabilities is within reach. Like AI technologies, HE requires two basic variables: enormous amounts of data and fast data processing speed.

As Budde and Pickl mention in their article,[7] the majority of HE technologies require an Internet connection to control the respective product that is used. This in turn poses challenges for the IT infrastructure and the energy supply that is required for it. How much energy does an enhancement need, and

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6 Wells, Jane: The Man with the Pentagon Checkbook. In: CNBC. May 13, 2014. https://www.cnbc.com/2014/05/13/ll-the-man-who-procures-weapons-for-the-pentagon.html.

7 See Budde, Dieter/ Pickl, Stefan: Human enhancement - An ethical perspective. In chapter ETHICS in this publication.

where does this energy come from, even if the enhancements are in the nano range, for example? Will the current energy storage devices be able to fulfil the needs of future HE technology?

Comprehensive questions arise for all HE systems, irrespective of whether they are used non-invasively (outside the body), invasively (inside the body), reversibly or irreversibly. Particularly the irreversible applications such as brain-computer interfaces (BCI) raise further problems. For instance, the question of the right of disposal of invasive high technology remains open. Who is the owner of the HE product that is installed for a certain period of time or for a certain purpose (e.g. military)? Is it the person with the product inside them, or is it the institution that financed the procedure? It is plausible that such HE deployments could be coupled with the promise of social or economic benefits for soldiers following their military service. It is very likely that future technologies for establishing communication between the brain and external products will include a more moderate (non-invasive) form of BCI, as well as an increasing number of different sensors.[8]

Medicine

Technical achievements have always inspired the medical world. The stated goal is to free people from health restrictions. The use of HE methods has become almost routine at some levels in the healthcare system. In addition, thanks to AI, increasingly intelligent computer systems make Homo sapiens appear in need of optimisation. Successes, particularly in the technical and medical fields, appear to make this possible.

In addition to a number of clinical challenges, further disadvantages of HE for humans are possible. Health risks, especially with invasive HE variants, have yet to be satisfactorily and comprehensively researched. There may be a risk of side effects, such as those associated with the medical use of HE. Cognitive optimisation could lead to fatal long-term effects. More research is needed here.

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[8] See Klerx, Joachim: Outlook into the future of warfare with innovation race regarding human enhancement. In chapter MILITARY in this publication; Klerx, Joachim: The future of human enhancement in the military domain. In chapter TECHNOLOGY in this publication.

Studies of German soldiers deployed in Afghanistan have shown that more than 20% of military personnel suffer from a mental illness.[9] A cost-benefit analysis could lead to the minimisation of failures such as this using HE technologies, at least for elite soldiers. Would HE be an adequate solution? However, possible solutions using brain-machine connections cause epileptic seizures in humans.[10] Tests for effective use for military purposes must be carried out in a holistic approach, drawing on adequate scientific disciplines.[11]

Ethics

Which challenges, particularly those of an ethical nature, can be expected? Are humans as human beings called into question? Countless other ethical issues are linked to HE, such as, whether HE can/should/may be applied by personal request. Additional considerations arise in the military context. Are there moral/legal exceptions to the use of HE in a military context, such as in war or conflict operations? Is it permissible for a sovereign state to order HE to be used in its armed forces, or is it exclusively subject to the voluntary consent of the user? Is it possible for military personnel to refuse HE without consequences? Will this have a detrimental effect on their career? Does a soldier weaken their own platoon if they refuse to use HE? When it comes to developments in HE, human dignity is usually an under-represented, yet essential, social building block.

Society

Soldiers are part of society. It is therefore crucial to analyse the positive and/or negative aspects of HE for the general public in advance. If HE is

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9 Willmund, Gerd/et al. Psychotraumazentrum der Bundeswehr (Psychotrauma of the Bundewehr): Wehrpsychiatrie für eine Armee im Einsatz (Military Psychiatry for an Army in Action). Psychiatrische Forschung und Entwicklung in der Bundeswehr 2010 – 2020 (Psychiatric Research and development in the Bundeswehr) 2020, p. 12, https://www.bundeswehr.de/resource/blob/109368/d6195ce9a544497a2b31e1f94f0bb581/06-download-studie-zur-wehrpsychiatrie-fuer-eine-armee-im-einsatz-data.pdf.

10 See Vogl, Doris: Human enhancement with Chinese characteristics – AI as a factor for China's military modernisation with special consideration of human-machine teaming. As a case example in this publication.

11 See Grinschgl, Sandra: Cognitive enhancement – A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication.

integrated into daily life, social consequences can be expected. One facet is the handling of the personal data that is collected by HE. This will have to be taken into account in both civil and military use. The issue of who in society is ultimately intended for optimisation measures raises further ethical and legal questions. Do only those from higher social classes "benefit" from improving human capabilities? Or should HE be used primarily as a hyped benefit for lower population groups? What would be the psychological and resulting long-term effects of HE on society? The positive aspects of HE certainly include the possibility of social equality. Conversely, everyday use of HE could create unwanted peer pressure to avoid exclusion. Socio-political tension is inevitable. Principles for the applications of HE are essential, as are political, legal and ethical regulations. For this reason, the early inclusion of humanitarian rights and Western values is essential.

Law and social ethics

The general line of argument is that people can make their own decisions about their bodies. Therefore, performance enhancement should be possible for everyone, by means of technological assistance. This argument legally contradicts the autonomy of individuals, which is subject to restrictions. There is no legal way for a person to voluntarily give up human dignity, since these rights are regarded as inalienable. An exception is a combatant who, during an operation, is obliged to have minor interventions, such as vaccinations, in accordance with the mission.[12]

HE presents countless legal challenges for soldiers. For example, what should be observed in the case of HE when taking prisoners of war? Should "enhanced" personnel be treated like standard prisoners of war? If they are captured, do their special medical needs (e.g. service, energy, etc.) need to be taken into account?

What generally happens in the event of technical malfunctions, and who is responsible for them? Does a different code of conduct apply on the battle-

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12 See Balthasar, Alexander: Human Enhancement: The perspective of the Charter of the United Nations. In chapter LAW & SOCIAL ETHICS in this publication.

field? Is the currently applicable law of war prepared for HE? Such challenges are addressed in the legal chapter of this publication.

Military

In the future, complex technological developments will "fundamentally change the dynamics of armed conflict. […] If the necessary steps are not taken now, the challenges in the future will increase because it will be very difficult to catch up with important developments and adjustments."[13]

In order to be well prepared for emergencies, political and military leaders rely on analyses of probable threat factors. The aim of the project was to intellectually prepare Austrian defence forces for possible aggressors – equipped with HE technologies. Potential situational developments therefore had to be determined, in order to develop counter-strategies in a timely manner. Together with an interdisciplinary pool of experts, the IFK focused on the current and future challenges of HE. The intention was to prepare the results for political, economic and military decision-makers. The purpose of the HE project was not to promote the use of HE for the ÖBH and its soldiers.

Revolutionary technological changes must at least be tolerated by society in order to obtain sufficient supported. This is similar to the civilian use of drones, which later became an integral part of military tactics. Once interventions for human enhancement have been accepted by society, introducing them into the armed forces is only a small next step. A strategic approach is required in order to achieve something like this with citizens. Sci-fi novels, blockbuster films and video games with heroes who gain superpowers by means of technology would be a promising approach. There are obvious parallels to historical state propaganda films depicting heroic deeds in crisis situations.

Endeavours by states to emerge militarily victorious on the battlefield using all possible means and therefore change the political power structure will

13 Arnold, Torben: Neue Technologien für die Bundeswehr, SWP-Aktuell, Nr. 14, März 2024, S. 1 (New technologies for the armed forces, SWP-Aktuell, No. 14, March 2024, p 1).

continue to be the intention of conflict resolution in the future. Developments in the field of human enhancement could reinforce this notion.

It is questionable whether HE procedures can be imposed on a soldier if they will increase the chance of survival of the individual combatant or the entire group. What if military combat could only be successful with the use of HE?

Can the use of HE have any negative effects, and which ones would be specifically related to military applications? Could HE products be subject to sanctions? This is particularly problematic in the case of invasive use, as travel restrictions, for example, are to be expected in such cases. Do invasive components in a human-machine combination enable electronic traceability? What would this entail for individual security forces?

There is a risk that countries producing HE technology will be able to locate and even disrupt "their" exported products. A procedure needs to be clarified for when, for example, irreversibly implanted chips are installed in brains. Should the originally intended functionality be deactivated during a family holiday, due to safety concerns? What should be done if this is not possible? What if the soldier equipped with the expansion resigns?

In addition to possible health consequences, HE has both technical and economic consequences. For example, logistical problems could arise. Who produces HE devices, and what does that mean for maintainance and spare parts, etc.? In her article, Grinschgl raises the question of what would be expected if the producing company were to go bankrupt.

An increasingly ageing population in a society results in a smaller range of young talent. At least three possible solutions are imaginable:

1. Younger generations from other countries could be recruited to serve in the military.
2. High-tech weapon systems may be acquired, so that even older personnel can operate them.
3. The country's own nationals may undergo HE procedures. This means that they could be recruited for military service well into old age or could serve in the forces for longer due to their improved physical and mental capabilities.

Ray Kurzweil – inventor, futurist and Director of Engineering at Google LLC – popularised the concept of "technological singularity", which leads to a fourth solution: using only machines in war. Kurzweil refers to "[...] the point at which machines, as a result of the further development of AI, will gain their own consciousness and be able to improve themselves without human intervention."[14] That sounds like an ideal situation, since hardly any human casualties would be expected. The disadvantage is that the old military premise, that a territory is only taken over when real people set foot in it, is still applicable. The philosopher, futurist and writer Nick Bostrom is convinced that, "[...] computers with their own will are among the greatest existential risks that humanity will have to reckon with in this century, and are even more dangerous than nuclear weapons".[15] If this proves to be the case, such a development could only be countered by an amalgamation of man and machine or by "updating" human capabilities. A modification such as this would override all of the previous social and military rules.

Climate change is one aspect that speaks for the advantages of an application of HE in and by the military. In the future, armed forces will have to cope with increasingly extreme weather conditions and therefore more extraordinary stress levels in their missions. HE would be a possible option for continuing to deploy security forces for successful crisis and conflict management tasks.

The aspect of camaraderie is a factor that should not be underestimated in military operations. If "HE equipment" leads to different qualities of soldiers and therefore to a two-class combat community, this community could suffer. Would the "enhanced" super soldiers be seen as an elite unit and would a "healthy" mutual ability dependency develop accordingly? Potential psychological effects such as aggressive behaviour or "disturbances" in the social group structure must be ruled out in advance.

Ultimately, the question as to the efficiency of HE arises. Not all conceivable HE deployment options make sense from a military perspective. Optimising

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14 Wagner, Thomas: Der Vormarsch der Robokraten (The Advance of the Robocrats), In: Blätter für deutsche und internationale Politik 3/2015, S. 112 (Pages for German and International Politics 3/2015, p. 112).

15 Ibid.

humans with skills that machines could master better and more specifically is suboptimal and needs careful consideration.

Finally, there is an economic and, for the armed forces, logistical question. Whoever provides HE technologies and the required resources is able to influence the provision of such products and their supply chains. There is also access to raw materials (e.g. rare earth, etc.). The issue of spare parts, which are often subject to government sanctions, has already been addressed. HE therefore has the potential to trigger hybrid threats on multiple levels.

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President Putin at the World Festival of Youth, Sochi, Russia, October 21, 2017, Source: Joosten, Peter: Festival of Youth - What Vladimir Putin Thinks About Genetic Engineering. Via YouTube. 2021. https://www.youtube.com/watch?v=WnlaAIKPjAw.

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Wells, Jane: The Man with the Pentagon Checkbook. In: CNBC. May 13, 2014. https://www.cnbc.com/2014/05/13/ll-the-man-who-procures-weapons-for-the-pentagon.html.

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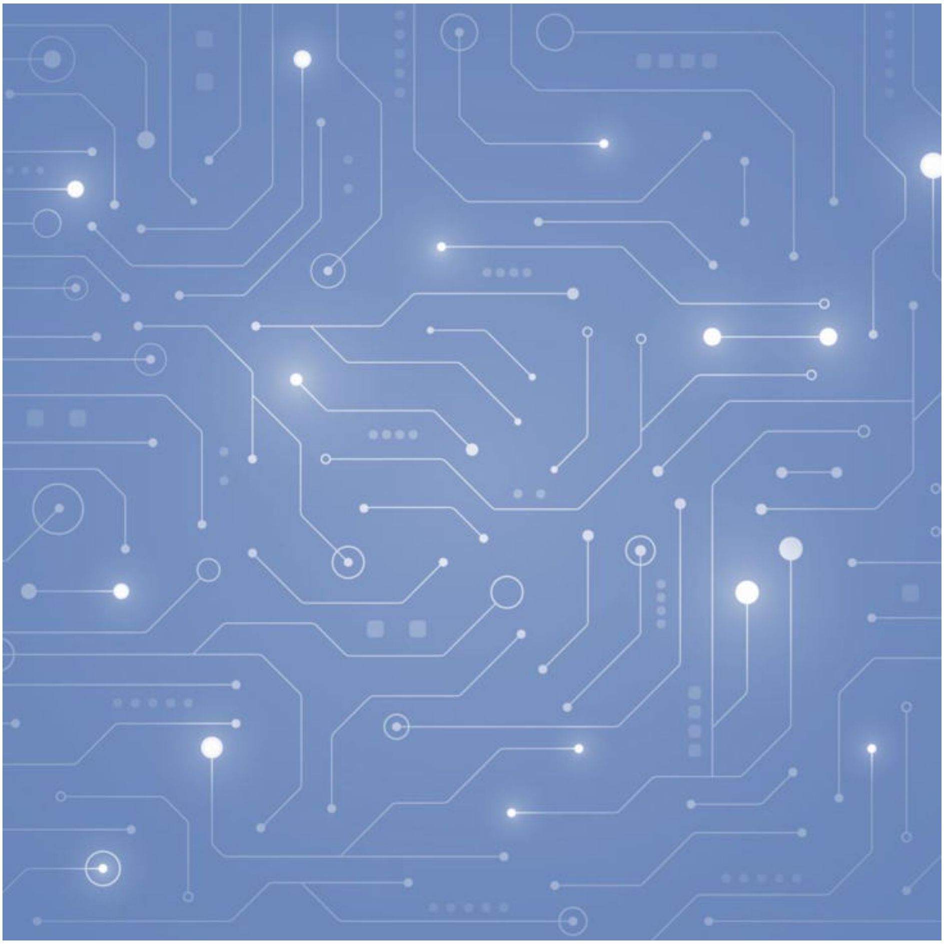
Chapter I – Technology



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Technology. Chapter Summary

When the technology panel was asked to imagine what "technical human enhancement" may look like, we immediately venture into the world of science fiction and, in particular, Hollywood's vision of people and humanity in the future. There are plenty of examples where technologies that were once dreamt up as gadgets in such films are now in everyday use in the real world. James Bond is definitely among the best examples. It just so happens that in 2024, when this book was being written, Agent 007's third big screen outing, "Goldfinger", marked its 60th anniversary. In the film, Mr Bond uses a system called "Homer", which allows him to secretly track other vehicles and people worldwide. Being shown on-screen in the 1960s as technology of the future, which appeared to be difficult to implement, is now a real and useful form of technology that is widely used around the world, such as in Navigation Systems and AirTags, as well as GPS collars for tracking domestic animals. In addition, possible technologies such as nanobots like those which appeared in the most recent James Bond film are not as far-fetched as you might think in these times of mRNA and miniaturisation.

The technology topic block in the Human Enhancement project is divided into the following three sections: a consideration of the current and historical developments of the general interest in human enhancement; an overview of the common phases of human enhancement on the basis of existing technical and human medical achievements; and a look into the future based on relevant films that can currently be placed in the "science fiction" category. The common link between these three topics is the consideration of the paths to human enhancement from a 'yesterday-today-tomorrow' perspective. Current technical obstacles for the real-world development of possible future technologies can be identified from this, which in turn form the basis for separating promising approaches from those that currently seem rather utopian. In addition to establishing our own development programmes in this area, the foundations are being laid for research to determine where and how other armed forces and countries stand in the race to create technically feasible military technologies. Since there are separate panels focussing on legal and ethical aspects, these topic blocks are not examined in detail in our technical analysis.

Technical Human Advancement

Markus Klug

Introduction

When challenged with the topic of (technically) enhancing human capabilities, human enhancement in general can be said to essentially be as old as mankind itself. Already the invention of spears dating back to the Palaeolithic Age[1] contributed to having greater success when hunting and therefore improved the chances of survival. A modern, popular variant of this trend can also be found in the continuous success of energy drinks. The desire for performance-enhancing substances is reflected in the expected growth of the energy drinks market, increasing approximately + 25% from 2024 to 2029, which is already worth hundreds of billions of Euros.[2] From a military point of view, this topic is always of interest due to the potentially enhanced combat capabilities and sustainability of soldiers. The most innovative development in this field involves technologies that are used for invasive human enhancement, i.e. implants with the aim to enhance human performance in the future. In accordance with the scope of the project, taking a look into the future at this point in time and attempting to predict potential approaches from current developments is therefore indispensable. Addressing this goal, the article focuses on approaches for human advancement, which ultimately result in invasive technical human advancement. This defines the changes to humans made below the surface of the skin (subcutaneous) which fundamentally enhance their capabilities (cognitive, physical, etc.). It indicates ex-

1 Thieme, Hartmut: Altpaläolithische Holzgeräte aus Schöningen, Lkr. Helmstedt. (Lower Palaeolithic wooden tools from the Schöningen, Helmstedt district) Germania. Anzeiger der Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts. 77 (Bulletin of the Roman-Germanic Commission of the German Archaeological Institute) (2), pp. 451-487. 1999. doi:10.11588/ger.1999.91650.

2 Statista Research Department: Umsatz mit Energy Drinks und Sportgetränken weltweit in den Jahren 2018 bis 2024 mit einer Prognose bis 2029 (Energy drink and sports drink sales worldwide from 2018 to 2024 with forecast until 2029). Statista. 2024. https://de.statista.com/statistik/daten/studie/1342142/umfrage/umsatz-mit-energy-drinks-und-sportgetreanken-weltweit/,accessed on 11 Nov 2024.

tensions which are at least temporarily implanted into people (such as pacemakers).

This topic has frequently been discussed internationally over a longer period of time, as shown by various publications from the previous century,[3] to more recent publications.[4]

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[3] See e.g.: Druckman, Daniel/Bjork, Robert A.: In the Mind's Eye - Enhancing Human Performance. (N. R. Council, Publ.) Washington, D.C., USA: The National Academies Press. 1991. doi:10.17226/1580; Druckman, Daniel/Bjork, Robert A.: Learning, Remembering, Believing: Enhancing Human Performance. (N. R. Council, Publ.) Washington, D.C., USA: The National Academies Press. 1994. doi:10.17226/2303; Druckman, Daniel/ Swets, John A.: Enhancing Human Performance - Issues, Theories, and Techniques. (N. R. Council, Publ.) Washington, D.C., USA: The National Academies Press. 1988. doi:10.17226/1025. Harris, Monica J., & Rosenthal, Robert: Enhancing Human Performance: Background Papers, Issues of Theory and Methodology. (N. R. Council, Publ.) Washington, D.C., USA: The National Academies Press. 1988. doi:10.17226/779.

[4] See e.g.: Blumenthal, Marjory S./Hottes, Alison K./ Foran, Christy/ Lee, Mary: Technological Approaches to Human Performance Enhancement. Rand Corporation. Santa Monica, CA: Rand Corporation. 2021. https://www.rand.org/pubs/research_reports/RRA1482-2.html, accessed on 30 May 2024; Committee on Assessing Foreign Technology Development in Human Performance Modification: Human Performance Modification: Review of Worldwide Research with a View to the Future. (N. R. Council, Publ.) Washington, D.C., USA: The National Academies Press. 2012. doi:10.17226/13480. Committee on Creating a Framework for Emerging Science, Technology, and Innovation in Health and Medicine: Toward Equitable Innovation in Health and Medicine: A Framework. (N. A. Medicine, Publ.) Washington, D.C., USA: The National Academies Press. 2023. doi:10.17226/27184; Committee on Human-System Integration Research Topics for the 711th Human Performance Wing of the Air Force Research Laboratory: Human-AI Teaming: State-of-the-Art and Research Needs. (N. A. Sciences, Publ.) Washington, D.C., USA: The National Academies Press. 2022. doi:10.17226/26355; Committee on Leveraging the Future Research and Development Ecosystem for the Intelligence Community: Improving the Intelligence Community's. (N. A. Sciences, Publ.) Washington, D.C., USA: The National Academies Press. 2022. doi:10.17226/26355; Committee on Protecting Critical Technologies for National Security in an Era of Openness and Competition: Protecting U.S. Technological Advantage. (N. A. Sciences, Publ.) Washington, D.C., USA: The National Academies Press. 2022. doi:10.17226/26647; Juengst, Eric/ Moseley, Daniel: Human Enhancement. (E. N. Zalta, Publ.). The Stanford Encyclopedia of Philosophy (Summer 2019 Edition). 2019. https://plato.stanford.edu/archives/sum2019/entries/enhancement/, accessed on 14 April 2024.

This article primarily attempts to find a common basis which characterises these developments in order to draw up an example of what the future may look like. Following this introduction, the article is divided into the following sections:

Firstly, the article focuses on covering the possible scope of challenges in human enhancement, then the current variants that are found in medical technology and derives a generally applicable three-phase model from this, which is supposed to form the basis for extrapolating future developments based on the current state of development. The prerequisites which have been established in the meantime for making these new developments possible are also examined.

Following this theoretical illustration, selected examples are used to illustrate what the civil and military situations look like according to the documentation which is publicly available. Building on this, a thought experiment sets out a future scenario, before finishing with a brief explanation of the legal framework conditions for the subject matter and an illustration of selected physiological limits.

This article attempts to clarify the subject matter from a technical perspective. Overlaps with medicine in the medical/technical sector are unavoidable. Due to the wide-range and difficult-to-predict subject area within such a joint publication, statements in other contributions may also appear contradictory and therefore represent a large variety of potential future scenarios.

Distinguishing between scenarios

As well as the generally defined central working hypothesis (trend scenario), at least two borderline scenarios are also considered, since these can have a considerable impact on the meaning of the topic. Based on the scenario technique,[5] a "best case" and a "worst case" regarding human enhancement are derived, which represent the most likely limits of the current topic.

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[5] Amongst other things, see Wilms, Falko E. P. (ed.): Szenariotechnik (Scenario technology): Vom Umgang mit der Zukunft (Dealing with the future) (1st ed.). Haupt Verlag. 2006.

Best Case

In the best-case scenario, there is a worldwide ban on human enhancement in the military environment comparable to the initiative which was co-initiated by Austria for achieving a worldwide ban on (fully) lethal autonomous weapons systems (amongst other things, see the "Vienna Conference on Autonomous Weapons Systems" of 29 April 2024).[6] This includes a strict regulation and monitoring of such technologies in order to prevent the uncontrolled spread and illegal use of human enhancement. The permitted use of comparable human enhancement technologies is restricted to military or civil persons with physical or cognitive impairments with the aim of compensating permanent effects, given that these impairments are either inbred or suffered during life. The use of these technologies for relief, healing or bionic reconstruction does not necessarily mean that the affected persons must not be involved in military operations: However, it must be reliably assured at the technical level that the existing artificially technical functionality is limited to the generally expected or previous existing human capability of the corresponding body part or function, and cannot be extended to a human-unlike level, not even temporarily. The primary task of the international community is the technical and legal safeguarding of the related technologies as well as establishing a full control for access to them, but no new military capabilities are achieved.

Worst Case

In a worst-case scenario there are no regulations regarding human enhancement. The technology would be freely available also to extremist or terrorist organisations due to missing or at least ineffective control mechanisms. Those organisations would exploit it using fanatical ideologies such as "God's chosen one(s)" and use it to promote seemingly necessary permanent changes in their followers leading to a spread of human enhancement among those irregular fighters. The primary intention is to maximise the persever-

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[6] Federal Ministry for European and International Affairs Department for Disarmament, Arms Control and Non-Proliferation: Humanity at the Crossroads: Autonomous Weapons Systems and the Challenge of Regulation, 2024. https://www.bmeia.gv.at/fileadmin/user_upload/Zentrale/Aussenpolitik/Abruestung/AWS_2024/2024_09_16_AWS_Broschuere.pdf.

ance of fighters in the most harmful way by (almost) fully eliminating sensitivity to pain, fatigue, basic needs such as hunger or thirst or other perceptions which may impair performance. Hormone production is raised to a level that represents the highest level of performance from the person in question, comparable to doping. In case of action, executive and military branches do not have any information about any enhancements applied to adversary forces, meaning that the worst-case scenario must always be assumed. The use of “man-stopping”, non-lethal weapons is essentially ineffective, and the only remaining possibility of sustainably neutralising a threat is the targeted killing of such a manipulated opponent. This scenario is exceptionally threatening the internal security of a country, because the current executive forces, including the special forces, are not sufficiently prepared for. The range of capability innovations or enhancements must be regarded as unlimited. In Austria, it is the Federal Armed Forces who might then face such issues as assistants to the police and being sufficiently armed and equipped for.

On the other hand, the possibility that human enhancement technologies could be used for psychological support should not be ignored, particularly for soldiers during combat operations, as well as their potential to provide soldiers with technical protection from the effects of post-traumatic stress disorder.

The way to Human Enhancement

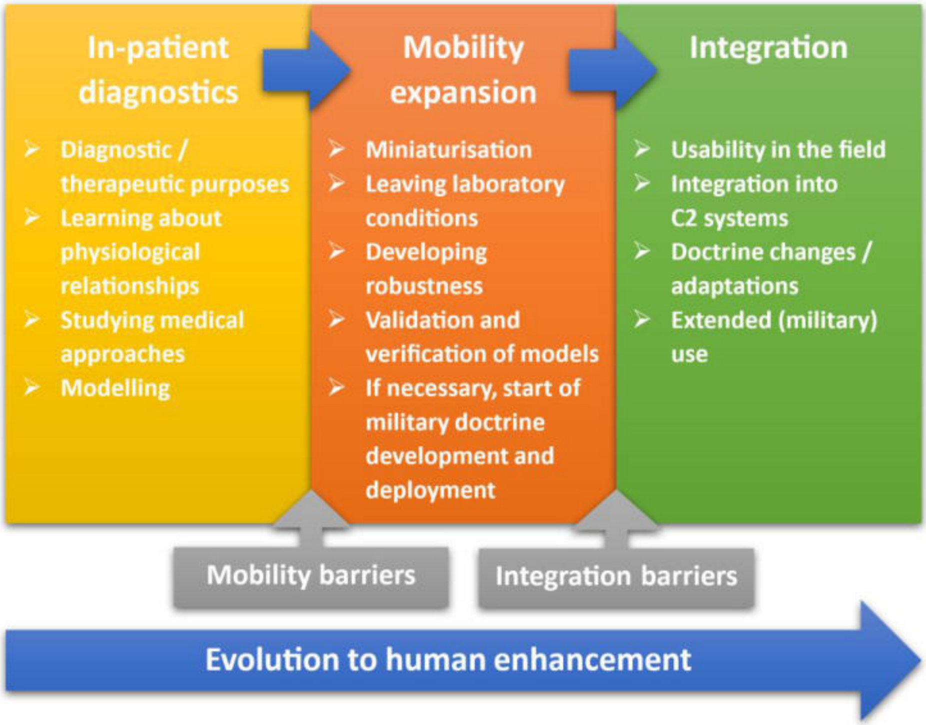
Human enhancement is generally the result of decades or even centuries of ongoing research and development. For this reason, developments such as this are not necessarily surprising, but are a result of the former development of existing medical knowledge and procedures.

Three fundamental, current variants have been studied to analyse similarities on the way to human enhancement:

- The pacemaker and its precursors
- The Brain-Computer-Interface and the way it emerged
- Current options provided by bionic prostheses and precursors

An underlying, general pattern is recognisable in this case. Existing technologies for human enhancement have been around for decades or even hundreds of years. This generally begins with initially unresolved diagnostic or subsequent therapeutic necessities that are addressed by technological innovations and are rounded off by making these suitable for personal use. In general, this occurs as follows:

Figure 1: Three-stage phase model of human enhancement



Source: Author

In the case of the pacemaker, the path from diagnosing the condition to the use of medication (Digitalis) can be traced back to the 18^{th} century, and Wayne[7] even refers to comparable attempts from the Roman era. At the mo-

7 Wayne, Thomas F.: Clinical Use of Digitalis: A State of the Art Review. American Journal on Cardiovascular Drugs: Drugs, Devices and other Inventions, 18(6), pp. 427-440. 2018. doi:10.1007/s40256-018-0292-1.

ment, potential uses include state-of-the-art mobile diagnostic devices and smart watches, which are now sufficiently accurate.[8] Mobile and generally available monitoring of heart activity is therefore a product which arose after a long research period and is still undergoing development.[9]

Comparable processes can also be seen regarding prosthetics and bionic implants. After sufficient studies of the human anatomy resulted in a better understanding, the first prosthetics were used back in the days of Ancient Egypt, to counteract the loss of a toe, for instance.[10] Looking beyond the aesthetics, prosthetics were later used as substitutes for limbs, not just for injuries caused by war, but also as a result of widespread malnutrition.[11] In the meantime, this has developed into a technology that is thoroughly competitive in certain applications, such as Oscar Pistorius and the prosthetic limbs made from carbon. Furthermore, Lindsay Vonn, an exceptionally successful skier, is returning to the World Cup with an artificial knee.[12] However, apart from this there have been new achievements such as a bionic eye which

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8 Veltmann, Christian: Deutsche Herzstiftung (German Heart Foundation). Mit der Smartwatch Vorhofflimmern erkennen (Detecting atrial fibrillation with a smart watch). 2022. https://herzstiftung.de/infos-zu-herzerkrankungen/herzrhythmusstoerungen/vorhofflimmern/vorhofflimmern-diagnose-smartwatch#welche-smartwatch.

9 Lemke, Bernd: Geschichte der Herzschrittmacher-Therapie in Deutschland (History of pacemaker therapy in Germany). Herzschrittmachertherapie + Elektrophysiologie (Pacemaker therapy and electro-physiology) (Special Edition 1/2024), pp. 18-54. 2024. doi:10.1007/s00399-024-01010-4.

10 Dönges, Jan: Eine 3000 Jahre alte Zehenprothese (A 3000 year old toe prosthesis). Spektrum der Wissenschaft (Scientific Spectrum). 2017. https://www.spektrum.de/news/altes-aegypten-eine-3000-jahre-alte-zehenprothese/1465821, accessed on 24 Nov 2024.

11 Schatz, Iris: Objekte der Nächstenliebe (Objects of Brotherly Love). Deutsches Ärzteblatt (German Medical Papers), 2007, p. 360. https://www.aerzteblatt.de/archiv/54408/Kulturgeschichte-der-Prothesen-Objekte-der-Naechstenliebe.

12 Welt: Ski Alpin: Comeback Von Lindsey Vonn Mit Künstlichem Knie. DIE WELT, November 19, 2024. https://www.welt.de/sport/wintersport/article254519720/Ski-alpin-Comeback-von-Lindsey-Vonn-mit-kuenstlichem-Knie.html.

has been used in people for the first time,[13] or miniature hearing aids which have been produced using 3D printing.[14]

The development leading to the connections between brain and computer that is currently known as the **Brain-Computer-Interface** is particularly interesting. Most widely discussed, the company Neuralink has invested a lot of effort to bring this topic also to a significant public awareness. This development arises from a long history of Electroencephalography (EEG) development, which made it possible to obtain sufficient knowledge about the human brain.[15] Additionally, knowledge of the human brain also branched to the mathematical / informatics-related research field of neural networks for an artificial representation of the human brain for providing the technological foundation of artificial intelligence, particularly reinforcement learning as one form of enhancement. This reinforcement learning technology[16] inevitably enables these kinds of **Brain-Computer-Interfaces** as bionic implants can adapt to the individual unique behaviour of the connected body part over time, and recognise thought and pulse patterns accordingly. This enables the implants to integrate themselves into the body's internal environment.

Phase 1: Medical/technological applications

Medical technology development is the starting basis. However, it primarily focusses on healing ailments, and therefore on compensating physical defi-

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13 NIHR Moorfields Biomedical Research Centre: Moorfields patient receives bionic chip implant in blind eye. 2022. https://moorfieldsbrc.nihr.ac.uk/nihr-moorfields-biomedical-research-centre-receives-20-million-for-another-five-years-of-vision-research-innovation/, accessed on 30 May 2024.

14 3DSourced: How 3D Printed Hearing Aids Silently Took Over The World, accessed on 30 May 2024 from 3DSourced: The World's Most Informative 3D Printing Source. 2023. https://www.3dsourced.com/editors-picks/custom-hearing-aids-3d-printed/.

15 Wilcken, Sandra: Die Geschichte des EEG in der Hirnforschung – von den Anfängen bis zum goldenen Zeitalter (The History of EEG in Brain Research – from the Beginnings to the Golden Age), accessed from Deutsche Gesellschaft für Klinische Neurophysiologie und Funktionelle Bildgebung (DGKN) e.V. 2024. https://dgkn.de/dgkn/presse/pressemitteilungen/478-die-geschichte-des-eeg-in-der-hirnforschung-von-den-anfaengen-bis-zum-goldenen-zeitalter.

16 Ris-Ala, Rafael: Fundamentals of Reinforcement Learning. Springer Nature Switzerland. 2023.

cits that have either been suffered or inbred using medical/technical diagnosis, chemistry, physics and other relevant scientific fields. From a representative pool of data, medical statistics obtain information regarding normal values, acceptable deviations or those which require treatment, or deviations which are beyond the acceptable parameter ranges.

Figure 2: Example of classifying blood pressure[17]

	Systolic (mmHg)	Diastolic (mmHg)
Optimal	< 120	< 80
Normal	120 - 129	80 - 84
Prehypertension	130 - 139	85 - 89
Grade 1 Hypertension	140 - 159	90 - 99
Grade 2 Hypertension	160 - 179	100 - 109
Grade 3 Hypertension	> 180	> 110

As medicine endeavours to return people suffering from ailments (=people with diagnostic values which lie outside a generally specified normal state determined in relation to the basic population) to this representative domain, it can basically not be assumed that target values (a.k.a. benchmarks) can be obtained or determined for the maximum performance capability which can be achieved. Note: This approach is also rigorously being applied in the area of doping, where performance-enhancing substances are also forbidden in the interests of maintaining fair competition.

Nevertheless, this first phase is essential in order to obtain sufficient information about the anatomy and physiology of the part of the human body investigated. It creates the basis for the set of treatment approaches possible, as well as the limits of impact on the human body. These limits must not be regarded as absolute, as shown by recent immunisation and healing methods

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17 Guyton, Arthur C./Hall, John E.: Guyton and Hall textbook of medical physiology. USA: (12th ed.). USA: Saunders. 2011.

made possible by genetic developments (e.g.: CAR-T cell therapy for combating leukaemia or mRNA-based vaccinations),[18] but move along with the ever-increasing knowledge of the human body.

This gathering of information represents the basis for producing models which act as a risk-free development basis for new applications. An example of this, which ought to be mentioned, are the cardiovascular research from the Austrian Institute of Technology[19]or the publication on the possibility of using artificial intelligence to create new approaches for medications based on existing knowledge.[20] This model development part leads to a situation in which at first new and previously unresearched questions for a more comprehensive study emerge during model development and also during the course of the validation and verification of the models, whilst the validated and verified model subsequently becomes available for experiments which could not be carried out on a living object for ethical or risk-related reasons, or could only be carried out at great expense.

The models do not always have to be in direct relation to the medical technology but can also be used in other scientific areas. The winners of the 2024 Nobel Prize for Physics Geoffrey Everest Hinton and John Hopfield used the functionality of the human brain that was known at the time for the purpose of machine learning. Human learning was well imitated even at the beginning of the 1990s, with the widespread approach of the Backpropagation of Error in supervised learning. This approach determines the outcome for a specified task and in the event of an error, the individual weightings of the network are appropriately adapted / modified by means of back-calculations. This barely differs from writing a text and correcting any spelling mistakes, which is how a schoolchild learns how to improve its spelling.

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18 A discussion about immunisation against COVID-19 is not going to take place at this point, merely a reference to the technological basis of such vaccinations.

19 AIT Austrian Institute of Technology GmbH: Cardiovascular Diagnostics. https://www.ait.ac.at/themen/cardiovascular-diagnostics, accessed on 10 Oct 2024.

20 Gupta, Rohan/ Srivastava, Devesh/ Sahu, Mehar/ Tiwari, Swati/ Ambasta, Rashmi K./ Kumar, Pravir: Artificial intelligence to deep learning: machine intelligence approach for drug discovery. Molecular Diversity (25), pp. 1315-1360. 2021. doi:10.1007/s11030-021-10217-3.

Furthermore, the "genetic algorithms"[21] behind Darwin's theory of evolution have been used to develop a well-known and frequently used procedure for optimising large-scale (mathematical) (called NP-hard) problems. The basics of the "survival of the fittest" are also established with a wide range of features within fauna.

Phase 2: Extending mobility

The acquired results and physical applications are generally static in phase 1 within a controlled environment (laboratory, hospital), and may therefore not be sufficiently representative. Furthermore, fundamental technological developments are not a basis for statements regarding stressful situations which arise outside standardised medical test procedures (e.g. stress ECG).

To propagate medical knowledge and create a more comprehensive knowledge, aside of lowering side-effects medical technology also seeks to apply diagnostic approaches and procedures via miniaturisation and energy autonomy of diagnostic equipment for prolonged periods within the patient's normal environment in order to obtain more realistic diagnostic data and information which is more representative in real life. This requires thresholds to be bridged which can be shown as follows, for example:

- Impact on the typical course of life (weight, size, additional tasks, visibility and societal reservations)
- Safety of the procedure
- Restrictions to quality of life
- Expense for energy supply

In a military environment, the load from existing equipment can also be added to this.[22] The additional load must also be noted in contrast to the benefit, particularly for soldiers. A wide range of publications on the subject

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21 Goldberg David E.: Genetic Algorithms. Addison-Wesley. 1989.

22 Townsend, Stephen J.: THE FACTORS OF SOLDIER'S LOAD. Master's Thesis, U.S. Army Command and General Staff College, Fort Leavenworth. 1994. https://apps.dtic.mil/sti/tr/pdf/ADA284389.pdf.

of the load on soldiers due to additional equipment in general can be found in the scientific literature.[23]

In particular, these loads include:

- Energy supply in the field
- Reliability and security of data transmission
- Security regarding electronic intelligence (ELINT)
- Weight and size
- Sensory overload during deployment

The easier it is for a technology to be integrated into an existing system (already temporarily invasive in some cases, not yet invasive in others), the more likely it is to be accepted, regarded as a natural part of daily life and will therefore provide more comprehensive results. This also applies to technology which already provides assistance in a non-invasive form.

ECG is one example of such mobilisation, particularly in diagnosing atrial fibrillation. Starting from classical systems (12-channel ECG), the technology has developed in such a way that current information such as that from smart watches can already regarded as suitable for supporting a diagnosis at least to a limited extent.[24] Alternatively, subcutaneously implemented event recorders are another option.[25]

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23 Joseph, Aaron/ Wiley, Amy/ Orr, Robin/ Schram, Benjamin/ Dawes, Jay J.: The Impact of Load Carriage on Measures of Power and Agility in Tactical Occupations: A Critical Review. International Journal on Environmental Research and Public Health, 88(15(1)). 2018. doi:10.3390/ijerph15010088; Knapik, Joseph J./ Reynolds, Katy L./Harman, Everett: Soldier Load Carriage: Historical, Physiological, Biomechanical, and Medical Aspects. Military Medicine, 169(1), pp. 45-56. 2004. doi:10.7205/MILMED.169.1.45.

24 Veltmann, Christian: Deutsche Herzstiftung (German Heart Foundation). Mit der Smartwatch Vorhofflimmern erkennen (Detecting atrial fibrillation with a smart watch). 2022. https://herzstiftung.de/infos-zu-herzerkrankungen/herzrhythmusstoerungen/vorhofflimmern/vorhofflimmern-diagnose-smartwatch#welche-smartwatch.

25 Klingenheben, Thomas: Deutsche Herzstiftung (German Heart Foundation), accessed on 27 October 2024 from Vorhofflimmern: Diagnose oft nur mit Langzeit-EKG (Atrial fibrillation: diagnosis often only with long-term EEG). 2024. https://herzstiftung.de/infos-zu-herzerkrankungen/herzrhythmusstoerungen/vorhofflimmern/vorhofflimmern-diagnose.

A comparable situation exists with patients with diabetes, where a sensor attached to the skin records glucose values every minute for up to 15 days, before transmitting this data to an app on a mobile phone.

In these cases, the technologies that are used invoke minimal opposition to their use if wearing a smart watch with a much shorter battery life compared to a normal watch is readily accepted by the user, or an implant is hidden beneath the skin.

Examples of relevant military developments in this phase

Example: The approach within the context of the human-brain interface

The development of the human-brain interface follows such a logic. A Joint Helmet Mounted Cueing System (JHMCS) is in use as a preliminary step to a military helmet featuring EEG for several fighter jets (Typhoon, F-35) and also attack helicopters, which allows the pilot to also determine the target for the guided missile mounted on the fighter jet by recording the relevant line of sight.[26] It must be said that unlike the science fiction film "Firefox", the helmet does not have mind control, but does already have complex technologies in place for recording pilot's intentions.[27]

This non-invasive but gesture-controlled interaction with the plane is continued in the F-35 Lightning II. The pilot is therefore even more integrated into the system of the aircraft. Additional helmet weight plays a part as a criterion, for example, particularly with military pilots. Additional loads in strenuous flying manoeuvres must not have a negative impact on the cervical spine. On the other hand, the helmet is connected to the system and there-

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[26] Henderson, Freddie P.: Using Helmet Mounted Displays to Designate and Locate Targets in the Urban Environment. Knoxville: University of Tennessee. 2005. https://core.ac.uk/download/pdf/268802086.pdf, accessed on 30 Oct 2024; Pelosi, Michael J.: US Patentnr (US patent number). US7266446B1. 2004. https://worldwide.espacenet.com/patent/search/family/038456985/publication/US7266446B1, accessed on 30 Oct 2024.

[27] Collins Aerospace: F-35 Gen III Helmet Mounted Display System (HMDS). No date. https://www.collinsaerospace.com/what-we-do/industries/military-and-defense/displays-and-controls/airborne/helmet-mounted-displays/f-35-gen-iii-helmet-mounted-display-system.

fore supplied with energy. This also applies to other possible uses of such systems. Comparable equipment for typical infantry soldiers with a helmet, which is provided with power via batteries due to the lack of alternative energy sources, must not lead to increased strain on the soldier due to its weight. These phases of the use of EEG information via external sensors represent an initial basis for the development of military doctrines.

The American military has had similar experiences with the use of Augmented Reality. An article from Kallberg et al. explains the tactical benefits and disadvantages of dependency on technology based on the use of AR/MR with troops. It shows how such an extension can lead to a change in warfare tactics.[28]

Reports from 2023 also revealed that these were not free of technical issues, since Microsoft had to make significant adjustments to its HoloLenses in order to obtain a contract for the delivery of appropriately comprehensive equipment for AR/MR functions to satisfy the needs of the US Army.

In the future, the American army would therefore like to use equipment components enhanced with EEG, particularly a pilot helmet that is equipped with EEG sensors and can influence the aircraft and the weapon controls by analysing the pilot's thought patterns.[29] In addition to the advantage in speed, since the need for manual interaction with the fighter jet is at least partially avoided, this also enables better control of the pilot's state of mind in view of the additional forces that have an impact on the pilot in 5th generation fighter jets. In the future, the system should also be able to automatically land the fighter jet if it recognises that the pilot is unresponsive.

28 Kallberg, Jan/ Beitelman, Victor/ Mitsuoka, Victor/ Pittman, Jeremiah/ Boyce, Michael/Arnold, Todd W.: The Tactical Considerations of Augmented and Mixed Reality Implementation. Military Review, pp. 105-113. 2022. https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/May-June-2022/Kallberg/, accessed on 30 Oct 2024.

29 Roblin, Sebastién: The Military Is Developing a Helmet That Will Allow Fighter Pilots to Maneuver Their Jets—and Fire Weapons—By Just Thinking About It. Popular Mechanics. 2024. https://www.popularmechanics.com/military/a62719626/darpa-n3-ai-helmet/, accessed on 30 Oct 2024.

There has also been a series of trials and plenty of research into using an exoskeleton as a non-invasive preliminary step towards strengthening the limbs, as described by Gollan, Kaiser or Tucker.[30] Studies regarding the benefits thereof have also been published.[31]

Phase 3: Invasive Human Enhancement

Following the mobilisation of the technology, the third phase is about making it suitable for use by extending the function of existing body parts with technological supplements. This is nothing new, since - to continue with the above-mentioned example of the ECG - life-saving technologies such as pacemakers are already a part of everyday life and society in general. This progress also required decades of development, from the initial application on 8 October 1958 to the modern devices that are used today.

In addition to the mobilisation of the technology, other aspects must be considered that lead to a successful use when advancing towards Invasive Human Enhancement.

1. Electrical energy:
   The human body uses electrical energy to control its muscles. However, production of electrical energy is limited to match these corresponding needs. Typical support in the form of implanted semi-conductors via the body's own production of electricity for autonomous use is currently ruled out. In addition to the initiatives of the chip manufacturers for reducing the electricity usage of the manufactured chips with the aim of running laptops, smartphones, smart watches and other energy-autonomous devices for longer, there is also a

[30] Gollan, Benedikt:. Mit dem Exoskelett wieder gehen lernen (Learning to walk again with an exoskeleton). Research Studios Austria Forschungsgesellschaft. 2021. https://www.researchstudio.at/exoskelett-gehen/; Kaiser, Arvid: "Muscle Suit" verspricht dreifache Körperkraft für 4000 Euro ("Muscle Suit" promises three times the body strength for 4000 Euros). manager Magazin. 2014. https://www.manager-magazin.de/unternehmen/artikel/marktstart-fuer-exoskelett-muscle-suit-in-japan-a-1002743.html, accessed on 30 May 2024; Tucker, Patrick: Russia, US Are In a Military Exoskeleton Race. Defense One. 2018. https://www.defenseone.com/technology/2018/08/russia-us-are-military-exoskeleton-race/150939/.

[31] Slaughter, Paul R./ Rodzak, Katherine M./Fine, Sarah J./ et al.: Evaluation of U.S. Army Soldiers wearing a back exosuit during a field training exercise. Wearable Technologies, 4. 2023. doi:10.1017/wtc.2023.16.

European research project in Germany which focuses on the aspect of energy efficiency.[32]

2. Environmental conditions:
   The implanted environment must correspond to the physical environmental conditions.
3. Adaptability to the individual human psyche:
   The invasive enhancements must be compatible with bodily functions. This is not a trivial matter - even if you consider the complexity of the human brain or the impact of genes on the effectiveness of medication. It is possible to teach the system how to correctly recognise the intentions of the body (training/calibration) with "Reinforcement Learning" methods mentioned above.

The use of invasive technology on the human physiology and psychology must be studied during this phase at the very latest. Particularly the recovery phases of the body parts which are exposed to higher levels of activity due to technological influences should be observed closely to ensure that rest times and partial deactivation of components are adhered to.

Thought experiment:
Extrapolation of opportunities starting from dialysis

Dialysis should be used as a starting point to illustrate the three phases. At the moment, it is used if kidneys are malfunctioning in order to regularly filter toxins which are stored in or produced by the body.

Basically, it would not be unreasonable to regard phase 2 as the time to possibly initiate using such a measure for allowing soldiers to operate in areas with limited biological or chemical contamination for a certain period of time. A personal dosimeter would be used to measure the length of time and the intensity to which the soldier was exposed to the related hazardous substances on site. After a specific period of time or alert by the particular do-

[32] Goll, Niklas.: Fraunhofer IZM. Chips der Zukunft könnten durch Magneteffekt in Elektronen 100-mal weniger Energie verbrauchen (Chips of the future could consume 100 times less energy by means of the magnet effect in electrons). 2023. https://www.izm.fraunhofer.de/de/news_events/tech_news/chips-der-zukunft-koennten-100-mal-weniger-energie-verbrauchen.html, accessed on 27 October 2024.

simeter, the soldier then must return to base in order to filter the absorbed substances out of the body once again using a form of dialysis.

An invasive enhancement (phase 3) involving a personal dialysis equipment in the field for the soldier would be imaginable if the size is properly reduced. This then makes it possible for the soldier or the unit to operate in Anti-access/area denial (A2/AD) theatres which are currently not accessible due to contamination because of continuous filtering and removal of hazardous substances from the body.

Measurability of human enhancement

An approach to measurability of human enhancement is defined mainly based on the concept of statistical significance. Three significance levels and the term "enhancement limit" are defined, starting from a pool of measurement data which represents a representative population.[33]

- A "significant enhancement" is when the person enhanced by such means is among the best 5% in a quantitative evaluation of a civil or military discipline compared to the outcomes of a representative general sample of non-enhanced participants.
- A "highly significant enhancement" is when the person enhanced by such means is among the best 1% in a quantitative evaluation of a civil or military discipline.
- A "highest significant enhancement" is when the person changed by such means is among the best 1‰ in a quantitative evaluation of a civil or military discipline.
- The "enhancement limit" is the maximum possible increase achievable considering the technological opportunities and limitations of the current (computer) technologies or the physical limits of the human body.

[33] Kleppmann, Wilhelm: Versuchsplanung - Produkte und Prozesse optimieren (Design of Experiments - Optimising products and processes) (10th Edition.). Carl Hanser Verlag GmbH & Co. KG. 2020.

No absolute scale is defined as a reference for measurement, but reference is made to the existing metrics or standards. This also correlates with the combat value which shows this relative value.

This theoretical construct shall now be explained by using chess rankings as a practical example: The ELO rating is the measure of the capability of a chess player.[34] The basis of the calculation is the same for all players and was developed in its current approach by the chess player and mathematician Árpád Imre Élő. The FIDE database which is available to the public currently contains 182,467 players with an international ELO rating of greater than zero as of April 2024 and who are also currently regarded as active chess players.

If this database is evaluated in the "Standard Tournament Chess" discipline accordingly, a rating of 2,177 ELO points would be needed for a player to be part of the 95% quantile. This does not correspond to any general FIDE norm yet and covers 9,147 players who are at least at this level. Mental human enhancement when it comes to chess would be seen as a "significant enhancement" if a previously average chess player who is properly equipped with additional artificial calculation power achieves and maintains an ELO ranking of 2,177 points or more as a result.

A highly significant enhancement would be achieved if the 99% quantile of all rankings is maintained, which corresponds to an ELO value of 2,399 points based on the current state of the data: This corresponds to the ranking of a FIDE Master, and is marginally below of the necessary playing strength of an International Master. 1,827 people are playing on this level or even higher.

A high significant enhancement would mean the technology would improve a player to a point where they had an ELO ranking of at least 2,603 points, which would correspond to a Grand Master. 183 chess players are currently in this group, including Austria's best player, Markus Ragger.

[34] Zermelo, E.: Die Berechnung der Turnier-Ergebnisse als ein Maximumproblem der Wahrscheinlichkeitsrechnung (The calculation of tournament results as a maximization problem of probability calculus). Mathematische Zeitschrift 29, pp. 436–460. 1929. doi: 10.1007/BF01180541.

The enhancement limit would currently be at 3,637 ELO points (see: CCRL index (computerchess.org.uk)) with a variation of ± 12 points (at 95% probability). This is the maximum performance that is currently achieved by the chess program Stockfish 16, being regarded as best-in-class chess program compared to other chess programs which are available on the market and which itself would have the possibility of accessing 4 state-of-the art CPUs in parallel. This value therefore is more than 800 ELO points above the leader in the FIDE rankings, GM Magnus Carlsen, who has an ELO ranking of 2,830 (as of April 2024). This performance limit of the computer program represents an upper limit which cannot be exceeded.

Limits of human enhancement

Management consultant Tom DeMarco also covered this in his books "Slack" and "The Deadline".[35] The statement "People under pressure don't work better; they just work faster" shows the contrast to IT systems. Whereas the latter improves in terms of computing (Moore's Law), the processing speed of the human brain remains consistent and generally cannot be overclocked. The possibility of closely observing the influence of technology on cognitive abilities is therefore possible in this phase.

This is also supported in another area. Starting from stationary EEGs which record the brainwaves on systems installed in the laboratory, Professor Gianluca Borghini and his team at the Sapienza University of Rome started to analyse (military) pilots and drivers, and therefore mobilising the stationary use of EEG.[36] What was examined in this study was the brain's adaptability during the learning phase. Experienced pilots showed less brain activity for the same task in the simulator in comparison to newly trained pilots. The possibility of adapting to new technologies is clearly present, since the human brain is optimised to respond to the amended basic conditions / requirements and therefore works in a more energy-efficient manner.

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[35] DeMarco, Tom: Spielräume - Projektmanagement jenseits von Burn-out, Stress und Effizienzwahn (Playgrounds - Project management beyond burnout, stress and efficiency mania) (1st ed.). Carl Hanser Verlag GmbH & Co. KG. 2001.

[36] Borghini, Gianluca/ Aricò, Pietro/ Di Flumeri, Gianluca/Ronca, Vincenzo/ Giorgi, Andrea/ et. Al.: Air Force Pilot Expertise Assessment during Unusual Attitude. Safety, 8(2). p. 17. 2022. doi: 10.3390/safety8020038.

Even during this phase, limits to human receptiveness and therefore the possibility of integrating technology can be recognised. Sensory overload leads to shorter concentration spans, meaning that users can only concentrate on the content for shorter periods of time.[37] Even with this form of technology mobilisation, this must also be taken into consideration if it is designed for that purpose.

Framework conditions for human enhancement by means of EU legislation

Due to the inevitability of the use of artificial intelligence procedures, the EU AI Act is also primarily important from a technical point of view. Generally speaking, military technologies are exceptions to EU legislation provided they are only used for military purposes.[38] Unlike other countries and continents, aside of ethical considerations, developments must therefore be fully funded by armed forces within the EU, since the legally specified limits mean that they cannot be used for civil developments. As individual countries cannot afford these financial challenges in certain sub-areas, developments in the field of human enhancement within the European context will presumably be driven by joint bodies and initiatives including NATO or EDA.

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[37] Aufmerksamkeitsspanne im E-Learning-Zeitalter (Attention span in the e-learning era). Copendia GmbH & Co KG – Logo. 2024. https://copendia.de/2024/04/09/aufmerksamkeitsspanne-im-e-learning-zeitalter/, accessed on 27 October 2024.

[38] European Union: Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations. 2024. EUR-Lex - Access to European Union law: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401689&qid=1733759024686, accessed on 9 December 2024.

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The future of human enhancement in the military domain

Joachim Klerx

Abstract

The future of human enhancement technologies in the military domain presents transformative opportunities and complex challenges. This report explores advancements in physical and cognitive enhancements, including genetic engineering, brain-computer interfaces and pharmaceutical interventions, highlighting their potential to redefine soldier capabilities and military strategies. While these technologies promise significant advantages, such as improved resilience, situational awareness and operational efficiency, they also raise critical ethical, legal and societal concerns. The report provides a comprehensive analysis of emerging trends, technological innovations and their implications for future warfare, culminating in strategic recommendations for policymakers and military planners. By balancing innovation with ethical considerations, these advancements can be harnessed to create a resilient and adaptive military force capable of addressing the dynamic challenges of modern conflict. Currently, it seems that the EU is paying relatively little attention to human enhancement and rather considerable attention to artificial intelligence. However, these research topics are interconnected and should be considered as such to foster the positive aspects for industrial development and economic prosperity.

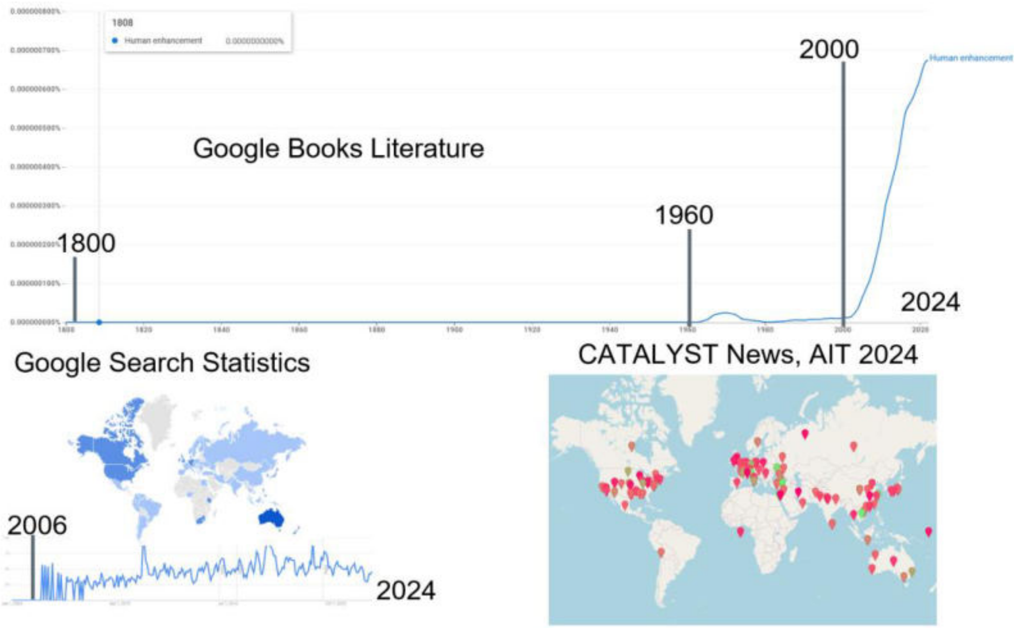
Introduction

The future of human enhancement in the military domain holds transformative potential, offering profound implications for national security, combat readiness and soldier capabilities, even in small countries. This report aims to explore the horizon of possibilities afforded by advancements in technology that can amplify human physical and cognitive abilities. As nations increasingly invest in military technology, understanding these enhancements' ethical, strategic and operational dimensions becomes imperative.

The primary purpose of this report is to provide a comprehensive analysis of current and future technologies in human enhancement within the military. It seeks to identify potential applications, benefits and challenges, offering guidance to policymakers, military strategists and defence researchers. The scope of this report encompasses a wide range of technologies, including genetic engineering, cybernetic implants, pharmaceutical interventions and neurotechnology to compile **a roadmap to 2045** with potential research and development directions. A small selection of most promising technologies is examined for its current capabilities, potential military applications and associated risks. The analysis also considers the ethical and social implications for society of deploying these technologies in military settings.

In its broadest sense, human enhancement refers to the application of technologies and scientific methods to improve or expand the physical, cognitive or psychological abilities of humans. As such, it is a relatively new scientific research topic. The bibliometric research, visualised in the following figure, did show that the active research was conducted in two waves. The first wave started in 1960 and mainly concerned neuroactive drugs. The second wave, started in 2000, concerned a wide variety of different technologies.

Figure 1: Overview of the relevant information space



Source: Author's own compilation, based on Google and AIT data.

The report will focus on the second-wave innovations and is organised into several key sections, beginning in Chapter 2 with a background overview of human enhancement technologies. Subsequent sections delve into specific types of enhancements, discussing their development, implementation and the strategic advantages they may confer.

In Chapter 3, future trends and possible future innovations are portrayed, referring to possible future war scenarios. Weak signals for future trends, innovations and threats of these technologies are discussed and summarised in a roadmap to 2045 for military research opportunities, followed by an exploration of potential tactical and societal impacts of these technologies.

In Chapter 4, the report concludes with a set of recommendations aimed at navigating the future landscape of military enhancements with risk assessment and some social and ethical considerations for each core technology cluster. The reader can expect to obtain a comprehensive overview of new and upcoming potentially useful future military capabilities in the fast-evolving field of human enhancement.

Current scientific research and technologies in military use

In general, human enhancement refers to the application of science and technology to improve human performance beyond what is necessary to restore or sustain health. This includes any alteration or augmentation that increases physical or cognitive function, potentially giving individuals abilities considered superior to normal human capacities. Over time, almost all military tactics have involved some kind of performance improvement, often reflected in the military doctrine as a "game changer", with disrupting effect to win a conflict. In recent times, the amount and the effectiveness of these disruptive innovations has grown exponentially, in particular, because of the digitalisation in research. Therefore, it is the intention of this publication to draw attention to this and find solutions to the high pace of innovations in the military context, avoiding linear improvements and focussing on the non-linear yet exponential growing amount of essential military capabilities, without the overwhelming effect of overtraining.

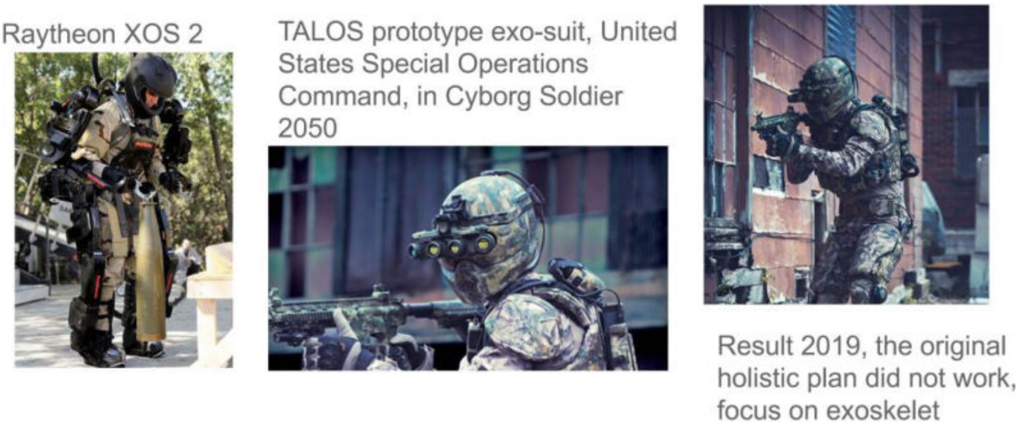
As mentioned in the document "Cyborg Soldier 2050: Human/Machine Fusion and the Implications for the Future of the DOD",[1] the US vision for

1 Defense Technical Information Center: Cyborg Soldier 2050: Human/Machine Fusion and the Implications for the Future of the DOD, 2019, https://apps.dtic.mil/sti/pdfs/AD1083010.pdf.

human enhancement by the year 2050 discusses the potential for integrating advanced biotechnologies to augment human capabilities, enhance situational awareness and improve communication and control systems through direct neural enhancements. This future vision includes ocular, auditory and muscular enhancements, with particular emphasis on the revolutionary impact of brain-machine interfaces that could enable two-way data transfer directly with the human brain, enhancing operational effectiveness in military contexts. All concept scenarios in this document point to some sort of human performance improvements.

The following figure shows different concepts of the future military suit. None of these are in operational use yet, but it is very likely that the next-generation suit will contain new forms of protection and other features to enhance the capabilities of soldiers.

<u>Figure 2</u>: Future soldier body suit



Source: Different internet sources.[2] [3]

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2 Osias: Robotic Exoskeletons - SlideServe. SlideServe. July 17, 2014. https://www.slideserve.com/osias/robotic-exoskeletons.

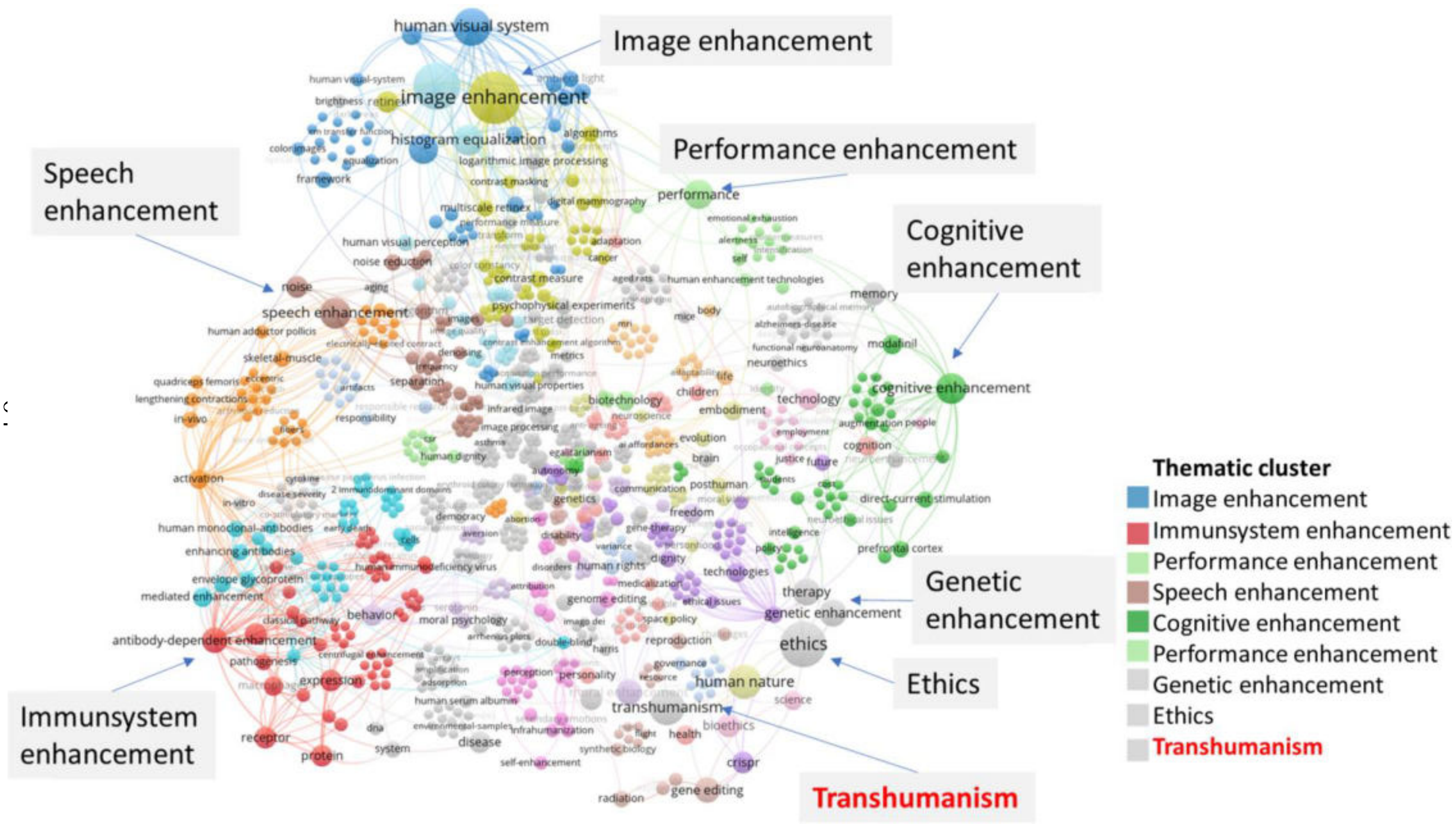
3 Keller, Jared: The Inside Story Behind the Pentagon’s Ill-fated Quest for a Real-life ‘Iron Man’ Suit. Task & Purpose, July 11, 2021. https://taskandpurpose.com/news/pentagon-powered-armor-iron-man-suit/.

Soldier suits are an obvious approach to new and enhanced soldier capabilities. Other military applications within the future US scenarios focus on augmenting human capabilities to improve effectiveness, resilience and survivability in complex and demanding combat environments. These enhancements range from physical and cognitive enhancements to more futuristic implementations. Physical enhancements, such as on the left-hand side of the figure, include exoskeletons designed to augment strength and endurance, allowing soldiers to carry heavier loads and maintain peak performance for longer periods. These devices can also help in reducing the risk of injury by providing additional support and reducing the strain on the body during intense physical activities. Cognitive enhancements are another critical area, involving the use of neurotechnology to improve decision-making and information processing abilities. Technologies such as brain-computer interfaces (BCIs) enable direct communication between the brain and external devices, enhancing situational awareness and enabling faster reactions to dynamic situations. Additionally, advances in biomedical technologies have led to developments in gene editing and biotechnology that could potentially enhance physical endurance, resistance to environmental stresses and recovery times for injuries. Overall, these technologies from future US scenarios are being explored with the aim of providing soldiers with a significant advantage on the battlefield, ensuring they are better prepared, more resilient and capable of performing at higher levels in the most challenging situations.

In this publication, advanced horizon-scanning methods are used to identify likely future technologies for military human enhancement and compare these with the existing future scenarios to update future expectations. An initial step towards this is the creation of a topic map, based on recent scientific publications. The results of this approach, with data from 2023 and 2024, are visualised in the following graphic, resulting in eight identified clusters.

Figure 3: See next page.

Figure 3: Topic cluster - human enhancement research



Source: Authors calculation, data WoS (Clarivate, Web of Science, https://www.webofscience.com).

The cluster "**image enhancement**" in the military refers to any type of sensor or method to improve the visualisation of information, useful for better situational awareness. It pertains to improving the quality and effectiveness of visual equipment such as night-vision goggles, thermal imaging devices, surveillance cameras and any other sensors. Thus, enhanced imaging technologies give soldiers greater situational awareness and operational capability in diverse environments, enabling clearer, more accurate identification and tracking of targets under various conditions. Usually, these sensors are outside of the human body. Cyborg Neil Harbisson, a colour-blind artist, implanted a sensor for perceiving colours beyond the natural range, allowing him to even sense, e.g., infrared light. This is not directly useful to the military, but did show that sensors could potentially be implanted, which would give them somewhat enhanced capabilities to recognise valuable radiation in a previously unrecognised spectrum. The US forecast is expecting soldiers to have human brain implants, eye implants and ear implants by 2050.[4] An overview of actual implantable sensors shows that the actual trend is to provide implants for medical purposes.[5]

Another well-known and often mentioned cluster of human enhanced capabilities is that of **immune system enhancements** (e.g. by vaccinations and bacteriophage). They are crucial in military tropic settings to protect soldiers from biological threats, including engineered pathogens. Enhancing a soldier's immune system can involve advanced vaccinations or genetic modifications aimed at creating superhuman resistance to toxins and diseases, thus maintaining readiness of forces in biologically compromised environments. It is likely that future enhancements will make more use of synthetic biology and artificial intelligence.

Another research direction involves **physical enhancements** such as exoskeletons that increase strength and load-carrying capacities, or substances

[4] Morrison, Ryan: Cyborgsoldiers: Plan to Create Deadly 'machine Humans' by 2050 Outlined in US Military Report. Mail Online, November 29, 2019. https://www.dailymail.co.uk/sciencetech/article-7738669/US-Military-scientists-create-plan-cyborg-super-soldier-future.html.

[5] Yogev, David/ Goldberg, Tomer/Arami, Amir/ Tejman-Yarden, Shai/ Winkler, Thomas/ Maoz, Ben: Current state of the art and future directions for implantable sensors in medical technology: Clinical needs and engineering challenges. APL Bioeng. 27 September 2023, 7(3):031506. doi: 10.1063/5.0152290. PMID: 37781727; PMCID: PMC10539032.

that boost stamina and reduce fatigue. Mental performance enhancements could also be employed to improve focus, reduce stress responses and enhance decision-making speed under pressure.

Speech enhancement technologies are used to improve communication clarity in noisy or chaotic battle environments. Enhanced speech systems could include advanced communication devices that offer noise-cancellation features or even implantable devices that facilitate silent communication through sub-vocal recognition technologies, facilitating covert operations.

Cognitive enhancement is clearly highly valued in the military for roles that require high levels of cognitive function such as strategy development, real-time decision-making in combat or complex machinery operation. Techniques might include pharmacological agents to enhance alertness and cognitive processing, or neural interfacing to directly integrate devices that augment cognitive capacities as well as LLMs or other AI reasoning mechanisms. It is very likely that the reasoning mechanism will be connected to new brain-machine interfaces.

Genetic enhancement might be pursued to develop soldiers with naturally enhanced capabilities such as heightened senses, superior muscle growth and accelerated healing processes. These genetic modifications could potentially create soldiers who are better adapted to extreme conditions and capable of performing at high levels that are currently not reached by unmodified humans. However, it is a question of whether this is favourable, whether the other option would be to use machines in dangerous environments and hot zones.

Lastly, a very special cluster in the actual publications about HE is formed by the cluster **transhumanism,** in which proponents are claiming to produce a new species, which is better and more capable than humans. This is likely the most radical approach to HE. In a military context, this can essentially be seen as creating a new soldier for strategic advantages through biotechnological superiority, including controversial technologies such as genetic improvements. The concept pushes for the development of "super soldiers" who are extensively enhanced through a combination of biotechnologies, artificial intelligence and information technologies. This could lead to fundamental changes in the conduct of warfare, where enhanced soldiers might display abilities that blur the lines between human and machine capabilities.

All of these enhancements not only promise to increase effectiveness and survivability in combat situations but also pose complex ethical and legal challenges, as *the line between soldier and weapon becomes increasingly blurred*. The implications for international law, warfare ethics and the nature of conflict itself are profound and require careful consideration as these technologies evolve, which will be discussed in Chapter 4.

The next argumentative step will, however, be to go into the two most promising examples of human enhancement in more detail:

- physical enhancements with pharmaceuticals and
- cognitive enhancements with artificial intelligence, sensors and computation power, either in a human body, externally or in combination.

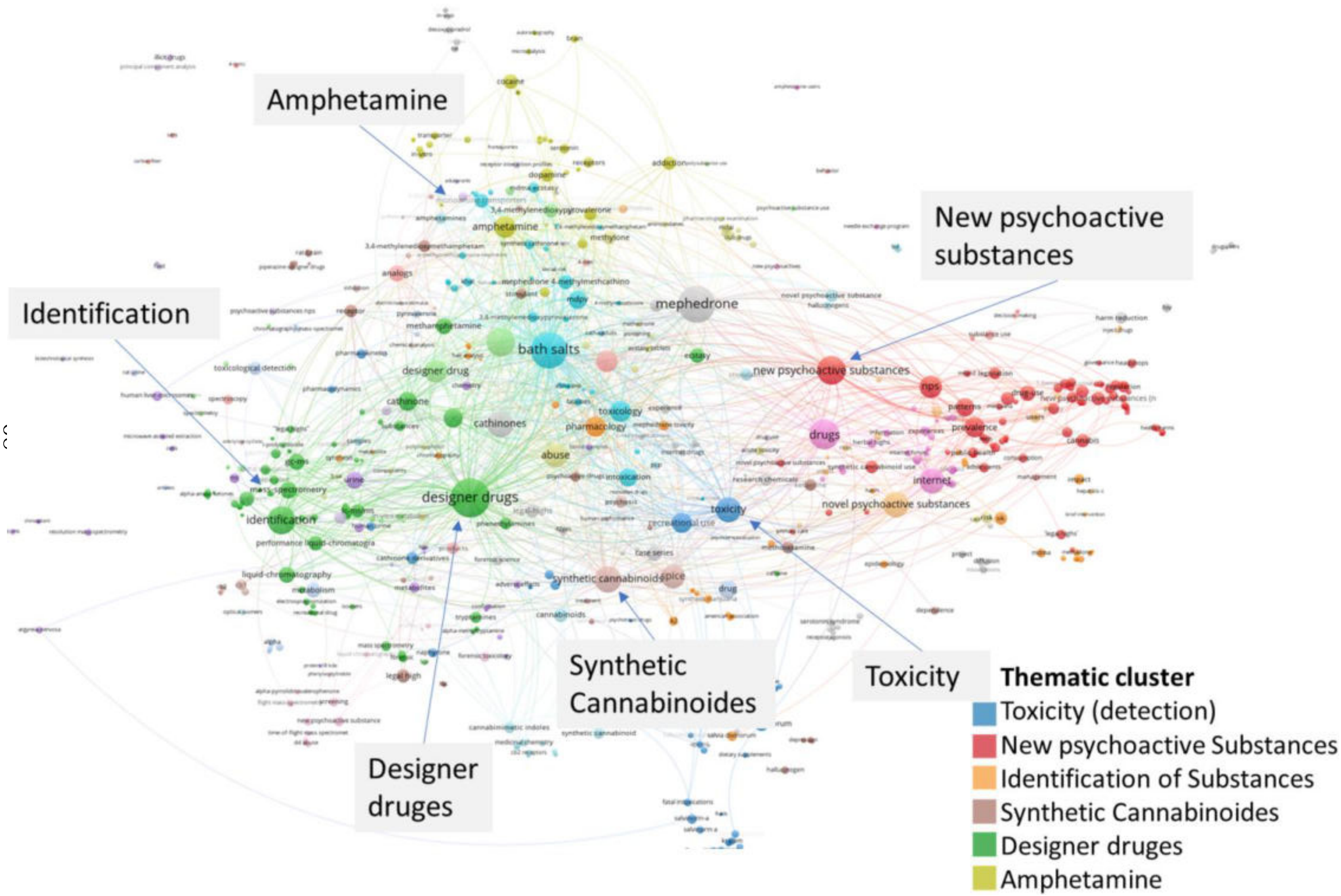
The following excurses will present detailed research topic maps with examples of technology innovations, which are particularly relevant to military use.

Excurse: Pharmaceutical enhancements

The military relevance of human enhancement technologies related to toxicity detection and the identification and use of new psychoactive substances, synthetic cannabinoids, designer drugs and amphetamines is significant in several aspects. Enhancing the ability of military personnel to detect and identify toxic substances within the environment is essential to survival in combat and reconnaissance missions. Technologies that can quickly and accurately determine the presence of chemical agents can be lifesaving. This capability is essential not only for immediate threat responses but also for long-term health monitoring in potentially contaminated areas.

Furthermore, the use of new psychoactive substances, synthetic cannabinoids, designer drugs and amphetamines can impact military operations. These substances can be engineered to enhance alertness, reduce fatigue and increase endurance among soldiers, potentially giving them an edge in prolonged engagements. However, the use of such substances also raises ethical, legal and health concerns that must be carefully managed. The identification of these substances is crucial for enforcing bans, monitoring usage and understanding their effects on human performance and decision-making in military settings.

Figure 4: Topic map of psychoactive substances

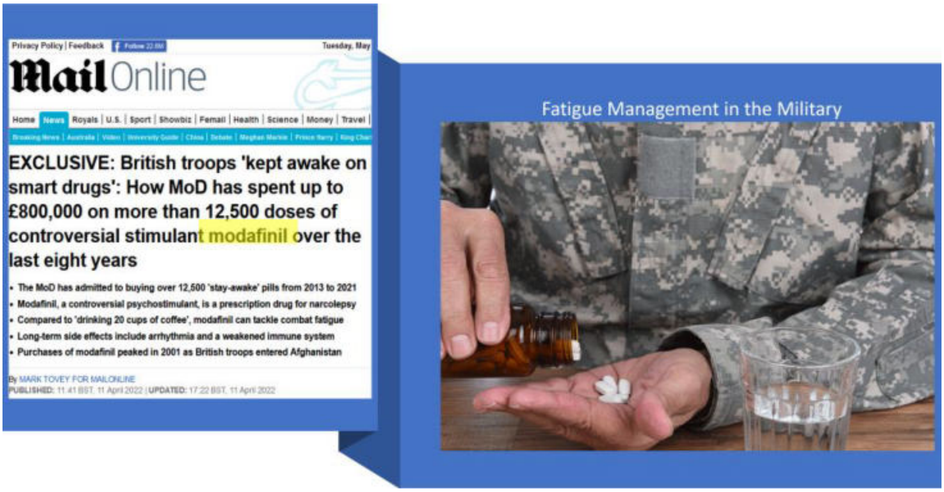


Source: Authors calculation, data WoS (Clarivate, Web of Science, https://www.webofscience.com).

The future trends in human enhancement technologies related to toxicity detection and new psychoactive substances are likely to focus on integration, miniaturisation and increased sophistication. As technology advances, we can expect to see more portable and user-friendly drugs capable of providing a customised range of possible improvements, without strong side effects. These drugs will likely support humans in collaborating or even incorporate advanced sensors and artificial intelligence to provide immediate, accurate analyses, enabling military personnel to make quick decisions in the field.

In some specific situations the US military recommends the use of modafinil to treat "sleep work shift disorder". "The use of modafinil as a 'cognitive enhancer' in healthy subjects has been suggested in the literature; however, the precise benefits and risks associated with this use remain uncertain".[6]

Figure 5: Human enhancement with smart drugs



Sources: different internet sources and scientific reports[7] [8] [9]

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[6] Greenblatt, Karl/ Adams, Ninos: Modafinil. StatPearls - NCBI Bookshelf. February 6, 2023. https://www.ncbi.nlm.nih.gov/books/NBK531476/.

[7] Bendak S and Rashid HSJ (2020) Fatigue in aviation: A systematic review of the literature. International Journal of Industrial Ergonomics 76. https://doi.org/10.1016/j.ergon.2020.102928.

[8] Wingelaar-Jagt YQ, Wingelaar TT, Riedel WJ and Ramaekers JG (2022) Subjective Effects of Modafinil in Military Fighter Pilots During Deployment. Aerospace Medicine and Human Performance 93(10), 739-745. https://doi.org/10.3357/amhp.6072.2022.

[9] https://www.banyantreatmentcenter.com/2022/11/29/modafinil-military-use-mvir/.

In the area of psychoactive substances, research might expand into developing substances that can be safely used to enhance cognitive and physical abilities, such as concentration, reaction times and resilience to stress. However, ethical considerations will drive the development of guidelines on the use and control of these substances, with an emphasis on safety and the reversibility of effects.

Lastly, as synthetic biology and chemical synthesis technology evolve, there will be a concurrent need for improved regulatory and detection methods to keep pace with the rapid development of new compounds. Military and civilian sectors will likely collaborate more closely to harness these technologies, ensuring that advances in enhancement technologies meet broader societal needs while maintaining national security.

The intersection of technology, medicine and ethics will increasingly shape the discourse and direction of pharmaceutical enhancement technologies in the military sphere. However, the most important question remains unanswered in several publications: why would a pharmaceutically enhanced soldier be necessary when it is possible to send autonomous robots?

Excurse: Cognitive enhancement

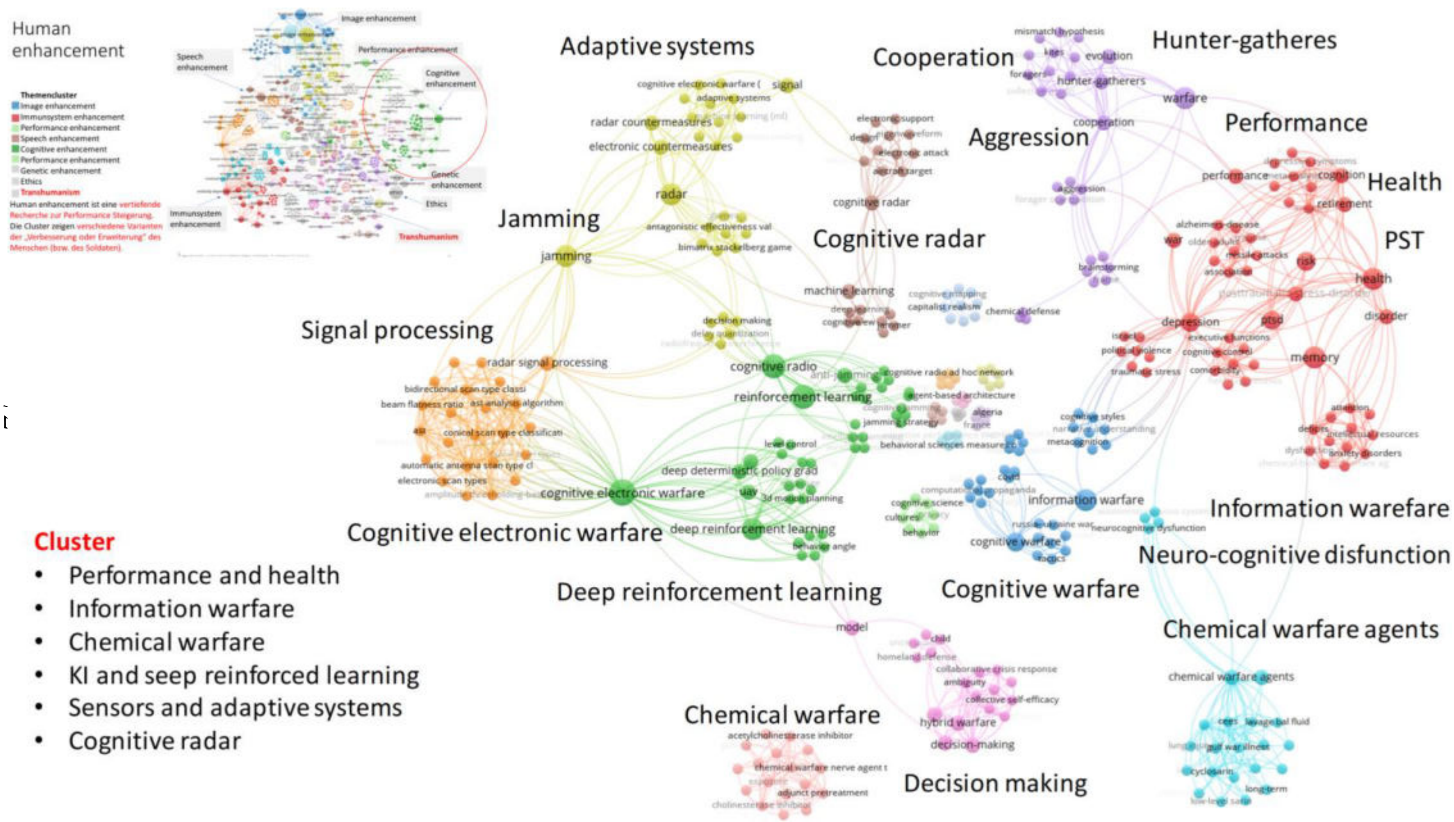
Cognitive enhancement refers to the application of various techniques or substances to improve mental functions, such as memory, attention, creativity and intelligence, beyond typical human capabilities, either internal to the human body, externally or in combination. This can involve the use of pharmaceuticals, brain stimulation technologies, neurofeedback or cognitive training exercises, as well as artificial intelligence, human-machine interfaces and any other IT infrastructure, designed to boost cognitive performance and overall brain function. The goal of cognitive enhancement is to enhance mental processes, potentially leading to better decision-making, problem-solving and learning abilities.

Based on this, cognitive warfare strategies target the mind and behaviour of individuals and the culture of societies to influence perceptions, beliefs and actions within the cognitive enhancement infrastructure. In this context, human enhancement plays a crucial role by augmenting cognitive and psychological capabilities to gain an advantage or render an advantage of the adversary harmless.

The following figure shows clusters of scientific research concerning recent (2023-2024) human enhancement research topics correlated to cognitive warfare and thus going further into specific details than the previous, more general introduction on human enhancement.

Figure 6: See next page.

Figure 6: The role of human enhancement in cognitive warfare



Source: Authors calculation, data WoS (Clarivate, Web of Science, https://www.webofscience.com).

The identified clusters include internal as well as external solutions. However, the mind-blowing advances in artificial general intelligence (AGI) and artificial superintelligence (ASI) are not yet incorporated.

Biometric monitoring, through wearable technology and health analytics, tracks physiological and cognitive states to provide real-time feedback and optimise performance. This monitoring helps predict and mitigate cognitive decline or mental fatigue. Educational and cognitive training programmes, using advanced pedagogical techniques and cognitive exercises, accelerate learning, improve retention and enhance specific cognitive skills such as memory, attention and problem-solving.

Neuroenhancements, such as pharmaceuticals, neurostimulation techniques and genetic modifications, can improve cognitive functions like memory, focus and learning abilities. For instance, nootropics can enhance cognitive performance, while transcranial magnetic stimulation or transcranial direct current stimulation can boost mood and cognitive abilities. Potential future applications of genetic technologies, such as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), might also offer ways to enhance cognitive capacities.

Brain-computer interfaces (BCIs) allow direct communication between the brain and external devices, enhancing the control over technology and cognitive processes. These interfaces can improve decision-making speed and accuracy, situational awareness and strategic planning. Augmented reality (AR) and virtual reality (VR) are also valuable in cognitive warfare, providing immersive training environments to enhance cognitive and psychological preparedness. Additionally, AR interfaces can overlay real-time data and intelligence, improving situational awareness and decision-making.

Data-driven personalisation through psychographic profiling and targeted messaging uses big data and analytics to understand and predict behaviours, creating more effective influence operations. Personalised messages and information campaigns can sway opinions and behaviours based on detailed profiles.

Cybernetic enhancements, such as devices that improve sensory perception and motor functions, can enhance operational capabilities. Behavioural and psychological techniques, including cognitive behavioural strategies, mindfulness and stress reduction practices, improve mental resilience, focus, emotional regulation and stress management, thus enhancing cognitive performance.

Artificial intelligence (AI) and machine learning contribute significantly to cognitive enhancement in warfare. AI tools assist in processing large amounts of data, improving decision-making processes and providing insights through cognitive assistants. These technologies can enhance memory and suggest strategies based on data analysis.

Social and behavioural engineering in cognitive warfare involves sophisticated use of social media and other platforms to shape perceptions and influence public opinion. Crafting and disseminating narratives that align with strategic objectives leverage storytelling to influence thought and behaviour. These elements of human enhancement, when combined, can significantly improve the cognitive capabilities of individuals involved in cognitive warfare, enhancing their effectiveness in conducting and defending against such operations. However, the ethical implications and potential risks associated with these enhancements, particularly regarding autonomy and consent, are significant considerations in their deployment.

To answer the question about new military capabilities, it is helpful to look into the concept of cognitive warfare in detail, which is a rather new concept, most likely introduced by the PLA of China. In 1999, Qiao Liang published a book titled "Unrestricted Warfare: China's Master Plan to Destroy America",[10] which could be seen as the first manual concerning cognitive warfare, later analysed and improved by the NATO publication "Cognitive Warfare, a Battle for the Brain".[11]

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10 Liang, Qiao/ Xiangsui, Wang: Unrestricted Warfare: China's Master Plan to Destroy America. Free Download, Borrow, and Streaming: Internet Archive. Internet Archive. 1999. https://archive.org/details/unrestricted-warfare/page/n3/mode/2up.

11 du Cluzel, Francois: Cognitive Warfare, a Battle for the Brain, 2020, https://www.sto.nato.int/publications/STO%20Meeting%20Proceedings/STO-MP-HFM-334/$MP-HFM-334-KN3.pdf.

Figure 7: Search interest in cognitive warfare

Source: Authors compilation, search interest data from Google Trends and correlated book cover.[12] [13]

The Chinese book emphasises the shift from conventional warfare to more diverse and integrated forms of conflict, where the boundaries between war and peace, military and non-military actions, are increasingly blurred, causing intense cognitive challenges that future commanders will face. It suggests using all available means – military and non-military, violent and non-violent – to achieve strategic objectives, highlighting the importance of innovation and adaptability in modern conflict. In terms of military implications and future trends, "Unrestricted Warfare" underscores the need for nations to develop capabilities in cyber warfare, economic manipulation and psychological operations. It also points to the importance of human enhancement

[12] Unrestricted Warfare (Chinese Edition 1999) – Softcover, Wang Xiangsui; Qiao Liang.

[13] Manual for "cognitive warfare" of the PLA, https://archive.org/details/unrestricted-warfare/page/n5/mode/2up.

technologies, suggesting that future conflicts will require enhanced cognitive and physical abilities to effectively manage and counter multifaceted threats.

The US publication focuses on the "militarization of Neuroscience and Technology" but refers to the more holistic approach of the PLA.

Both approaches recognise the importance of the brain and foster a comprehensive and flexible approach to warfare, integrating technological advancements and unconventional methods to disrupt and outmanoeuvre traditional military powers. This perspective on warfare suggests a future where conflicts are pervasive, leveraging all aspects of society and technology to achieve national objectives, and where cognitive capabilities are the most important military resource, either supportive or destructive. Recent AI models show typical cognitive capabilities, including not only information management but also creativity and problem-solving capability.

Future trends and innovations

This chapter explores how current scientific research and technology advancements could shape future war scenarios, highlighting the potential of emerging technologies and their impact on military operations. It discusses weak signals indicating future trends, innovations and threats, providing a roadmap for military research opportunities leading up to 2045.

Starting with the current landscape of future warfare scenarios, based on the interdependence of disruptive military innovations and corresponding changes in military doctrines reflected in the composition of military domains, it delves into the interdependence of warfare scenarios, disruptive innovation and domain concepts. Each of these domains is briefly analysed for their disruptive effect on military tactics with reference to their current capabilities, potential military applications and associated risks. This comprehensive overview sets the stage for understanding how human enhancements could transform military operations and soldier capabilities.

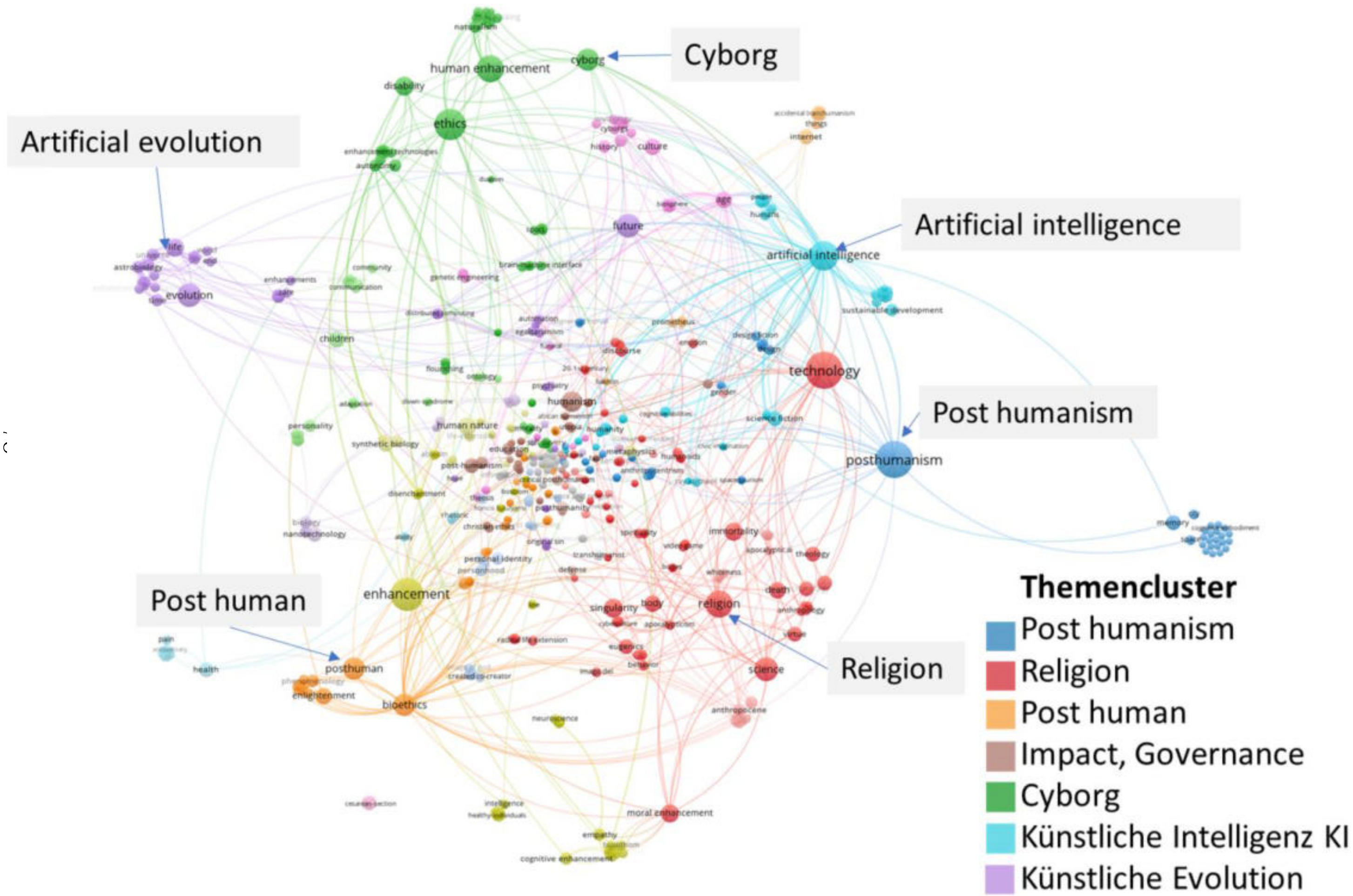
Following this, the chapter about predictions for the next decade investigates possible future innovations, considering how these technologies might evolve and be integrated into military strategies. It looks at hypothetical war scenarios where enhanced soldiers might play a crucial role, analysing the tactical advantages and societal impacts of deploying such technologies. The discussion also includes several explorations of the ethical and social implications, such as the blurring line between soldier and weapon, and the potential challenges in international law and warfare ethics.

Lastly, the chapter presents a summarised roadmap to 2045, outlining research opportunities and strategic directions for military enhancements. This roadmap is designed to guide policymakers, military strategists and defence researchers in navigating the complex landscape of future military human enhancement technologies. It emphasises the importance of staying ahead of technological advancements to maintain national security and combat readiness.

Transhumanism, a movement that advocates enhancing human capabilities through technology, intersects with military concerns in several ways. At its core, transhumanism explores the potential for humans to transcend their biological limitations, which naturally extends to military applications where enhanced physical and cognitive abilities can provide significant advantages.

Figure 8: See next page.

<u>Figure 8</u>: Transhumanism



Source: Authors calculation, data WoS (Clarivate, Web of Science, https://www.webofscience.com).

One of the central themes within transhumanism is the concept of posthumanism, which envisions a future where humans have evolved beyond their current physical and mental forms, possibly through genetic engineering or cybernetic enhancements. This entails profound implications for military forces, as soldiers could potentially be augmented with superior strength, endurance or intelligence, redefining the capabilities and strategies of the armed forces.

Religion also plays a role in the discourse surrounding transhumanism, as the latter challenges traditional beliefs about the sanctity and purpose of human life. In military contexts, these enhancements could lead to ethical and moral dilemmas regarding the treatment of enhanced soldiers and their role within the traditional frameworks of military ethics and laws of war.

The theme of cyborgs, or cybernetic organisms, is particularly pertinent. By directly integrating technology into the human body, such as through implanted devices that enhance sensory capabilities or cognitive processes, soldiers could operate more effectively in diverse and challenging environments. This not only shifts the tactical dynamics on the battlefield but also raises questions about the governance and regulation of such technologies, including international laws and norms.

Artificial intelligence (AI) is another significant element of transhumanism with military relevance. AI can augment human decision-making processes, provide sophisticated analyses of complex scenarios or autonomously operate systems and machinery, which are all critical in modern warfare. However, this integration of AI raises concerns about control, accountability and ethical use in military settings.

AI is necessary to address the increasing complexity on the battlefield. Drones can attack at any time and in any place, making it increasingly difficult for human agents to keep track of the situation.

Figure 9: The complexity of future warfare

Source: Authors compilation with pictures from youtobe videos demonstrating drone swarms[14] [15] and a youtube video showing Neuralink's First Patient.[16]

Lastly, the concept of artificial evolution touches on the deliberate genetic or mechanical enhancement of humans to better adapt to future environments and challenges. In a military context, this could mean creating soldiers tailored to specific tasks or environments, a controversial prospect that touches upon issues of bioethics, inequality and the potential misuse of technology.

Overall, the exploration of transhumanism within the military sphere involves a complex interplay of technology, ethics, governance and human potential, driving both opportunity and profound caution in the evolution of military capabilities. To the most extend, it was resulting from the perception of the Silicon Valley Tech Community, which did experience "successful hegemony in the global information space". It seems that the capability to get data from billions of people, literally looking into the brains of billions of customers and managing services with billions of customers did leave their tracks.

[14] https://www.youtube.com/watch?v=rPul9WKQ6oQ
[15] https://www.youtube.com/watch?v=y0KNhSejkOI
[16] https://www.youtube.com/watch?v=5SrpYZum4Nk

The following figure shows some of the as of yet not fully realised trends, with the possibility to enhance human species in a way, not possible today.

Figure 10: Transhumanism – Research and innovation or religion?

Not yet fully realized trends

- Cybernetic tattoos and skin sensors
- Symbiotic relationship with artificial intelligence
- Genetic manipulation for the development of a new humanoid species
- Mind uploading
- Digital immortality vs cryonics
- Nanotechnology sensors
- Biomechanics
- Neuro-enhancement
- Life extension and anti-aging technologies
- Virtual reality vs augmented reality

Source: Authors compilation, picture generated with Dall-E 2, by making use of the not yet fully realized trends.

The trends represent a fascinating exploration of emerging possibilities in science, technology and human evolution. Cybernetic tattoos and skin sensors point towards a future where the human body integrates seamlessly with technology, providing real-time data and interaction capabilities. A symbiotic relationship with artificial intelligence envisions humans and AI working closely together, potentially merging capabilities to enhance decision-making and creativity. Genetic manipulation, meanwhile, aims at developing entirely new humanoid species, pushing the boundaries of biology and ethics (due to ethical limitations, cell experiments are either not possible or not fully documented).

Mind uploading and the quest for digital immortality introduce the prospect of transferring human consciousness to a digital medium, contrasting with cryonics, which focuses on preserving biological bodies. Nanotechnology sensors and biomechanical systems promise advanced monitoring and enhancement of human health and abilities, while neuroenhancement seeks to augment cognitive and neurological functions. Life extension and anti-ageing technologies continue to push the limits of the human lifespan, challenging traditional concepts of ageing. Lastly, the interplay between virtual reality and augmented reality redefines how we experience and interact with the digital world, offering immersive and transformative applications across many aspects of life. These trends collectively showcase humanity's relentless pursuit of innovation, reshaping the boundaries of existence and interaction.

Predictions for the next decade

In strategic planning and foresight, weak signals and knowledge of emerging trends are essential elements used in creating roadmaps because they provide a structured means to anticipate future environments and prepare for potential changes. Roadmaps are visual and strategic tools that outline the path from the current state to a desired future state, incorporating milestones and timelines. The following "knowledge elements" are identified for useful military human enhancement technologies:

Anticipation of future trends and changes: by integrating weak signals and trends into roadmaps, organisations can visualise potential futures and the emergence of new technologies or market shifts. This helps in understanding how these factors might impact their operations, enabling them to strategize effectively. Identifying weak signals early on allows for a proactive response to emerging opportunities or threats, rather than a reactive one.

Guided decision-making (context information on most relevant innovations): including these elements in roadmaps aids decision-makers in prioritising resources, such as time, money and manpower, based on anticipated changes. It helps in aligning strategic objectives with the expected evolution of the market or technology landscape, ensuring that the organisation remains relevant and competitive.

Enhanced innovation (detecting root cause innovations): roadmaps that incorporate knowledge of emerging trends and weak signals foster an environment conducive to innovation. They encourage organisations to explore new ideas and technologies before they become mainstream, potentially securing a first-mover advantage on the market. This forward-thinking approach is crucial for staying ahead in rapidly changing industries.

Risk management (threat identification): by acknowledging and planning for possible future disruptions indicated by weak signals, roadmaps help organisations mitigate risks. Preparing for multiple scenarios allows them to develop contingency plans, reducing the impact of negative events and ensuring business continuity.

Weak signals are early indications of potential trends, trend changes, threats, innovations and disruptive events that might significantly influence the future. In the context of foresight, identifying and interpreting these weak signals is crucial for anticipating changes and making informed decisions. In addition, weak signals are often overlooked due to their subtlety, ambiguity or the obscurity of their sources. They can emerge from various areas, including technological advancements, social shifts, economic fluctuations or environmental changes. For example, a novel application of an existing technology in a new field might initially appear irrelevant or unviable but could eventually lead to significant industry disruptions.

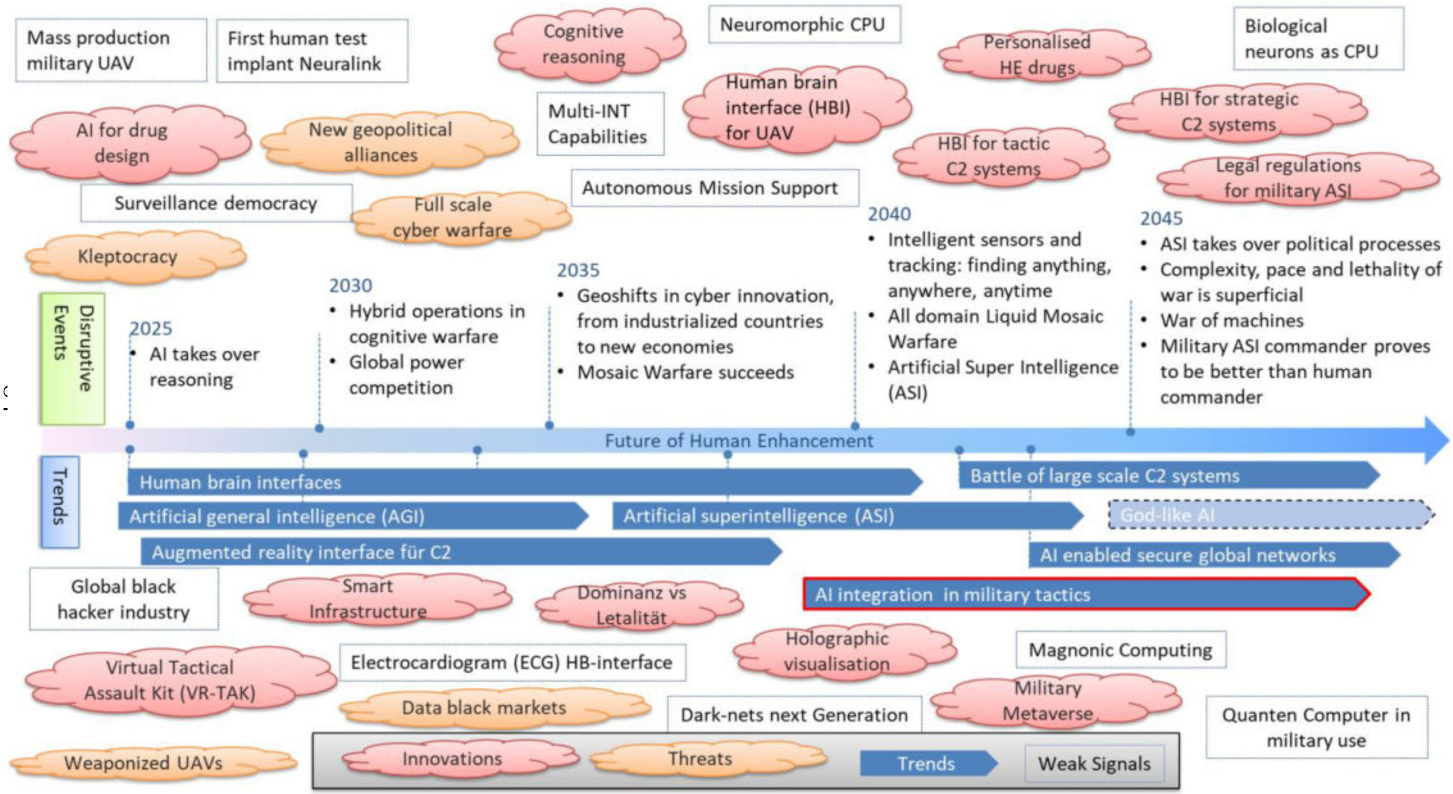
The challenge in working with weak signals lies in their interpretation and the ability to distinguish between noise and genuine emergent issues. Analysts often rely on systematic scanning of a wide range of sources, from academic publications and patents to social media and beyond, to capture these signals. The next step involves connecting seemingly disparate pieces of information to construct plausible scenarios concerning the future.

Recognising weak signals requires a mindset open to new information and alternative perspectives. It also demands continuous learning and adaptation, as the relevance and impact of weak signals can evolve over time. Effective use of weak signals in foresight can provide organisations and policymakers with a strategic advantage, allowing them to prepare for and shape future developments rather than to merely react to them. This proactive approach is essential for navigating the complexities of an increasingly unpredictable world.

The following roadmap was generated with CATALYST[17] data from AIT.

[17] CATALYST (Collaborative Trend Analytics System), AIT, 2024.

Figure 11: Conceptual road map for the global future of military human enhancement



Source: Authors compilation.

The image depicts a comprehensive roadmap for military human enhancement, illustrating various trends, innovations, threats and weak signals projected up to the year 2045. The timeline is marked with significant milestones and anticipated developments in human enhancement technologies and their integration into military operations.

At the top, the timeline is segmented by years, starting from 2025 and extending to 2045. Key developments and future predictions are marked along this timeline. For instance, by 2025, artificial intelligence (AI) is expected to take over reasoning tasks, and mass production of military unmanned aerial vehicles (UAVs) is anticipated. Around this period, Neuralink will conduct its first human test implant, signifying advancements in brain-machine interfaces.

By 2030, hybrid operations in cognitive warfare and global power competition are highlighted, indicating a shift in military strategies influenced by cognitive enhancement technologies. Additionally, there is mention of surveillance democracy and the rise of new geopolitical alliances, reflecting broader sociopolitical impacts.

Moving towards 2035, significant trends include geoshifts in cyber innovation from industrialised countries to new economies, and the success of Mosaic Warfare. Innovations such as Multi-INT capabilities and autonomous mission support are expected to emerge, enhancing operational efficiency and decision-making in military contexts.

The timeline further projects into 2040 and 2045, with advancements in intelligent sensors and tracking technologies that allow for precise, real-time situational awareness. These technologies will support all-domain liquid Mosaic Warfare and the advent of artificial superintelligence (ASI). By 2045, it is anticipated that ASI will surpass human commanders in political and military decision-making, leading to a new era where the complexity, pace and lethality of war are dramatically increased.

The roadmap also identifies various technological and tactical integrations. Human brain interfaces (HBI) for UAVs and other command and control systems are noted, along with AI-enabled secure global networks. These integrations will facilitate seamless coordination and enhanced operational capabilities.

Several innovations are highlighted, such as augmented reality interfaces for command and control, holographic visualisation, smart infrastructure and neuromorphic CPUs. These technologies are expected to revolutionise military operations and strategy.

Threats such as weaponised UAVs, data black markets and the rise of dark nets are identified, emphasising the need for robust security measures. Additionally, the roadmap points out weak signals such as magnonic computing and biological neurons as CPUs, indicating emerging technologies that could impact future military capabilities.

Overall, the roadmap presents a detailed and forward-looking view of how human enhancement technologies and associated advancements are poised to transform military operations, strategies and global power dynamics over the next two decades.

Conclusion and recommendations

The evolution of human enhancement technologies represents a pivotal shift in military capability planning, with profound implications for future warfare. As nations confront increasingly complex and multifaceted security challenges, the integration of advanced physical, cognitive and technological augmentations promises to redefine the boundaries of human performance in military operations. These advancements not only aim to enhance individual soldier capabilities but also transform strategic planning by introducing a new paradigm of human-machine collaboration, biotechnological augmentation and cognitive warfare.

The intersection of innovation and military planning necessitates a nuanced understanding of both the opportunities and risks inherent in these technologies. On the one hand, enhanced physical endurance, cognitive agility and real-time decision-making enabled by brain-computer interfaces, genetic modifications and pharmaceutical innovations could provide unparalleled advantages on the battlefield. On the other hand, the ethical, legal and societal implications of these advancements pose significant challenges, particularly as the lines between human soldiers and automated systems blur.

Strategic capability planning must navigate this dual imperative by fostering a proactive approach to technology integration while addressing critical issues of governance, regulation and ethical deployment. This involves anticipating the long-term impact of enhancements on the nature of warfare, ensuring that innovations align with international norms, and safeguarding human dignity amidst rapid technological change. The roadmap for military human enhancement must therefore balance the pursuit of operational superiority with the responsibility to uphold ethical principles, foster global stability and prepare for a future where human potential and technological innovation coexist harmoniously.

In conclusion, human enhancement technologies are not merely tools to improve military efficiency but catalysts for reimagining the role of soldiers, the conduct of warfare and the relationship between humanity and technology. By embracing a forward-looking and ethically grounded approach, military planners can harness these innovations to build a resilient and adaptive force capable of meeting the demands of an unpredictable and interconnected world. The success of this endeavour will depend not only on the sophistication of the technologies themselves but also on the wisdom with which they are deployed.

Strategic recommendations for policymakers and capability planners within the realm of military human enhancement technologies must balance innovation, operational necessity and ethical responsibility. Therefore, the following recommendations attempt to guide the integration of human enhancement technologies into military strategy while addressing the broader societal, legal and ethical implications of their use.

Embrace a holistic approach to capability planning: policymakers and capability planners should adopt an integrated perspective that considers the full spectrum of human enhancement technologies, including genetic engineering, pharmaceutical interventions, brain-computer interfaces and exoskeletons. This requires a multidisciplinary approach that bridges military strategy, biomedical research, cognitive science and artificial intelligence to ensure cohesive planning and deployment. Capability planning should be informed by both immediate operational needs and long-term strategic objectives, ensuring the development of technologies that enhance military effectiveness while remaining adaptable to evolving threats.

Establish clear ethical and legal frameworks: human enhancement technologies challenge existing ethical norms and legal frameworks, particularly regarding autonomy, privacy and the implications of creating **"augmented" soldiers**. Policymakers must work to establish robust ethical guidelines and international norms that govern the research, deployment and use of these technologies. These frameworks should prioritise transparency, informed consent and the reversibility of enhancements to safeguard human dignity and rights. Additionally, clear legal protocols must address liability issues, particularly in scenarios where enhanced soldiers are deployed alongside autonomous systems.

Invest in resilience and risk mitigation: while human enhancement technologies promise significant operational advantages, they also introduce risks, including the dependency on fragile technologies, cybersecurity vulnerabilities and the potential for adversaries to exploit or reverse-engineer similar capabilities. Capability planners should prioritise investments in resilience, such as developing redundant systems, ensuring interoperability between human and machine systems and implementing robust cybersecurity measures. Policymakers must also consider contingency planning for scenarios where these technologies may be rendered ineffective or compromised.

Foster international collaboration and norm-setting: given the global nature of technological innovation, international collaboration is essential to manage the proliferation and use of human enhancement technologies in military contexts. Policymakers should engage with allied nations, international organisations and private-sector stakeholders to establish shared norms, promote transparency and prevent the misuse of these technologies. Collaboration can also facilitate the exchange of best practices, accelerate innovation and ensure that military advancements align with broader societal values.

Promote dual-use innovation for broader societal benefit: many human enhancement technologies have applications beyond the military, including in healthcare, disaster response and public safety. Policymakers should encourage dual-use innovation by supporting research that benefits both military and civilian sectors. This approach not only maximises the return on investment but also fosters public acceptance of these technologies by demonstrating their potential to improve quality of life and address societal challenges.

Prioritise education and training for enhanced soldiers: the successful integration of human enhancement technologies into military operations depends on the ability of personnel to effectively utilise these capabilities. Policymakers should ensure that training programmes are developed to address the unique demands of operating enhanced systems, emphasising both technical proficiency and ethical decision-making. Education should also extend to leaders and planners, equipping them with an understanding of the strategic implications of these technologies to make informed decisions about their use.

Maintain a balance between human and machine capabilities: as military operations become increasingly reliant on **human-machine collaboration**, policymakers must strike a balance between leveraging technological advancements and preserving the unique strengths of human soldiers. Capability planners should focus on integrating enhancements that augment, rather than replace, human capabilities, ensuring that the role of the soldier remains central to military operations. This balance is critical to maintain operational flexibility and ensure that the military can adapt to diverse and dynamic combat environments.

Monitor and address societal implications: the deployment of human enhancement technologies within the military will inevitably influence broader societal perceptions of these advancements. Policymakers must actively monitor public sentiment, address concerns about inequality or misuse and engage in transparent communication about the purpose and limitations of these technologies. Building trust and ensuring public accountability will be essential to sustaining long-term support for military innovation.

By adhering to these recommendations, policymakers and capability planners can navigate the complex landscape of military human enhancement technologies, ensuring their responsible development and deployment in ways that strengthen national security while upholding ethical standards and societal values. Currently, it seems that the EU is paying relatively little attention to human enhancement whilst it pays considerable attention to artificial intelligence. However, these research topics are interconnected and should be considered as such to foster the positive aspects for industrial development and economic prosperity.

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Transhumanism –
Viable vision or just a deus ex machina concept?

Norbert Frischauf

How realistic are the utopias and dystopias on the topic of "human enhancement" from a STEM perspective?

Figure 1: Transhumanism symbol. Source: Antonu. In: Wikipedia: Transhumanism. https://en.wikipedia.org/wiki/Transhumanism, accessed: Dec. 17, 2024.

> "Up till now human life has generally been, as Hobbes described it, 'nasty, brutish and short'; the great majority of human beings (if they have not already died young) have been afflicted with misery… we can justifiably hold the belief that these lands of possibility exist, and that the present limitations and miserable frustrations of our existence could be in large measure surmounted… The human species can, if it wishes, transcend itself – not just sporadically, an individual here in one way, an individual there in another way, but in its entirety, as humanity."[1]

[1] Huxley, Julian: Transhumanism. In: *New Bottles For New Wine*, London: Chatto & Windus, 1957, pp. 13-17. https://archive.org/details/NewBottlesForNewWine/page/n15/mode/2up, accessed Dec. 16, 2024.

The transhumanism vision…

According to Wikipedia,

> "***Transhumanism*** **is a philosophical and intellectual movement that advocates the enhancement of the human condition** by developing and making widely available new and future technologies that can greatly enhance longevity, cognition, and well-being" and
>
> "**Transhumanist thinkers study the potential benefits and dangers of emerging technologies that could overcome fundamental human limitations**, as well as the ethics of using such technologies. Some transhumanists speculate that human beings may eventually be able to transform themselves into beings of such vastly greater abilities as to merit the label of posthuman beings."[2]

As stated in the introduction, the concept of transhumanism is not brand new, but dates back to the year 1957, when biologist Julian Huxley popularised the term "*transhumanism*" in an essay.[3] **The idea of becoming immortal, staying young forever and increasing one's power and intellect to (demi-)god-like levels, however, is much older and goes way back in human history**.

Such visions may have been expressed as early as in the *Epic of Gilgamesh*, which had been written in approx. 2100-1200 BC.[4] Later on, such ideas surfaced in the writings of influential philosophers such as Aristotle, René Descartes and Friedrich Nietzsche as well as famous authors such as Dante Alighieri or Mary Shelley, and they became a mainstream theme in the 20th century due to the rise of the science fiction and fantasy genre.

… and the science fiction and fantasy genre

Today's film industry has largely embraced the science fiction and fantasy genre. This should come as no big surprise, if we bear in mind that ***Star Wars*****,** ***Avatar*** **and Marvel's superhero movies, such as** ***Iron Man*****, make**

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2 Wikipedia: Transhumanism. https://en.wikipedia.org/wiki/Transhumanism, accessed Dec. 17, 2024; emphasis added by the author.

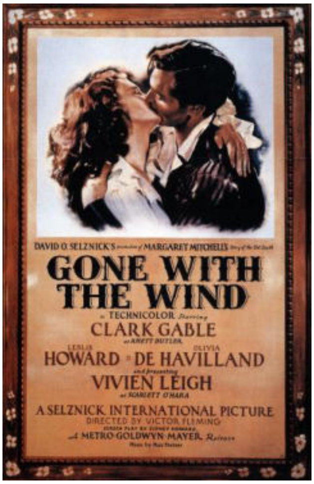
3 Huxley, Julian: Transhumanism.

4 Sin-leqi-unninni: *Epopeia de Gilgámesh*. Belo Horizonte: Autêntica Editora, 2017. https://books.google.at/books?id=OolDDwAAQBAJ&redir_esc=y, accessed Dec. 17, 2024.

up the best cash cows in the cinematic sector. Seven out of the top ten Top Lifetime Grosses[5] are science fiction movies, with the top three being:

1. ***Avatar***, released in 2009, lifetime gross: $ 2,923,706,026
2. ***Avengers: Endgame***, released in 2019, lifetime gross: $ 2,799,439,100 and
3. ***Avatar: The Way of Water***, released in 2022, lifetime gross: $ 2,320,250,281

Even on the list of the highest-grossing films of all time,[6] five of the top-ten movies are connected to the science fiction genre (in a red box), and it is likely only a matter of time until *Avatar* obtains first place on this list as well.



Rank	Title	Worldwide gross (2023 $)	Year
1	Gone with the Wind	[GW]$4,341,000,000	1939
2	Avatar	[A1]$3,957,000,000	2009
3	Titanic	[T]$3,677,000,000	1997
4	Star Wars	$3,563,000,000	1977
5	Avengers: Endgame	[AE]$3,275,000,000	2019
6	The Sound of Music	$2,984,000,000	1965
7	E.T. the Extra-Terrestrial	[ET]$2,917,000,000	1982
8	The Ten Commandments	$2,758,000,000	1956
9	Doctor Zhivago	$2,615,000,000	1965
10	Star Wars: The Force Awakens	[TFA]$2,577,000,000	2015

Figure 1: Poster of the movie "Gone with the Wind", the leader on the list of highest-grossing films of all time, as of 2022 adjusted for inflation. Source: Wikipedia.[7]

5 IMDbPro: Top Lifetime Grosses. Box Office Mojo, https://www.boxofficemojo.com/chart/top_lifetime_gross/?area=XWW, accessed Dec. 17, 2024.

6 As of 2022 and adjusted for inflation, see Wikipedia: List of highest-grossing films. https://en.wikipedia.org/wiki/List_of_highest-grossing_films#endnote_GWTW, accessed Dec. 17, 2024.

7 Wikipedia: List of highest-grossing films. 2024. https://en.wikipedia.org/wiki/List_of_highest-grossing_films#endnote_GWTW, accessed Dec. 17, 2024.

Whether it is the movie *Star Wars*, *Limitless* or *Iron Man*, *The Witcher (Geralt of Rivia)* or the satirical superhero television series *The Boys*, one commonality in all of their plots is the concept of human enhancement. **The protagonists feature faster reaction rates (*Star Wars, The Witcher*), rely on higher power levels (*Iron Man, The Boys*), succeed due to enhanced consciousness (*Limitless*) or overcome their foes because of their improved regeneration (*Deadpool, Wolverine*).**

One element often discussed in conjunction with superhero powers are the ethical limits and/or responsibilities involved. "*With great power comes great responsibility*" has become a famous proverb that also touches upon this. Popularised by Stan Lee's Spider-Man, the underlying idea dates back to the parable of the *Sword of Damocles* or the French expression "*La noblesse oblige*" and emerged in several books and stories in previous centuries. In essence, the proverb states that "**power cannot simply be enjoyed for its privileges alone but necessarily makes its holders morally responsible both for what they choose to do with it and for what they fail to do with it**."[8]

Obviously not everyone will live up to this moral code. A protagonist for such a "fallen warrior" is Khan, Captain Kirk's adversary in *Star Trek II*. Khan is the perfect warrior who, thanks to genetic engineering, is stronger, smarter and faster but also much more unscrupulous than Captain Kirk and others. In the end, he comes into direct conflict with Kirk and Spock and although he is stronger, he loses against Spock. **Albeit very unscrupulous in his appearance, Khan represents more of a grey than a purely black figure and one might ask oneself whether he has always been like that or has been turned into this cold-blooded being because of the genetic engineering that he had to endure.** (Figure 2).

8 Wikipedia: With great power comes great responsibility. https://en.wikipedia.org/wiki/With_great_power_comes_great_responsibility, accessed Dec. 17, 2024.

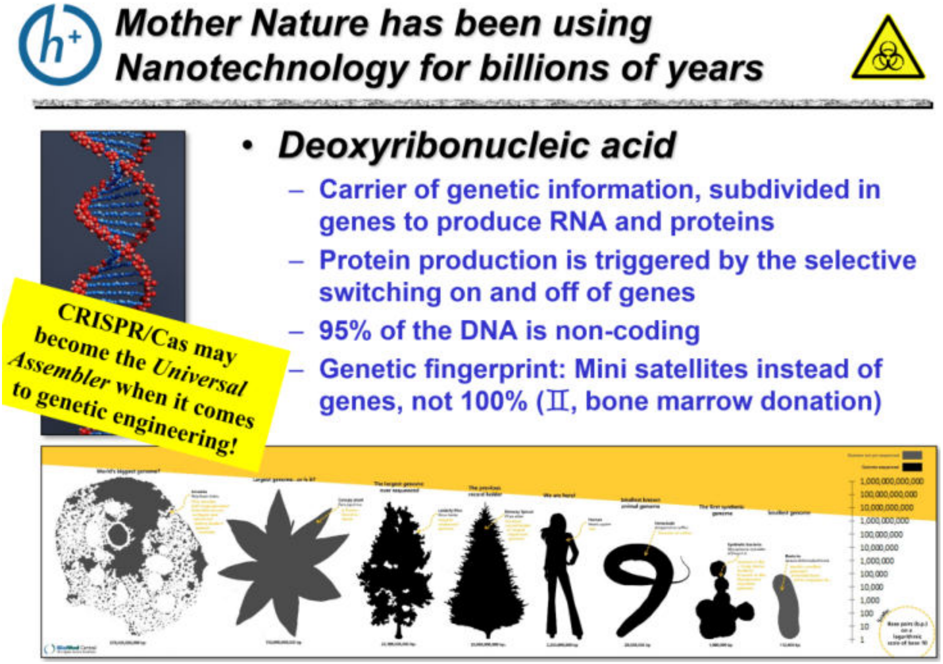


Figure 2: Genetic engineering may be the easiest gateway to human enhancement. Author's compilation.[9]

The ethical dimension is not only depicted in Khan, but a key element in *Limitless*, *The Witcher*, *The Lord of the Rings* and numerous other science fiction and fantasy movies, novels and books. This gives the whole transhumanism discussion and its interconnection with the science fiction genre an interesting spin, as on one hand science fiction movies are likely the main populariser of the underlying philosophy, as they visualise its concepts and stream the resulting representations of transhumanist thought to the public, while on the other hand the movies also critically address the ethical issues that come with human enhancement and humanity's desire to become (demi-)god-like.

[9] Sources: https://pixabay.com/de/photos/gen-dna-lernen-wissenschaft-6527964/, https://www.biologyonline.com/dictionary/exon and https://blogs.biomedcentral.com/on-biology/2014/03/20/worlds-largest-sequenced-genome-unlocking-the-loblolly-pine/.

Deus ex machina?

Khan is not only a great warrior and a controversial character due to the effects of eugenics,[10] but also a great example of a *deus ex machina* moment in the science fiction movie "*Star Trek Into Darkness*". This moment arrives when Captain Kirk sacrifices himself to save his crew, but is then brought back to life by a dose of Khan's blood, which is able to entirely negate the lethal effects of radioactive poisoning. The ability of Khan's blood to act as a miraculous cure comes out of nowhere and provides the movie with a completely unforeseeable happy ending.[11] **This is what *deus ex machina* is all about: the "*god from the machine*" moment is typically…**

> […] a plot device whereby a seemingly unsolvable problem in a story is suddenly or abruptly resolved by an unexpected and unlikely occurrence. Its function is generally to resolve an otherwise irresolvable plot situation, to surprise the audience, to bring the tale to a happy ending or act as a comedic device.[12]

Needless to say that some *deus ex machina* moments create severe headaches for the audience. **Notable examples are – besides Kirk's rescue by Khan's blood – *Superman*, who twists time to rescue his girlfriend Lois Lane, *The Lord of the Rings*, where Sam and Frodo are taken to safety from Mount Doom by giant eagles, and *Jurassic Park*, where a T-Rex appears like a ghost out of nowhere and rescues the protagonists from assured death by attacking the velociraptors.** It is not so much the fact that the T-Rex attacks the smaller critters, which have surrounded the humans and are about to kill them in the next few moments, but the issue of the movie's immense focus on the size of the T-Rex, which makes it completely impossible to overlook an approach by a T-Rex due to the tremors that accompany it. The movie depicts this nicely through the vibrating water

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[10] Wikipedia: Eugenics. https://en.wikipedia.org/wiki/Eugenics, accessed Dec. 17, 2024.

[11] McCormick, Collin/ Peeke, Dan: The 20 Biggest Deus Ex Machina Moments In Film History, Ranked By How Crazy They Were. Screenrant. https://screenrant.com/biggest-deus-ex-machina-moments-in-film-history/, accessed Dec. 18, 2024.

[12] Wikipedia: Deus ex machina. https://en.wikipedia.org/wiki/Deus_ex_machina, accessed Dec. 18, 2024.

in the glass scene. However, in the final, critical moment, the T-Rex approaches the scene without a sound.[13]

The 5-million-dollar question now is whether transhumanism is the big elephant in the room that approaches us silently like the T-Rex in its *deus ex machina* moment? Or is it nothing more than a "magical remedy"[14] that likely won't work in practice. Time for a STEM[15]-based reality check.

STEM reality check

Figure 3: Cover of the ITSF Study by the European Space Agency.[16]

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[13] McCormick, Collin/Peeke, Dan: The 20 Biggest Deus Ex Machina Moments In Film History, Ranked By How Crazy They Were. Screenrant. https://screenrant.com/biggest-deus-ex-machina-moments-in-film-history/, accessed Dec. 18, 2024.

[14] This is the way the *deus ex machina* phrase is used within the medical context.

[15] STEM: Science, Technology, Engineering and Mathematics.

[16] Source: Woods, Arthur: Innovative Technologies From Science Fiction for Space Applications. The Space Option. October 5, 2019. https://thespaceoption.com/innovative-technologies-from-science-fiction-for-space-applications/.

1999 saw the European Space Agency (ESA) launch the Innovative Technologies from Science Fiction (ITSF) study (**Fehler! Verweisquelle konnte nicht gefunden werden.**), "the main objectives of which were to review the past and present science fiction literature, artwork and films in order to identify and assess innovative technologies, systems, devices, designs, configurations and concepts described therein which could possibly be developed further for space applications**. The study resulted in some250 innovative technologies and concepts mentioned in the science fiction genre being found,** and a preliminary assessment was performed in order to identify whether any of these technologies might indicate potential for a more-in-depth analysis leading to subsequent feasibility studies."[17]

The technological studies within **the ITSF study centred on 35 different topics often mentioned within the science fiction genre**, such as: Warp Drives and Tunnels, Orbital Towers, Space Elevator, Space Power, Antimatter, Space Colonies, Magnetic Propulsion, Sails and Shields, Nanotechnology, Fusion Drives, Interplanetary Travel, Ramjets, Robotics and Automation, Tethers, Wearable Computers, Extraterrestrial Mining, etc.

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17 Woods, Arthur: Innovative Technologies from Science Fiction for Space Applications. The Space Option. https://thespaceoption.com/innovative-technologies-from-science-fiction-for-space-applications/, accessed Dec. 18, 2024, emphasis added by the author.

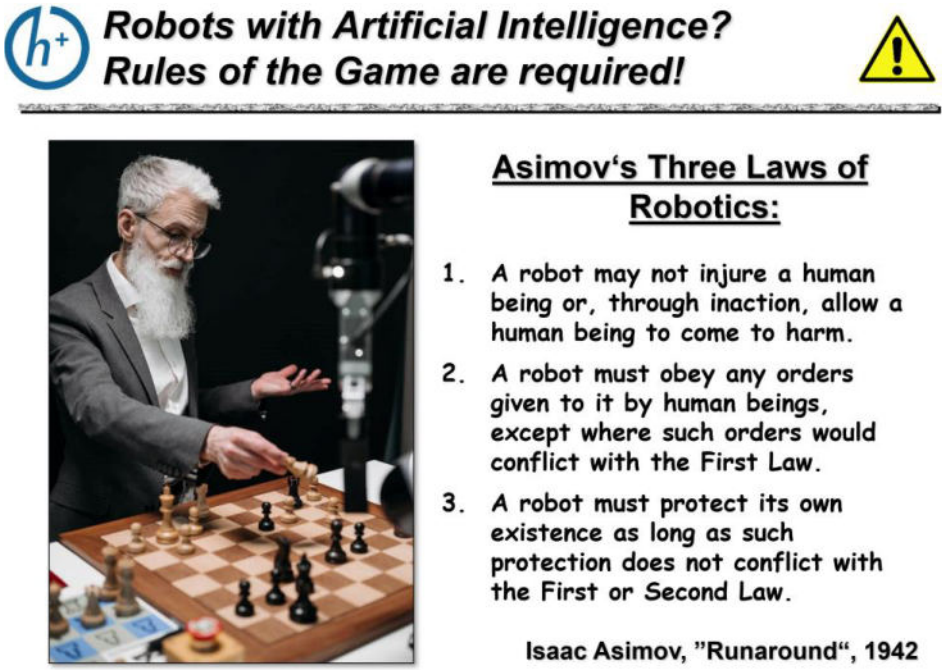

Figure 4: The three laws of robotics. Sources: Asimov, I. and Frischauf, N.[18]

Naturally, items such as **artificial intelligence (AI), as depicted by the computer *HAL 9000* in the movie *"2001"*, played a key role in the dossiers**, both from a technological as well as from an ethical standpoint. While the latter viewpoint focusses on the potential risks that may emerge with a robot that utilises a strong AI brain governed by the *Three Laws of Robotics* (Figure 4), and which are nicely depicted in the novel *"Runaround"*[19] published in 1942 by Isaac Asimov, the technological viewpoint outlines the limits that exist, the most profound being connected to the technology dimensions of information and energy (Figure 5, next page).

[18] Picture: https://www.pexels.com/de-de/foto/mann-technologie-schach-strategie-8438933/.

[19] Wikipedia: Runaround (story). https://en.wikipedia.org/wiki/Runaround_(story), accessed: Dec. 18, 2024.

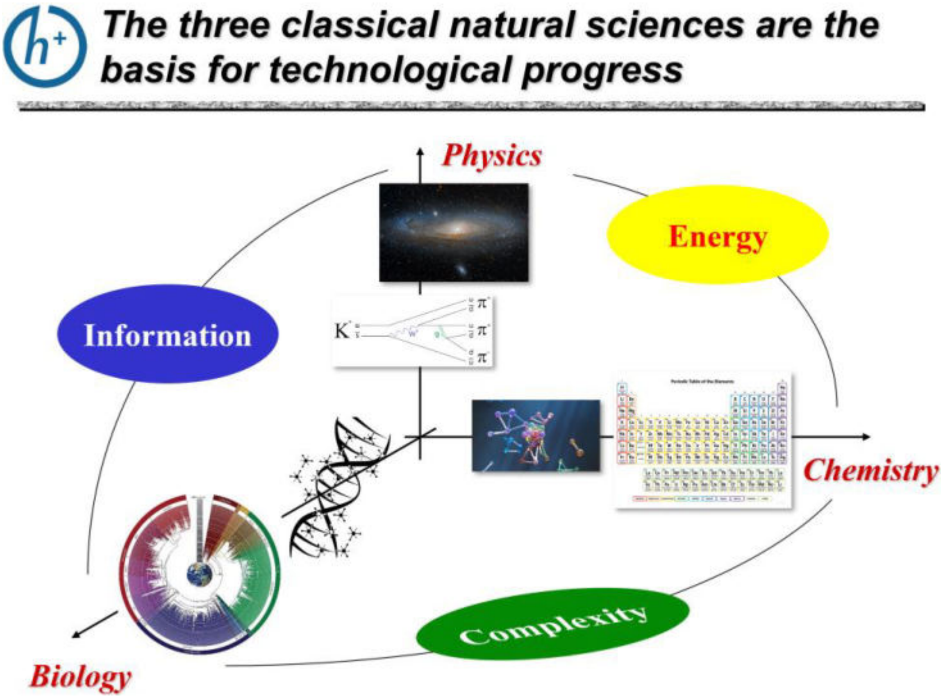

Figure 5: Biology, chemistry and physics create the three planes of technological progress.[20]

The key technology dimensions: Information and energy

When we look into the various concepts of *human enhancement* and *transhumanism* and negate the biotechnological approach to it (Figure 2), as depicted in movies such as *Limitless*, *Star Trek Into Darkness*, *The Boys*, *Deadpool*, *Wolverine*, etc., and focus on **physical concepts such as the exoskeletons being used by *Iron Man* or *Darth Vader*, specific technical issues start to**

[20] Author's compilation. Sources: https://apod.nasa.gov/apod/image/1407/m31_bers_1824.jpg, https://en.wikipedia.org/wiki/Feynman_diagram#/media/File:Kaon-Decay.svg, https://sciencenotes.org/printable-periodic-table/, https://www.pexels.com/de-de/foto/proteinfaltung-25626509/, https://en.wikipedia.org/wiki/Tree_of_life_(biology)#/media/File:Circular_timetree-of-life_2009.jpg and https://pixabay.com/de/photos/genetisch-wissenschaft-dna-biologie-2716263/

arise almost immediately. These issues are interconnected to the bits/bytes – the information - and the gigawatts – the energy (Figure 5) - necessary to turn these wonders into reality.

Figure 6: Darth Vader – a dark knight in a hi-tech suit (Source: Pexels[21])

Both suits make extensive use of sensors to enhance the senses of the human inside, both employing a powerful life-support system and requiring power to enable them to be used by their bearers**. Iron Man's suit even goes one step further as it also provides a powerful AI-based companion – Jarvis – which acts as an assistant, a consultant and as a co-pilot, depending on the situation**.

Our brains are 100 W computers developed by evolutionary design. They are built upon 10^{11} neurons and are capable of performing 10^{16} floating point operations per second (FLOPS). If we assume that it will one day be possible to create an SI-based AI and that such an AI will function similarly to our human brain, then this AI will have to have:

21 Pexels, https://www.pexels.com/de-de/foto/kostum-verkleidung-draussen-helm-9482193/, accessed Dec. 19, 2024.

- a comparable capability to perform logical/mathematical operations (represented by FLOPS); as well as
- the capability to learn, to adapt and to perform operations, which are granted by a neuronal network.

As depicted in Figure 7, electronic computers do not yet match the brain's capability. **While logical/mathematical operations do now exceed those of the brain (10^{18} vs 10^{16} FLOPS), the neuronal network of the electronic brains is still mediocre (10^{4} vs 10^{11} neurons). In addition, these systems are very power-hungry and demand 10 MW ("K") - 24.6 MW ("Frontier").** Needless to say that such power levels are beyond any level that can be accommodated by a mobile system, such as the aforementioned suit.

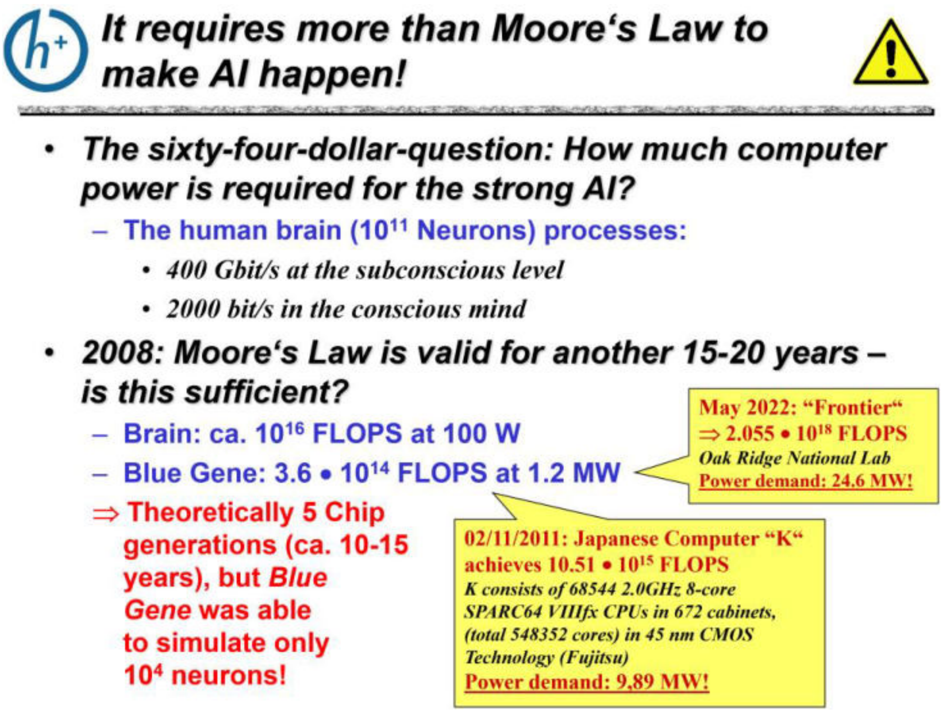

Figure 7: A comparison of the human brain with the best AI systems showcases the power demands of the electronic system. Author's compilation.[22]

[22] Source: https://en.wikipedia.org/wiki/Frontier_(supercomputer).

But even if we neglect the AI-based companion feature and just aim for the suit of Darth Vader, we face energy issues. **A typical human long-distance runner will generate 450 W of power while running (at a pace of 8.5 km/h).** If we assume that the runner continues this way for 5 hours – e.g. to finish a marathon – then the power level will turn into an energy demand of 2,250 Wh.

If this energy is to be catered for by LiPo batteries with an energy density of 150 Wh/kg, then we need at least 15 kg of batteries if we drain these batteries at 100% depth of discharge (DoD), which we would rather not do as it will have a negative effect on the battery's lifetime.

- If the **mass of the runner is twice as high** – e.g. if we visualise a supporting exoskeleton – then we need **twice the battery mass, hence 30 kg** (at 100% DoD).
- If the **runner aims to runs twice as fast**, hence 17 km/h, then the **battery mass will increase to 60 kg** (at 100% DoD).
- And if the **runner runs twice as fast (17 km/h) with twice the mass, then the battery mass will climb to 120 kg.**

These calculations are based on kinetic energy principles ($E = \frac{mv^2}{2}$) and apply to both suits. In the case of Tony Stark, who fights, flies and talks with Jarvis within his *Iron Man* suit, an additional power add-on of several MWs needs to be catered for as well.

Tony Stark, who is not only a multi-billion entrepreneur but also a genius, has solved the power issue by utilising an *ARC reactor* that powers his suit. *ARC* stands for *affordable, robust and compact* reactor and, based on the way it is depicted in the movies, this system needs to be some sort of magnetic confinement fusion (MCF) reactor. **While such an MCF reactor has been successfully tested, any technical concepts associated with the MCF principle are far from being such miniscule like Tony's ARC reactor.** In fact, an MCF system features a form factor like a classic coal/gas/oil-fired power plant, making it entirely unpractical for utilisation within any mobile system.

Is this the end to the story and is *transhumanism* therefore only a mere *deus ex machina*? As far as the power limits are concerned, concepts such as the *Iron Man* suit, exoskeletons and AI-based implants that improve a human brain beyond any limits are currently absolutely off the scale. However, if history has taught us anything then it is the fact that humans are very creative and will eventually overcome most of the limits and barriers they encounter, provided that the vision is strong enough to pursue. And the vision of becoming immortal, staying forever young and increasing one's power and intellect to (demi-)god-like levels is certainly a strong one – if not the strongest that exists within the human soul. **Therefore, it will only be a matter of time until the *deus ex machina* will be turned into a *deus cum machina*…**

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Chapter II – Medicine

alex_aldo/Adobe Stock

Medicine. Chapter Summary

The panel of participants representing the medical field faces the challenge of approaching the topic of human enhancement from a psychological, neurological, anthropological and general biological viewpoint, and to issue an appraisal regarding its relevance to the military and other security forces.

"Cognitive Enhancement – A critical reflection from psychology and neuroscience" by Dr rer. nat. Sandra Grinschgl provides a comprehensive examination of neuroenhancement which is supported by a wide range of literature. This emphasises that the scientific evidence regarding the effectiveness of these methods is often overestimated, and that a more circumspect and therefore critical attitude regarding the current possibilities and promises concerning cognitive improvement is therefore generally appropriate.

The second contribution to the panel also makes a similar argument from a medical perspective: for example, clinical trials with large numbers of patients are carried out in scientific medicine, which cost a great deal of time and money in order to optimise the risk-benefit balance. On the other hand, when it comes to researching neuroenhancements, individuals who are not medical experts often expect positive results to be achieved within a short period of time.

A review of the fundamental difficulties involved in enhancing or supporting the biological system underlying the human brain with technical measures however supports a more sceptical approach.

Despite the absence of any in-house processing, a brief observation regarding the process commonly referred to as Genetic Human Enhancement still seems appropriate.

In somatic gene therapy, small parts of the genetic material are removed, deactivated or replaced. Treatment can be successful where there is a clearly defined and, above all, simple genetic defect.

The situation is different for targeted "improvements". Due to the complexity and intricacy of the human genome, this kind of gene manipulation may result in unexpected and above all undesirable side effects if it is carried out under the current level of knowledge. In particular, the phenomenon of epigenetics, which influences the activities of gene segments that are not based on changes to the DNA sequence but are nevertheless passed on to daughter cells, has not yet been fully researched. Genetic enhancement is therefore possible, but the timeframe for its successful realization is not foreseeable.

Finally, the authors contributing to this chapter thoroughly enjoyed putting together this publication, and the discussion with the other authors of the project was considered to be extremely thought-provoking.

Human Enhancement – biological-neurological aspects from a military perspective

Harald Harbich, Michael Kunze

1. Introduction

The bodies of chronically ill or handicapped patients were originally improved through the use of prosthetics, physiotherapy and dietetics. Later on, findings from the fields of sports medicine, rehabilitation and plastic surgery as well as soft skills such as special training, were used to improve performance and, above all, to optimise quality of life.

Human enhancement (HE), on the other hand, is defined as the use of similar technologies or treatments to improve or increase the human capabilities of **healthy people** beyond their natural limits. Unlike transhumanism, human enhancement does not involve the further advancement or evolution of Homo sapiens, but rather the expansion of the abilities of specific individuals or distinct groups.

Armed forces have always had an interest in using artificial aids to improve the performance of their soldiers The range of these optimizations began in the late Palaeolithic period with the spear thrower as an extension of the arm lever. This was further developed in the Middle Ages, in the golden age of blacksmithing, when sophisticated armour reduced the risk of injury from sword strikes or projectiles. Later on, this led to the widespread use of Pervitin® (methamphetamine) mixed into "tanker's chocolate" in the German Wehrmacht to temporarily increase the endurance, cognitive performance and concentration of soldiers of all armed forces.

It goes without saying that HE is still being researched worldwide today. The challenges and opportunities that can arise from the use of originally medical-neurological methods of HE (i.e. **neuroenhancements**) are the focus of our work on this subject.

Efforts to enhance the mental performance of healthy people through the consumption of psychotropic substances are referred to as "pharmacological neuroenhancement" or "cognitive enhancement". Pharmacological neuroenhancement essentially aims to reduce fatigue and to increase attention, concentration, memory and motivation.[1]

The term "brain doping" refers, in a disapproving tone, to the use of psychotropic substances which, according to the Austrian Prescription Requirement Act, are prescription only and the use of which by healthy persons constitutes abuse or falls under the Single Convention on Narcotic Drugs of 1961 in its current version. They can cause long-term damage to consumers and their social environment.

The use of over-the-counter (OTC) medication is sometimes referred to as "soft enhancement", irrespective of whether a positive or negative effect can be clinically proven.

As well as "pharmacological neuroenhancement", there are non-pharmacological methods, such as vagus nerve stimulation, transcranial magnetic stimulation, deep brain stimulation or various neural implants, which will be discussed in another chapter. The range of methods is complemented by a vision of sentient and thought-controlled prosthetic limbs with extraordinary power or precision. However, there are few advantages that are not also linked to sometimes considerable disadvantages or negative consequences.

In keeping with the editor's intention, the focus of interest is primarily on the use of neuroenhancement by potential opponents of the Austrian Armed Forces and the associated effects on their own actions.[2] The Austrian Armed Forces could also encounter HE in the context of an international deployment in the medical care of "optimised" soldiers. Relevant ethical and legal aspects will not be explicitly considered in this chapter. Instead, references

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1 See Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit (Bavarian Health and Food Safety Authority – LGL): Neuroenhancement: Doping für das Gehirn – Zusammenfassung (Doping for the brain – Summary), 2019, https://www.lgl.bayern.de/gesundheit/arzneimittel/warnungen_verbraucherinformationen/verbraucherinformationen/neuroenhancement.htm.

2 See Planungsamt der Bundeswehr (Bundeswehr Office for Defence Planning): Human Enhancement: Eine neue Herausforderung für Streitkräfte (A New Challenge for the Armed Forces)? 2013. https://www.bundeswehr.de/resource/blob/140504/d757cfdc2b1a467fb7d88544075da1d9/ft-he-data.pdf.

will be made to the corresponding chapters of this book. The term "medical" is replaced by "biological" in this chapter, because the former has been clearly proven to imply a medical measure for the benefit of patients, and corresponding national and international standards are not applicable for present purposes.

Ultimately, the question that arises for the military stakeholders is whether performance-enhancing drugs are actually necessary or appropriate for modern soldiers. With this in mind, this article, as part of the overall project, will address the following three-part question:

- Which future biological-neurological HE developments are currently being researched, are they foreseeable for armed forces in the future and are they useful in terms of their objectives or, from the authors' point of view, pure aberrations?
- What could be the impact on security forces, the Austrian Armed Forces, society and the resilience of the EU, Austria and non-European countries?
- Are they generally superior to military-technical solutions to problems?

This article therefore aims to provide a brief inventory of relevant developments in biological-neurological human enhancements, and a basis for decision-making in strategic military planning.

2. State of research

Whereas the medical technology and pharmaceutical industries already have a number of standard means and methods for the treatment or rehabilitation of sick or injured patients, neuroenhancement, i.e. the use of these in healthy people, is still largely within the framework of application-oriented basic research or, as with addictive substances, illegal. This is mainly due to the fact that, despite the results of the corresponding treatments for affected patients bringing considerable improvements, the partial performance improvements in the overall result have not yet achieved superiority over healthy patients.

Taking medicines without medical necessity is regarded as drug abuse. This is often accompanied by numerous negative effects, both physical and psychological.[3] As psychotropic substances, these medicines almost always have the potential to become addictive. This means that there is a tendency to increase the dosage, with even more pronounced negative consequences, as well as a psychological or physical need for continued use.

Because there are no known clinical studies with positive overall results that are equivalent to contemporary drug research, long-term use by healthy people is strongly discouraged from a medical perspective!

It is therefore necessary to start by taking a look at the contemporary development of medication by the pharmaceutical industry:

Drug development is a very risky undertaking. On average, out of 5,000 to 10,000 substances which were originally considered promising, only one is actually approved of as medication after **about 14 years of development**. Studies have shown that the average cost of developing a new, innovative medication is up to **2.6 billion US dollars**.[4] This sum includes the direct costs of developing the substance, the associated failures and the opportunity costs, i.e. the indirect costs of financing these lengthy and costly development projects. These high costs arise from the considerable volume of documentation and safety requirements in clinical trials, as well as the large number of study participants that would be required. For many substances, it is only through extremely complex multinational studies on their therapeutic effectiveness ("Phase 3" studies) that it becomes clear that they are not sufficiently potent or have too many side effects.

Accordingly, it is highly likely that a show-stopping application will not be discovered until about ten years after the start of the research – if at all.

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3 See Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit (Bavarian Health and Food Safety Authority – LGL): Neuroenhancement: Doping für das Gehirn – Zusammenfassung (Doping for the brain – Summary), 2019, https://www.lgl.bayern.de/gesundheit/arzneimittel/warnungen_verbraucherinformationen/verbraucherinformationen/neuroenhancement.htm.

4 See PHARMIG Verband der pharmazeutischen Industrie Österreichs (Association of the Austrian Pharmaceutical Industry): Daten und Fakten 2024, Arzneimittel und Gesundheitswesen in Österreich (Data and Facts 2024, Drugs and Health in Austria), 2024, 2024-pharmig_daten-fakten_de.pdf.

Simply falling back on drugs that were previously used in clinical practice is not permissible, because, as previously described, clinical trials relating to drug development are carried out exclusively with patients suffering from precisely determined disease, for which pharmaceutical approval and licencing is being sought. The effectiveness and side effect profile in healthy individuals is not taken into account. The use of prescription drugs approved for a specific disease on healthy people without modern clinical research is therefore outdated, unscientific and not justifiable. As with any medication, the desired effect is only seen in some of the test subjects.

3. Examples

The selected areas of neuroenhancement can be briefly outlined here, and are limited to invasive methods or at least methods that interfere with physical integrity:

3.1 Pharmacological neuroenhancement

The consumption of psychotropic substances is not a modern invention. Some wild mammals often enthusiastically gnaw at fermenting fallen fruit. It is thought that even in ancient times, shamans harvested and produced various intoxicants. It is well documented that the Ancient Sumerians enjoyed beer, and that the Ancient Greeks drank wine to excess, especially at festivals in honour of Dionysus, the god of viticulture. The stimulating effect of coffee became known and popular in Central Europe after the second Turkish siege of Vienna in 1683. To this day, no office is complete without a supply of coffee, tea and energy drinks.

It is also generally known that the misuse of various prescription drugs is not uncommon in countries that are member to the Organisation for Economic Co-operation and Development (OECD). There are also known scientific studies involving the intake of naturally occurring catecholamines such as dopamine, serotonin, noradrenaline and others. The consumers – many of them students – want to improve their mood, increase their motivation and concentration, and reduce fatigue and anxiety.[5]

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[5] Maierhofer, Veronika: Human Enhancement – Entwicklung zum Übermenschen (Development into a Super-Human)? Master's dissertation to obtain the academic degree of Master of Science in Business Administration at the Karl-Franzens University of Graz, Austria. 2020. 4908970, p. 21.

3.1.1 Modafinil®

Modafinil® is an approved medicinal product and used therapeutically for a single application – specifically narcolepsy, a relatively rare sleeping disorder. If it is used improperly, it is expected that performance will be improved even with little sleep, for example before academic exams or other stressful situations.[6]

In addition to possible addiction to Modafinil®, the side effects can range from minor ones such as digestive disorders, headaches, colds and movement disorders to more serious ones, such as changes in blood values, aggression, sleep disorders, anxiety, tremors, muscle weakness and hyper excitability. The current medical instructions for use list no less than around 70 different side effects plus a large number of possible reactions with other medicines, which of course do not occur very frequently, but are unforeseeable for the individual consumer.

3.1.2 Methylphenidate (MPH)

Ritalin® for example, is a stimulant prescription drug intended for the treatment of attention deficit/hyperactivity disorder (ADHD). The exact mechanism of action of methylphenidate is not yet completely understood.[7]

In any case, methylphenidate improves attention and concentration and therefore has a positive effect on the deficits caused by ADHD. It is possible to increase cognitive performance.

3.1.3 Taurine

Taurine is an amino acid that plays a key role in several important biological processes in the metabolism of many mammals – and therefore also in humans – as a breakdown product of the amino acid cysteine.

A high concentration of taurine is found in tissues exposed to oxidative stress.

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6 See Walliczek-Dworschak, Ute.: Modafinil. In: Gelbe Liste Online (Yellow List Online), 2019. https://www.gelbe-liste.de/wirkstoffe/Modafinil_27434.

7 See Maucher, Isabelle Viktoria: Methylphenidate. In: Gelbe Liste Online (Yellow List Online), 2024. https://www.gelbe-liste.de/wirkstoffe/Methylphenidat_1306.

Drinks containing taurine are particularly popular in Japan, and the substance is said to have a positive effect on athletic performance. That is why taurine is an ingredient in several energy drinks.

However, meaningful scientific evidence of these effects in humans have yet to be corroborated.

Illegal substances used as neuroenhancers:

In certain circles, illegal substances such as **cocaine**, **hallucinogens** (magic mushrooms, LSD, etc.), **speed** or **ecstasy** are also regarded as popular performance-enhancing drugs.

Microdosing is becoming increasingly popular. It involves consuming a small dose with the aim of improving performance and creativity. This is how it is perceived subjectively, yet studies on long-term effects or successes are not yet known, which is why supra-individual use would be questionable.

Crystal or **crystal meth** deserves a special mention: These scene names designate methamphetamine, a fully synthetic stimulant produced in back-street laboratories, which was synthesised as early as 1893 by the Japanese chemist Nagayoshi Nagai. It was patented in 1920; and, until the 1980s, it was sold in pure form as a drug under the trade name Pervitin®. Methamphetamine is closely chemically related to amphetamine (speed), but the addiction potential of methamphetamine is considerably higher. Methamphetamine affects the metabolism of serotonin and dopamine neurotransmitters.

Figure 1: Tin of Pervitin. Source: Wikipedia.

"The physical agitation goes hand-in-hand with an increase in physical performance. Particularly monotonous and quickly tiring tasks can be performed for considerably longer, without signs of exhaustion, under the influence of methamphetamine. An increase in mental capacity and creativity is subjectively perceived; but objectively, this is usually not present."[8]

From a contemporary perspective, the long-lasting and diverse side effects alone prohibit the widespread use of methamphetamine in the armed forces, even after the poor military-historical experiences related to "tanker's chocolate (high dependency potential with a tendency to uncontrolled dose increase).

3.2 Non-pharmacological methods of neuroenhancement

3.2.1 Deep brain stimulation

Deep brain stimulation has become a promising treatment method for many people with various forms of movement disorders. Its best known application is in patients with Parkinson's disease. To date, electrodes have been installed in well-defined intracerebral regions in around 100,000 patients. The battery and the operating system are installed into the torso below the collarbone. The electrodes are placed under the skin of the neck and skull and finally placed in the target region of the brain.

A side effect is that neural implants can affect emotions. As a result, patients usually react in the form of conspicuous cheerfulness but occasionally respond the opposite way. Neural implants appear to change a patient's personality.

Depressive disorders disrupt the functioning of certain nerve fibre bundles. Accordingly, stimulating the intracerebral brain areas can also locally increase neuronal activity and lead to improvement in certain forms of therapy-resistant depressive disorders. PET scans of the brain can provide clues as to

[8] Bundeszentrale für gesundheitliche Aufklärung – eine Fachbehörde im Geschäftsbereich des Bundesministeriums für Gesundheit (Deutschland) / Federal Centre for Health Education – a specialist authority within the portfolio of the Federal Ministry of Health (Germany) Drugcom: Methamphetamine https://www.drugcom.de/drogenlexikon/buchstabe-m/methamphetamin/, accessed 21.08.2024. Translation by the editors.

whether behavioural therapy or drug treatment is appropriate. Deep brain stimulation is recommended when nerve cell networks are no longer capable of self-correction.[9]

The patient then becomes noticeably calmer and more relaxed, their interest in their surroundings increases and their cheerlessness decreases. If the pulse generator is deactivated, the patient's condition will deteriorate again.

The only side effects are infections in the area of the implanted pulse generator in the skin under the right or left collarbone. In some cases, patients also commit suicide, albeit much less frequently than with the untreated underlying disease.

There have also been promising initial treatment successes with deep brain stimulation for obsessive-compulsive disorders.

Although many people now live or work with therapeutic electrodes in their brains, the exact mechanism of action is still largely unclear.

As far as we know, relevant research was financially supported by the US armed forces.[10]

In summary, however, it seems questionable as to whether healthy people can ever benefit from deep brain stimulation without paying the price of a significant personality change.

3.2.2 Vagus nerve stimulation

For the best part of three decades, a method of stimulating the tenth cranial nerve (vagus nerve) has been used to treat certain forms of epilepsy, which does not require electrodes in the brain itself but on the side of the neck.

This treatment also has mood-enhancing effects, which is why such implants are approved in the USA as complementary treatment for severe depression when other therapies are insufficient or not tolerated by the patient.

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9 See Lozano, Andres M. / Mayberg, Helen S.: Depression an der Wurzel packen (Tackling the Roots of Depression). In: SPEKTRUM der Wissenschaft KOMPAKT. Issue from 25.03.2019, p. 4 et seq.

10 See Krämer, Tanja: Neuroenhancement – Kommt die gesteuerte Persönlichkeit (Here Comes the Controlled Personality). In: SPEKTRUM der Wissenschaft Spezial Physik-Mathematik-Technik. 2/2015, p. 40 et seq.

The medical risk of the operation is lower than with deep brain stimulation, so that the inhibition threshold is probably lower.[11]

As a method of neuroenhancement, there is currently no recognizable advantage over pharmacological methods - on the contrary: the mood-enhancing effect is very unspecific and comes at a relatively high technical and financial cost.

3.2.3 Transcranial magnetic stimulation

Transcranial magnetic stimulation (TMS) is a neurological treatment method in which areas of the brain can be both stimulated and inhibited with the help of strong magnetic fields that are applied externally, i.e. without damaging the skull bone. Transcranial magnetic stimulation is being investigated to a limited extent for the treatment of neurological conditions such as tinnitus, strokes, epilepsy or Parkinson's disease, and is also used in psychiatry for the treatment of affective disorders, especially depression and schizophrenia. Studies conducted thus far have demonstrated the antidepressant effectiveness of repetitive TMS (rTMS). A magnetic coil applied tangentially to the skull generates a short magnetic field of 200 to 600 μ, with a magnetic flux density of up to 3 Tesla. The resulting change in electrical potential in the cerebral cortex near the skull causes the depolarisation of nerve cells, triggering action potentials that propagate into the depths of the brain with exponential attenuation. The antidepressant effect is said to last for at least several months after several weeks of treatment. A fundamental problem with stimulation by TMS is the spatial resolution. It is uncertain to what extent connected regions are stimulated by the stimulation of a targeted region. It is therefore difficult to make statements about the exclusive role of a stimulated brain area. Despite intensive research since the introduction of the method in 1985, the exact mechanism is still not fully understood.[12]

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11 Ibid.

12 See Wikipedia, "Transcranial magnetic stimulation". In the "Adverse effects" section. 2004. https://de.wikipedia.org/wiki/Transkranielle_Magnetstimulation, accessed 04.08.2024.

An additional problem arises from the fact that TMS stimulations cannot currently be standardised in terms of their intensity. An individual, patient-specific calibration is required.[13]

Since magnetic stimulation was introduced in 1985, hardly any side effects have been noticed. The most frequent side effect is temporary headaches, which mainly occurs when muscles are stimulated.

As a method of neuroenhancement, this treatment is much more user- and patient-friendly than deep brain stimulation or vagus nerve stimulation. However, no advantages compared to pharmacological methods have been identified thus far.

3.2.4 Brain-computer interfaces (BCI)

A brain-computer interface (BCI) interprets the specific electrical signals of the cerebral cortex that are triggered when someone has certain and also regularly trained thoughts, and uses a computer to specifically control prosthetic limbs or other technical devices. Prototypes of these BCIs are intended to help people with disabilities to carry out everyday tasks and use a wide range of communication methods.

<u>Invasive BCIs – neuro implants</u>

The implantation of electrodes and electronic components in and on the brain requires a neurosurgical operation. This is not a routine task. It is lengthy and highly complex, and the follow-up medical care is complicated.

So far, the results have not yet been objectively satisfactory.

Typically, Elon Musk’s medical technology company, Neuralink, announced in a widely circulated press release that it had completed its first human brain implant in January 2024: “The patient is recovering well after the procedure on Sunday,’ the tech billionaire wrote on his online platform X (formerly

[13] See Wikipedia, “Transcranial magnetic stimulation”. In the “Medical uses” section. https://de.wikipedia.org/wiki/Transkranielle_Magnetstimulation, accessed 04.08.2024.

Twitter). 'Neuralink implants are intended to make it possible to operate a smartphone – and other technology – using thoughts."[14]

Apart from newspaper reports, there is a lack of objective information on the case. The implant allegedly had a comparatively large number of 1024 electrodes, which were connected to nerve cells in the patient's brain. However, just a few months later, in September 2024, newspaper reports appeared in which it was claimed that 85% of the 1024 electrodes were no longer functional. This 'result' is consistent with observations from other research groups, namely that the number of activatable neurons decreases over time. This problem can be understood biologically, yet it is unlikely that it will be overcome in the foreseeable future. There are no known scientific publications about this, and what can be read publicly in Europe ought to more plausibly be interpreted as "marketing".

Another of Neuralink's spectacular research projects is 'Blindsight'. This is an attempt to convey optical stimuli to blind people whose optic nerve and/or eyes are non-functional by means of direct electronic stimulation of the cerebral cortex responsible for visual acuity. The triggered image does not have to be limited to the spectrum of electromagnetic waves that is visible to the human eye.

Although the success of the venture will still require several years of observation, it appears that at least one promising funded study programme is already in progress.

<u>Non-invasive BCIs</u>

Unlike the invasive method, these appear to be easily reversible. They essentially involve an EEG device and a computer that analyses the EEG and uses it to generate control commands for another computer or a smart home.[15]

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14 See: Musk-Start-up Implantiert Ersten Chip in Menschlichem Gehirn (Musk Start-up Implants First Chip in the Human Brain). In: Tiroler Tageszeitung Online. 30 January 2024. https://www.tt.com/artikel/30874844/musk-start-up-implantiert-ersten-chip-in-menschlichem-gehirn.

15 See Lenzen, Manuela: Mit der Kraft der Gedanken (With the Power of Thought). In: Spektrum der Wissenschaft Kompakt. 03/2019.

A highly sophisticated system of this type has been developed by DARPA, the research department of the US Army. Patients are able to use such controlled prosthetic limbs to grasp a glass and drink from it, clench a fist and shake someone's hand. The artificial hands can even be equipped with sensors that give the wearer a feel for their new limb. This is sometimes so precise that they can tell which finger of their artificial hand is being touched.[16]

The main factor for further progress in this technology is the so-called brain plasticity, which makes targeted training of control methodologies possible. However, it can be expected that useful applications for healthy people will be possible in five to ten years. For this reason, and to avoid the difficulties with the invasive BCIs described above, the current research focus is on non-invasive BCIs.[17]

Enhancement objectives of BCIs

In recent years, research into BCIs has also intensified outside of medicine.

Using the power of thought to quickly communicate by e-mail or to even control aircraft are said to be the goals.

The fundamental problem with BCIs

Around 70 years ago, the neurosurgeon Wilder Graves Penfield (* 1891 † 1976), who was born in the USA, completed his education there and in Oxford and later worked in Canada, recognized that complex sensory impressions could be simulated and movements of peripheral muscles provoked with point-shaped, weak, electrical stimulation on the open brain of his patients without pain sensation. Back then, he mapped the corresponding areas of the cerebral cortex at the so-called sulcus centralis: this image became world-famous as the "Penfield's homunculus" in the standard works of anatomy.

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16 See Lenzen, Manuela: Mit der Kraft der Gedanken (With the Power of Thought). In: Spektrum der Wissenschaft Kompakt. 03/2019.

17 See UK's Ministry of Defence (MOD) and Bundeswehr Office for Defence Planning: Human Augmentation – The Dawn of a New Paradigm A strategic implications project. 2020. https://www.bundeswehr.de/resource/blob/5016368/fdc7f1c529ddfb014d4e321e8b666a2d/210111-sip-ha-data.pdf, accessed 20.11.2023.

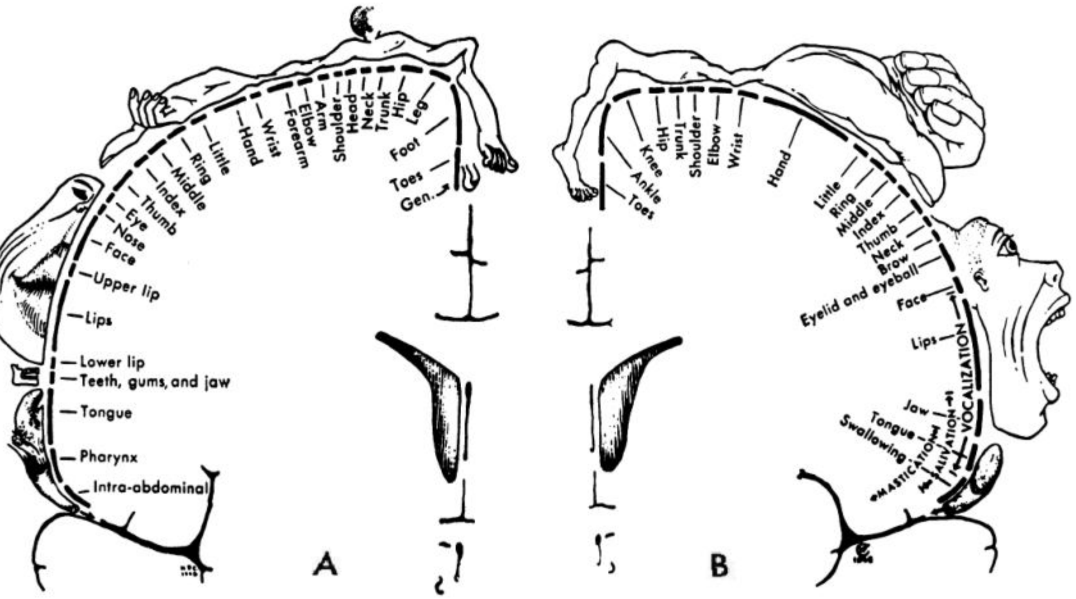

Figure 2: This illustration explains the widely held vision that neuroenhancement could be developed with smart electronics. 1954 Penfield Homunculi: (A) Sensory homunculus. (B) Motor homunculus. Image from the Penfield Archives, Osler Library of the History of Medicine.

Although it is now possible to enable patients with nerve failures caused by illness or injury to have some form of spectacular motor or sensory function, this remains far behind the capabilities of healthy people.

This is due to the fundamental differences between biological and electronic components, which make it difficult to create a common bio-electronic system. A Homo sapien's brain contains about 86 billion (= 8.6 x 10^{10}) nerve cells, of which around 16 billion (= 1.6 x 10^{10}) are in the cerebral cortex. The length of all the nerve pathways in the brain of an adult human totals to about 5.8 million kilometres, which is equivalent to 145 times the Earth's circumference. The nerve cells in a human brain are connected to each other via synapses, of which there are about 100 trillion (= 10^{14}). These large numbers alone defy comprehension; they can only be calculated statistically. In comparison, the 1024 electrodes of the neural link experiment and perhaps soon a multiple of that number will look downright minuscule.

Regardless, there are at least two further phenomena that stand in the way of a standardised BCI: electronic components can be manufactured identically, but no two human brains are exactly the same. There is even a difference between the biological genders in the internal organization of the brain with regard to language and spatial perception. But even within these gender groups, brains diverge according to different lifestyles and living conditions. Examples include different nutritional habits, exposure to harmful substances (including alcohol consumption and the like), exposure to radiation (high risk: flight personnel and astronauts) and, above all, major or minor, often unnoticed injuries. The fact that brains are usually capable of comparable performance, despite these individual differences, is demonstrated by their enormous plasticity, which also distinguishes them from technical components.

One aspect that should not be underestimated is the energy supply. A human brain has an output of about 20 W and is optimised for a working temperature of 37°C. Even a slight deviation in energy supply and temperature can have a very negative impact on function. Technical components have completely different tolerances here but also play in a completely different league in terms of process speed.

In summary, it is unlikely that the aforementioned differences between biological and technical systems will be able to be combined into a militarily useful instrument in the coming decades.

Biological consciousness versus artificial intelligence (AI)

It is still largely unknown how consciousness came to be as a sum of sensation, perception and experience. There is no recognised definition of consciousness, due to the variety of aspects that it involves. The primary focus of natural science is on the definable properties of cognitive and emotional reactions.

With its ability to automate complex tasks and process large amounts of data, AI can boost productivity, improve efficiency and create new opportunities for innovations.

However, there are serious differences between AI and biological or human consciousness:

Emotions such as love, loyalty, trust and the sense of security, joy or sadness, which – pars pro toto – arose in the evolution of placental mammals, are expressed at least partially unconsciously and have contributed decisively to the survival of the relevant species. The same applies to the human need to give our own existence some kind of meaning. Nowadays, it is no longer possible to define a small region of the brain as the seat of consciousness. This is a function of the entire brain, with its highly complex network of nerve cells. This means that targeted control of human consciousness cannot be stimulated by electrodes, however fine they may be.

On the other hand, AI is based on neural networks and thus ultimately on mathematical functions with the aim of optimising the results of an individual process specified by its programmers. Unlike the human brain, however, a decentrally organized AI is neither limited in size nor in its energy supply.

But it lacks the essential characteristics that constitute a personality and confer human dignity.

This gives AI the character of a powerful tool that can be used for both problem solving and criminal activities.

4. Ethical challenges and military significance

Whereas the advantages of neuroenhancement in terms of medical rehabilitation are largely undisputed, there are several ethical and legal-philosophical reservations regarding its justifiability outside of medical treatment or medical-technical support for rehabilitation.

The increasing pressure to perform in today's liberal, secular and capitalist Western society is a strong incentive to strive for the optimisation of the human workforce in general competition. Doping in sports is a widely known phenomenon. However, doping is internationally viewed as a form of fraud against non-doped athletes and against sports enthusiasts.

With regard to the ethical issue of the use of neuroenhancement by the armed forces, reference should be made to the wide range of relevant research and discussions activity. These numerous aspects – including legal ones – are discussed in detail in another chapter of this book.

Here are just a few brief points for discussion:

- The main questions that arise are the extent to which soldiers must 'dutifully' endure neuroenhancement methods, and the advantages that they may enjoy as a result. It is also unclear as to whether they will even be considered as combatants under international humanitarian law and whether doped soldiers will be allowed to take part in competitions with non-doped members of civil society, etc.
- What impact might the widespread use of neuroenhancement have on the organisational culture of the armed forces? What impact will this have on the self-perception of a person who is affected by this? Does this affect the cohesion within the team? New employer branding is therefore also important when recruiting professional soldiers.
- Due to the difficulties described and the high cost of the necessary intervention for an individual soldier, any relevant use of BCIs by armed forces can be ruled out at least until the middle of the 21st century. This leaves pharmacological NE, with which contradictory experiences were already made historically in the world wars. A possible short-term increase in performance due to Pervitin® was countered by drug dependency, alternating withdrawal and overdoses, the associated unreliability and long-term physical and mental deterioration and, in some cases, fatal overestimation of one's own abilities.
- However, it cannot be ruled out that pharmacological NE will be used in a targeted manner by various armed forces, especially if new substances with a safe effect and low side-effect rate are developed. However, a decisive influence on war is not to be expected because, despite 'doping', the increase in human performance remains limited for biological reasons in contrast to technical progress.

The following fundamental ethical objections can be raised against neuroenhancement in general:[18]

- There may be problems regarding the health and safety of the affected individual when 'enhancing' brain interventions, especially in terms of unwanted side effects and personality changes. This also includes questions about the limits of the risk that the addressee of such an intervention can legitimise for a third party by giving consent.
- Problems regarding autonomy, 'authenticity', and perhaps even personal identity: Could these qualities be impaired, or even nullified by mental enhancement?
- Disavowal, in the long term possibly a social devaluation of the desired goals, i.e. of the artificially enhanced characteristics themselves?
- Could there be corruption of human nature or even of human dignity?
- Could the frequency of medical corrections of variants of mental characteristics that were previously within the normal spectrum be increased?
- Misuse for external control of people?
- Social justice issues.

5. Conclusion

Everything that can be developed will be developed. It is just a matter of time. It should be kept in mind that European ethical and cultural viewpoints are of minor interests in today's world. What was and is unthinkable for European armed forces can often be realized outside of Europe without 'old-fashioned' reservations. The observation of the Asian and Islamic cultural area in particular is all the more important as a technical catch-up to Western science is foreseeable in the coming decades.

[18] See Merkel, Reinhard: Neuroenhancement aus normativ-rechtlicher Sicht (Neuroenhancement from a normative-legal perspective). In: SPEKTRUM der Wissenschaft. May 2015, p. 74. www.spektrum.de/artikel/1133992.

The fact is that relevant research is currently being carried out in both East and West, with the aim of exploring the extent to which healthy soldiers can be optimised in such a way that leaders, and particularly specialists such as military pilots, can carry out their duties longer and better thanks to increased intellectual abilities, particularly faster comprehension.[19] Physically-challenged soldiers should be able to fight even faster and with less fatigue, and military personnel should be able to devote themselves even more intensively and creatively to their specific tasks.

From today's perspective (2024), the authors expect pharmacological and non-pharmacological methods in medically indicated neurorehabilitation to continue to achieve impressive successes in the future. In our opinion, however, there are fundamentally insurmountable biological disadvantages and limitations to performance that stand in the way of widespread use in healthy soldiers. This is primarily due to the fact that the reproducibility of desired effects can be predicted with sufficient accuracy as a statistical average, but not for specific individuals. The same applies to undesirable effects and the reversibility of the measures taken. However, it cannot be ruled out that the pharmacological performance enhancement of soldiers from various armed forces will be sought – as has already been the case in the past – regardless of the aforementioned disadvantages.

Especially in the case of invasive BCI (neural implants), the surgical effort seems extremely unprofitable, due to the uncertainty of the resulting operation The mechanistic view of man held by Frederick the Great's personal physician Julien Offray de La Mettrie in his pamphlet 'L'Homme-Machine' (1748) has long been a concept of the past. Overall, humans cannot be understood as technically measurable machines. The human being in toto cannot be understood as a machine that can be technically grasped; the high number of nerve cells in the brain alone - around 86 billion - and, above all, the variety of rapidly changing connections between them prohibit this.

[19] European Parliament: Science and Technology Options Assessment – Human Enhancement Study, May 2019, https://www.itas.kit.edu/downloads/etag_coua09a.pdf.

In view of the advantages of increasing automation in weapons and air force technology and the support of tactical and operational decisions by networked information systems with artificial intelligence, the efforts of human enhancement with neurobiological methods and their limited results appear to be outdated.

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Cognitive enhancement – A critical reflection from psychology and neuroscience

Sandra Grinschgl

1. Introduction

Becoming smarter, healthier and more beautiful has long been at the heart of humanity.[1] In the 21st century, in particular, the topic of human enhancement has become ubiquitous – partly due to the transhumanist movement.[2] Transhumanism is a rather recent philosophical movement promoting and praising the development of technologies aiming to enhance human psychological and physical capabilities.[3] [4] The transhumanist community is numerically small but very well organised and funded; its activities have been characterised as secular faith and techno-idolatry.[5] [6] The main goal of this movement is a substantial enhancement of human capabilities, such as intelligence, creativity, social competencies, morality/values and character – with the final goal that we become "superhumans" who can find solutions to the world's most pressing problems, like the climate crisis, social inequality and the loss of democratic values.[7] Transhumanists propose that enhancement can be achieved through (neuro)technical or pharmacological methods that should be widely applied to healthy individuals – fundamentally transforming human existence (see working definition).

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1 See Pauen, Michael: Autonomie und Enhancement. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 89-114.

2 On the transhumanist movement, see also Tragbar, Lisa/Lagos, Rodrigo: Human enhancement for military purposes: Ethical considerations. In chapter ETHICS in this publication.

3 For an overview, see Ranisch, Robert/Sorgner, Stefan L.: Post- and Transhumanism: An Introduction. Frankfurt am Main 2014.

4 For critical accounts, see Grassie, William/Hansell, Gregory R.: Introduction H±: Transhumanism and Its Critics. In: Hansell, Gregory R./Grassie, William (ed.): Metanexus Institute. Philadelphia 2011.

5 Tirosh-Samuelson, Hava: Transhumanism. In: Zygon, 47/2012, pp. 659-1027.

6 Tirosh-Samuelson, Hava: The Paradoxes of Transhumanism: Technological Spirituality or Techno-Idolatry? In: Theologische Literaturzeitung, 146/2021, pp. 123-146.

7 See Liao, Matthew S./Sandberg, Anders/Roache, Rebecca: Human Engineering and Climate Change. In: Ethics, Policy & Environment, 15/2012, pp. 206-221.

But what does human enhancement actually mean and entail? Human enhancement is a rather broad term, encompassing different forms of enhancement targeting different human characteristics. It includes the enhancement of the human body, cognition, personality or even morality.[8] Importantly, we need to make a careful distinction between enhancement of healthy individuals – as is discussed in this chapter – and compensation for diagnosed diseases or disorders in patients. Both are sometimes referred to by the term "enhancement", but they should not be intermixed, as research findings cannot be transferred from one area (e.g. clinical studies with patients) to another (e.g. healthy samples).[9] Here we refer to the enhancement of healthy humans – as proposed by transhumanism.[10] [11] The overarching goal of human enhancement is to improve people beyond what is "normal" [12] and not to restore cognitive function in the case of disease or disorder. So, taken together, human enhancement as discussed in this chapter refers to the application of different methods (e.g. technologies, pharmaceuticals) to foster human characteristics such as physical and cognitive abilities above and beyond what is considered "normal" (see working definition).

One prominent form of enhancement is the improvement of the human body. For example, new technologies can be used to modify one's body.[13] [14] Through artificial body extensions humans can become cyborgs. By applying nanotechnology, they can change their physiology, and they can change their outer appearance with plastic surgery. Another frequently discussed form of

[8] For the latter, see Gyngell, Chris/Easteal, Simon: Cognitive Diversity and Moral Enhancement. In: Cambridge Quarterly of Healthcare Ethics, 24/1, 2015, pp. 66-74.

[9] See Grinschgl, Sandra/Ninaus, Manuel/Wood, Guilherme/Neubauer, Aljoscha C.: To enhance or not to enhance: A debate about cognitive enhancement from a psychological and neuroscientific perspective. Unpublished manuscript.

[10] See Birnbacher, Dieter: Neuroenhancement – eine ethische Sicht. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 18-42.

[11] See Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019.

[12] Almeida, Mara/Diogo, Rui: Human enhancement. In: Evolution, Medicine, and Public Health, 2019/1, pp. 183-189.

[13] See Kourany, Janet A.: Human Enhancement: Making the debate more productive. In: Erkenntnis, 79, 2014, pp. 981-998.

[14] See Ranisch, Robert/Sorgner, Stefan L.: Post- and Transhumanism: An Introduction. Frankfurt am Main 2014.

enhancement is the improvement of human cognitive abilities such as memory, attention or even intelligence.[15] For this form of enhancement, various methods are discussed, such as the use of smart drugs, brain stimulation or gene editing.[16] From a psychologist's and neuroscientist's point of view, this form of enhancement is highly interesting because it targets their core object of investigation – human cognition. Therefore, this chapter will focus specifically on cognitive enhancement and respective research findings from a psychological and neuroscientific perspective.

Besides the heavy promotion of cognitive enhancement within transhumanism[17], this topic is also at the centre of public and academic debates.[18] One reason for this might be the increasing use of modern technologies to support cognitive performance.[19] For example, cognitive offloading – the externalisation of cognitive processes for modern technologies (e.g. storing important information on one's smartphone) – has been extensively studied and shown to improve cognitive performance.[20] Thus, it could be seen as an indirect, external form of cognitive enhancement (i.e. an improvement in cognition mediated by technology use) that is already present in our daily lives. However, it also comes with the fear that relying on technology too much could make people stupid.[21] As a result, other – more direct, internal – ways of improving cognitive performance might be discussed (i.e. an actual improvement in cognition that is not mediated by technology use). Such cognitive enhancement could also help overcome another recent human fear –

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15 Dresler, Martin/Sandberg, Anders/Bublitz, Christoph/Ohla, Kathrin/Trenado, Carlos/Mroczko-Wąsowicz, Aleksandra/Kühn, Simone/Repantis, Dimitris: Hacking the Brain: Dimensions of Cognitive Enhancement. In: ACS Chemical Neuroscience, 10/3, 2019, pp. 1137-1148.

16 Bostrom, Nick/Sandberg, Anders: Cognitive enhancement: methods, ethics, regulatory challenges. In: Science and Engineering Ethics, 15, 2009, pp. 311-341.

17 Sorgner, Stefan L.: On Transhumanism. University Park 2020.

18 See Dijkstra, Anne M./Schuijff, Mirjam: Public opinions about human enhancement can enhance the expert-only debate: A review study. In: Public Understanding of Science, 25/5, 2016, pp. 588-602.

19 See Finley, Jason R./Naaz, Farah/Goh, Francine W.: Memory and Technology: How we use information in the brain and the world. Cham 2018.

20 Grinschgl, Sandra/Papenmeier, Frank/Meyerhoff, Hauke p.:Consequences of cognitive offloading: Boosting performance but diminishing memory. In: Quarterly Journal of Experimental Psychology, 74/9, 2021, pp. 1477-1496.

21 Carr, Nicholas: Is Google making us stupid? In: The Atlantic, July/August 2008.

the fear of losing jobs to artificial intelligence (AI) technologies.[22] Because of this fear, cognitive enhancement may become increasingly attractive in order to compete with these new AI technologies. In addition, reports of (cognitive) enhancement already in use are appearing not only on social media[23] but also in socially relevant areas such as the military.[24]

In line with the (supposedly) increasing need for cognitive enhancement, rapid advances in technology and medicine provide new opportunities for enhancement. On the one hand, non-invasive methods such as using technical tools as external help[25] or cognitive training[26], as well as non-invasive brain stimulation (e.g. transcranial electric stimulation), are discussed as cognitive enhancement methods. On the other hand, invasive methods such as smart drugs, gene editing and invasive brain stimulation (e.g. deep brain stimulation) and brain-computer interfaces might be applied with the goal of cognitive enhancement.[27] [28] [29]

As outlined at the beginning of this book, the present publication only focuses on invasive enhancement methods; thus, I will further elaborate on

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22 For example, see Caminiti, Susan: The More Workers Use AI, the More They Worry About Their Job Security, Survey Finds. CNBC. 19 December 2023. https://www.cnbc.com/2023/12/19/the-more-workers-use-ai-the-more-they-worry-about-their-job-security.html.

23 For example, see Bryan Johnson's Blueprint protocol.

24 For cognitive enhancement in the US military, see Brunyé, Tad T./Brou, Randy/Doty, Tracy J./Gregory, Frederick D./Hussey, Erika K./Lieberman, Harris R./Loverro, Kari L./Mezzacappa, Elizabeth p./Neumeier, William H./Patton, Debra J./Soares, Jason W./Thomas, Thaddeus P./Yu, Alfred B.: A Review of US Army Research Contributing to Cognitive Enhancement in Military Contexts. In: Journal of Cognitive Enhancement, 4/4, 2020, pp. 453-468.

25 See cognitive offloading; Risko, Evan F./Gilbert, Sam J.: Cognitive Offloading. In: Trends in Cognitive Sciences, 20/9, 2016, pp. 676-688.

26 See famous (and highly criticised) study by Jaeggi, Susanne M./Buschkuehl, Martin/Jonides, John/Perrig, Walter J.: Improving fluid intelligence with training on working memory. In: Proceedings of the National Academy of Sciences, 105, 2008, pp. 6829-6833.

27 For example, Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

28 For example, Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne: Introduction. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 3-14.

29 For example, Loh, Janina: Trans- und Posthumanismus. Hamburg 2018.

those to (potentially) enhance human cognition. More specifically, my contribution focuses on cognitive enhancement with pharmacological means (i.e. smart drugs and illicit drugs) and (invasive) brain stimulation techniques as well as brain-computer interfaces.

2. Current state of research with regard to cognitive enhancement methods

One crucial problem with regard to debates about cognitive enhancement is the extensive ignorance of relevant scientific evidence and, thus, an inflated hype surrounding enhancement.[30] From a scientific perspective, cognitive enhancement is far less promising than it is sometimes portrayed in, for instance, transhumanist publications but also in general media reports.[31] Furthermore, the rather strong belief in so-called neuromyths (i.e. false beliefs about the human brain due to misinterpreting neuroscientific findings) shows that the public oftentimes has false views of the possibilities and limitations of neuroscience.[32] To help correct those views, I want to highlight central scientific findings with regard to pharmacological enhancement and (invasive) brain stimulation as well as brain-computer interfaces.

Pharmacological enhancement

The intake of different substances to enhance cognition is not a particularly new or extraordinary form of enhancement. For many centuries, coffee has probably been the most distributed cognitive enhancer that improves individuals' wakefulness.[33] Nicotine can also be considered to enhance certain cognitive functions such as working memory or attention.[34] In addition to natural cognitive enhancers, a range of pharmaceuticals with the (believed)

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[30] See Birnbacher, Dieter: Neuroenhancement – eine ethische Sicht. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 18-42.

[31] Partridge, Bradley J./Bell, Stephanie K./Lucke, Jayne C./Yeates, Sally/Hall, Wayne D.: Smart Drugs "As Common As Coffee": Media Hype about Neuroenhancement. In: PLoS ONE, 6/11, 2011, e28416.

[32] For example, Grabner, Roland H.: Neuromythen: Fehlvorstellungen über das lernende Gehirn. 2017.

[33] See Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

[34] See Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

potential of cognitive enhancement have been developed.[35] [36] [37] Commonly known as "smart drugs", these substances are often utilised to improve concentration, attention, memory and other cognitive abilities.[38] However, most of these drugs were designed to treat medical conditions. Methylphenidate (e.g. Ritalin), for example, is typically prescribed for ADHD (Attention Deficit Hyperactivity Disorder). It is often misused by students to enhance focus, boost energy levels and improve concentration.[39] [40] Mixed amphetamine salts, such as Adderall, are also taken for cognitive enhancement to enhance mood, physical endurance and concentration.[41] Additionally, modafinil (e.g. Provigil), a medication for narcolepsy, has found off-label use for non-medical purposes to promote wakefulness.[42] [43] Moreover, some illicit substances are used for cognitive enhancement. Taking small amounts of LSD (Lysergsäurediethylamid - lysergic acid diethylamide) or other psychedelics is

[35] De Jongh, Reinoud: Overclocking the brain? The potential and limitations of cognition-enhancing drugs. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 37-56.

[36] Maher, Brendan: Poll results: Look who's doping. In: Nature. 452/7188, 2008, pp. 674-675.

[37] Schleim, Stephan/Quednow, Boris B.: How Realistic Are the Scientific Assumptions of the Neuroenhancement Debate? Assessing the Pharmacological Optimism and Neuroenhancement Prevalence Hypotheses. In: Frontiers in Pharmacology, 9, 2018, p. 3.

[38] Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

[39] See McCabe, Sean E./Knight, John R./Teter, Christian J./Wechsler, Henry: Non-medical use of prescription stimulants among US college students: Prevalence and correlates from a national survey. In: Addiction, 100/1, 2005, pp. 96-106.

[40] See Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

[41] Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

[42] Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

[43] See Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

believed to enhance creativity, mood and working memory without triggering a full psychedelic effect.[44] [45]

Transhumanism advocate Ray Kurzweil states that he is altering his body by taking about 250 pills daily and getting multiple infusions weekly to extend his life.[46] Among the general population, the vast distribution of different drugs for cognitive enhancement was shown by a large survey by the publisher Nature. One in five participants – who were mostly from the United States – indicated to have experience with pharmacological enhancers, with methylphenidate being the most favoured.[47] A few years later, Smith and Farah (2011) [48] conducted a review: across different studies from the US and Canada, between 2.30% and 55.00% of the surveyed student samples indicated to have taken prescribed drugs for non-medical purposes.[49] Testing a German sample, Bagusat et al. (2018) showed a life-time prevalence (i.e. applying pharmaceutical enhancement at least once) for cognitive and/or mood enhancement of 38.80%.[50] For an Austrian university student sample, the prevalence was considerably smaller (11.90%).[51] Moreover, a large prev-

44 Ona, Genís/Bouso, José C.: Potential safety, benefits, and influence of the placebo effect in microdosing psychedelic drugs: A systematic review. In: Neuroscience & Biobehavioral Reviews, 119, 2020, pp. 194-203.

45 Pustovrh, Tony/Mali, Franc/Arnaldi, Simone: Are Better Workers Also Better Humans? On Pharmacological Cognitive Enhancement in the Workplace and Conflicting Societal Domains. In: NanoEthics, 12/3, 2018, pp. 301-313.

46 Kurzweil, Ray: The Singularity Is Near: When Humans Transcend Biology. New York 2005.

47 Maher, Brendan: Poll results: Look who's doping. In: Nature, 452/7188, 2008, pp. 674-675.

48 Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

49 Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

50 Bagusat, Christiana/Kunzler, Angela/Schlecht, Jennifer/Franke, Andreas G./Chmitorz, Andrea/Lieb, Klaus: Pharmacological neuroenhancement and the ability to recover from stress – a representative cross-sectional survey among the German population. In: Substance Abuse Treatment, Prevention, and Policy, 13/1, 2018, p. 37.

51 Dietz, Pavel/Iberl, Benedikt/Schuett, Emanuel/Van Poppel, Mireille/Ulrich, Rolf/Sattler, Matteo C.: Prevalence Estimates for Pharmacological Neuroenhancement in Austrian University Students: Its Relation to Health-Related Risk Attitude and the Framing Effect of Caffeine Tablets. In: Frontiers in Pharmacology, 9, 2018, p. 494.

alence survey ($N = 2{,}347$) on microdosing – the intake of sub-hallucinogenic doses of psychedelic drugs to improve cognitive functions (among others) – showed that 59% of respondents are familiar with it and 17% have actually microdosed.[52] Although there is great variety across prevalence studies on pharmacological enhancement[53], they illustrate a rather broad distribution of smart drugs. It should be noted, however, that those studies predominantly included student populations only. Nevertheless, it is likely that pharmacological enhancement is also used to function at a high level in competitive work environments.[54]

Although the Nature prevalence survey[55] and the review by Smith and Farah (2011)[56] are more than 10 years old, I believe that the prevalence of pharmacological enhancement might be as high or even higher today. This assumption is supported by an increase in scientific publications related to pharmacological enhancement in the past two decades.[57] Furthermore, as the pressure for extraordinary performance is increasing in society[58] and the possi-

52 Cameron, Lindsay P./Nazarian, Angela/Olson, David E.: Psychedelic Microdosing: Prevalence and Subjective Effects. In: Journal of Psychoactive Drugs, 52/2, 2020, pp. 113-122.

53 See Schleim, Stephan/Quednow, Boris B.: How Realistic Are the Scientific Assumptions of the Neuroenhancement Debate? Assessing the Pharmacological Optimism and Neuroenhancement Prevalence Hypotheses. In: Frontiers in Pharmacology, 9, 2018, p. 3.

54 Pustovrh, Tony/Mali, Franc/Arnaldi, Simone: Are Better Workers Also Better Humans? On Pharmacological Cognitive Enhancement in the Workplace and Conflicting Societal Domains. In: NanoEthics, 12/3, 2018, pp. 301-313.

55 Maher, Brendan: Poll results: Look who's doping. In: Nature, 452/7188, 2008, pp. 674-675.

56 Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

57 Daubner, Johanna/Muhammad Imran Arshaad/Christina Henseler/Jürgen Hescheler/Dan Ehninger/Karl Broich/Oliver Rawashdeh/Anna Papazoglou/Marco Weiergräber: Pharmacological Neuroenhancement: Current Aspects of Categorization, Epidemiology, Pharmacology, Drug Development, Ethics, and Future Perspectives. Edited by Stuart C. Mangel. In: Neural Plasticity 2021: 1-27.

58 See Pustovrh, Tony/Mali, Franc/Arnaldi, Simone: Are Better Workers Also Better Humans? On Pharmacological Cognitive Enhancement in the Workplace and Conflicting Societal Domains. In: NanoEthics, 12/3, 2018, pp. 301-313.

bilities to obtain pharmaceuticals (e.g. via the internet) are growing, they may now be even more widely distributed.

<u>Brain stimulation and brain-computer interfaces</u>

Generally, one can differentiate between invasive and non-invasive brain stimulation techniques. Non-invasive techniques include transcranial direct and altering current stimulations (tDCS and tACS) as well as transcranial magnetic stimulation (TMS)[59]. The goal of those methods is to stimulate certain cortical regions and activate neurons therein. Non-invasive brain stimulation has been used rather often to (supposedly) improve, for instance, executive functions, language, memory and visuospatial processing.[60] [61] Even the US military tested transcranial electric stimulation to enhance performance in soldiers.[62]

Invasive brain stimulation techniques such as deep brain stimulation require more severe procedures for enhancement: for those methods, individuals need to undergo surgery to receive a brain implant which can then be used for invasive brain stimulation.[63] Similarly, for invasive brain-computer interfaces (BCI) that allow communication between the human brain and external

59 For example, Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

60 See Shah-Basak, Priyanka P./Hamilton, Roy H.: Cognitive enhancement using noninvasive brain simulation: weighing opportunity, feasibility, and risk. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 125-149.

61 See Antal, Andrea/Luber, Bruce/Brem, Anna-Katharine/Bikson, Marom/Brunoni, Andre R./Kadosh, Roi Cohen/Paulus, Walter: Non-invasive brain stimulation and neuroenhancement. In: Clinical Neurophysiology Practice, 7, 2022, pp. 146-165.

62 Brunyé, Tad T./Brou, Randy/Doty, Tracy J./Gregory, Frederick D./Hussey, Erika K./Lieberman, Harris R./Loverro, Kari L./Mezzacappa, Elizabeth p./Neumeier, William H./Patton, Debra J./Soares, Jason W./Thomas, Thaddeus P./Yu, Alfred B.: A Review of US Army Research Contributing to Cognitive Enhancement in Military Contexts. In: Journal of Cognitive Enhancement, 4/4, 2020, pp. 453-468.

63 Attiah, Mark: The use of brain stimulation technology for cognitive enhancement and the potential for addiction. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 150-163.

technologies, surgery to place implants is also needed.[64] [65] Due to this high level of invasiveness and risks associated with surgeries, these methods are not (readily) available to the general public but currently mostly used for medical treatment. However, they are at the centre of public debate due to prominent companies working on BCI technologies.[66]

Effectiveness of those enhancement methods

While pharmacological enhancement is already quite frequently applied[67], invasive brain stimulation techniques as well as brain-computer interfaces are more effortful (i.e. needing surgery and advanced brain implants) and, thus, not easily usable by healthy humans. Importantly, for all of those methods, substantial empirical evidence of their effectiveness in enhancing cognition is lacking.[68] [69] For some cognitive abilities, in some individuals, and through some studies, positive indications of cognitive enhancement due to methods such as pharmacological enhancement and non-invasive brain stimulation were found, but the overall effectiveness is highly questionable.[70] The effectiveness of invasive brain stimulation and brain-computer interfaces in healthy individuals is undetermined due to the inherent risks associated with such studies.

64 For example, Bostrom, Nick/Sandberg, Anders: Cognitive enhancement: methods, ethics, regulatory challenges. In: Science and Engineering Ethics, 15, 2009, pp. 311-341.

65 For example, Hramov, Alexander E./Maksimenko, Vladimir A./Pisarchik, Alexander N.: Physical principles of brain–computer interfaces and their applications for rehabilitation, robotics and control of human brain states. In: Physics Reports, 918, 2021, pp. 1-133.

66 For example, see Neuralink by Elon Musk.

67 See Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants “smart pills”? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

68 For example, Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

69 For example, Repantis, Dimitris/Schlattmann, Peter/Laisney, Oona/Heuser, Isabella: Modafinil and methylphenidate for neuroenhancement in healthy individuals: a systematic review. In: Pharmacological Research, 62, 2010, pp. 187-206.

70 See recent review, Grinschgl, Sandra/Ninaus, Manuel/Wood, Guilherme/Neubauer, Aljoscha C.: To enhance or not to enhance: A debate about cognitive enhancement from a psychological and neuroscientific perspective. Unpublished manuscript.

Smith and Farah (2011)[71] also emphasised that for some people positive effects can be observed during some tasks due to the intake of drugs. Repantis et al. (2010)[72] suggested an inverted U-shape function depicting the effectiveness of pharmacological enhancement. This means that depending on individuals' baseline level of certain neurotransmitters, the intake of medication might be more or less effective. So far, to my best knowledge, no cognitive enhancement research has taken into account such individual differences and, thus, they should be investigated in the future.

At the moment no general conclusions about the effectiveness of drug use for healthy individuals can be drawn[73], also because most studies only include small samples and, thus, lack statistical power.[74] The effectiveness of enhancement might even be overestimated due to publication bias.[75] Furthermore, it is difficult to transfer findings from laboratory research to the real world.[76] [77] Thus, much more additional research is necessary to make strong claims about the effectiveness of cognitive enhancement in the real world.

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71 Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

72 Repantis, Dimitris/Schlattmann, Peter/Laisney, Oona/Heuser, Isabella: Modafinil and methylphenidate for neuroenhancement in healthy individuals: a systematic review. In: Pharmacological Research, 62, 2010, pp. 187-206.

73 See Hills, Thomas/Hertwig, Ralph: Why Aren't We Smarter Already: Evolutionary Trade-Offs and Cognitive Enhancements. In: Current Directions in Psychological Science, 20/6, 2011, pp. 373-377.

74 See De Jongh, Reinoud: Overclocking the brain? The potential and limitations of cognition-enhancing drugs. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 37-56.

75 See Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

76 Antal, Andrea/Luber, Bruce/Brem, Anna-Katharine/Bikson, Marom/Brunoni, Andre R./Kadosh, Roi Cohen/Paulus, Walter: Non-invasive brain stimulation and neuroenhancement. In: Clinical Neurophysiology Practice, 7, 2022, pp. 146-165.

77 Smith, Elizabeth M./Farah, Martha J.: Are prescription stimulants "smart pills"? The epidemiology and cognitive neuroscience of prescription stimulant use by normal healthy individuals. In: Psychological Bulletin, 137/5, 2011, pp. 717-741.

Side effects and risks

In addition to missing evidence on the effectiveness of cognitive enhancement, side effects und long-term risks of both pharmacological enhancement and brain stimulation as well as BCI technologies are also mainly unexplored. Multiple researchers suggest a gain-loss asymmetry of cognitive enhancement[78] [79] [80]: an increase in cognitive functions for one specific area due to cognitive enhancement might come with a decrease in another area. Thus, if cognitive enhancement provides a benefit in one area, it might also induce negative side effects for another area. Hills and Hertwig (2011)[81] argue that psychological research is indispensable to identify which individual's enhancement is most effective and in which environments, and to investigate which cognitive functions might be vulnerable in the gain-loss asymmetry.

Additionally, for pharmacological enhancement via smart drugs or illicit drugs, there may be a risk of addiction as well as unexplored negative effects on healthy brains due to regular off-label drug intake.[82] Studies on repeated drug intake by healthy individuals are, however, lacking.[83] Thus, the risks of regular off-label drug intake remain unknown.

For (invasive) brain stimulation methods, the risks might be as or even more severe: first, the surgery to implant a brain chip comes with several risks such

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78 For example, Pustovrh, Tony/Mali, Franc/Arnaldi, Simone: Are Better Workers Also Better Humans? On Pharmacological Cognitive Enhancement in the Workplace and Conflicting Societal Domains. In: NanoEthics, 12/3, 2018, pp. 301-313.

79 See *net-zero concept*, Colzato, Lorenza p./Hommel, Bernhard/Beste, Christian: The Downsides of Cognitive Enhancement. In: The Neuroscientist, 27/4, 2021, pp. 322-330.

80 Hills, Thomas/Hertwig, Ralph: Why Aren't We Smarter Already: Evolutionary Trade-Offs and Cognitive Enhancements. In: Current Directions in Psychological Science, 20/6, 2011, pp. 373-377.

81 Hills, Thomas/Hertwig, Ralph: Why Aren't We Smarter Already: Evolutionary Trade-Offs and Cognitive Enhancements. In: Current Directions in Psychological Science, 20/6, 2011, pp. 373-377.

82 For example, Massie, Charles F./Yamga, Eric M./Boot, Brendon P.: Neuroenhancement: a call for better evidence on safety and efficacy. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 57-68.

83 Repantis, Dimitris/Schlattmann, Peter/Laisney, Oona/Heuser, Isabella: Modafinil and methylphenidate for neuroenhancement in healthy individuals: a systematic review. In: Pharmacological Research, 62, 2010, pp. 187-206.

as possible infections or other complications. Second, the enhanced individual is highly dependent on the company or organisation providing the brain chip. If, for instance, the company goes bankrupt, the question arises as to who is continuing to monitor the brain chip and take responsibility for it. Third, individuals with implants might be susceptible to cyberattacks which might manipulate implants.[84] [85] These are just some risks that brain implants used for deep brain stimulation or BCIs, for instance, might entail. Taken together, invasive brain stimulation and BCI methods seem – in the current state of research and medical possibilities – too risky to be used unless they are medically necessary.

As another – more general – risk of cognitive enhancement, Birnbacher (2019)[86] suggests an overconfidence in one's own abilities. While enhancement itself might not be particularly effective, individuals might believe that it is and overestimate their abilities. This is particularly dangerous in high-risk situations such as in the military or other security forces. If, for instance, soldiers overestimate their abilities, they might put themselves at risk, but also their comrades and entire military operations.

Critically, it seems that the media is promoting an overly optimistic view of enhancement – at least when it comes to specific enhancement methods. In a study, Partridge et al. (2011)[87] observed that newsprint media depicts pharmacological enhancement as more common than it actually is. Furthermore, the risks of this form of enhancement seem to be neglected. Birnbacher

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84 See brainjacking in: Pycroft, Laurie/Boccard, Sandra G./Owen, Sarah L. F./Stein, John F./Fitzgerald, James J./Green, Alexander L./Aziz, Tipu Z.: Brainjacking: Implant Security Issues in Invasive Neuromodulation. In: World Neurosurgery, 92, 2016, pp. 454-462.

85 See *brainjacking* in: Merkel, Reinhard: Neuroenhancement, Autonomie und das Recht auf mentale Selbstbestimmung. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 43-88.

86 Birnbacher, Dieter: Neuroenhancement – eine ethische Sicht. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 18-42.

87 Partridge, Bradley J./Bell, Stephanie K./Lucke, Jayne C./Yeates, Sally/Hall, Wayne D.: Smart Drugs "As Common As Coffee": Media Hype about Neuroenhancement. In: PLoS ONE, 6/11, 2011, e28416.

(2019)[88] points out that such an overly optimistic view of enhancement can also lead to the wasting of resources. For instance, individuals – or even organisations such as the military – might spend money on useless enhancement tools, or research efforts might be made that are not promising of success.

Alternative – potentially more promising –
forms of cognitive enhancement

As I outlined before, the described enhancement methods seem less promising than oftentimes suggested. Furthermore, they might entail severe risks for healthy humans. Thus, from a psychological and neuroscientific perspective I would – in the current state of research – not recommend applying those forms of enhancement. Furthermore, I would urge both laboratory and applied research to focus on other – potentially more promising – cognitive enhancement methods. Psychological research showed that those known as active enhancement methods which entail a certain effort by the user are more accepted by laypersons than passive methods such as pharmacological enhancement and brain stimulation methods for which the user's effort might be smaller.[89] Most importantly, active cognitive enhancement methods might entail fewer risks.

Active enhancement includes rather effortful cognitive enhancement methods such as working memory training or neurofeedback to learn how to train one's brain activity. While the effectiveness of those methods is also rather questionable in the current state of research,[90] active enhancement methods might foster individual's well-being by increasing their autonomy and moti-

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[88] Birnbacher,Dieter: Neuroenhancement – eine ethische Sicht. In: Viertbauer, Klaus/ Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 18-42.

[89] See Grinschgl, Sandra/Berdnik, Anna-Lena/Stehling, Elisabeth/Hofer, Gabriela/ Neubauer, Aljoscha C.: Who wants to enhance their cognitive abilities? Potential predictors of the acceptance of cognitive enhancement. In: Journal of Intelligence, 11/6, 2023, p. 109.

[90] For example, see Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

vation.[91] Furthermore, no dangerous side effects or long-term risks such as brain damage or infection due to surgery can be expected from them. I would therefore suggest to rather put scientific and public effort into the further development of these active enhancement methods as a potential means to enhance humans' cognition than to rely on highly risky methods such as pharmacological enhancement and brain stimulation.

Laypersons' views on cognitive enhancement methods
and users of cognitive enhancement

While there are certain populations who are known to (at least to some degree) apply cognitive enhancement methods such as "neurohackers"[92] and university students (when it comes to pharmacological enhancement[93]), there are only a few studies which empirically investigated laypersons' views on cognitive enhancement methods as well as the characteristics of enhancement users.

Generally, the public's view on enhancement is rather negative.[94] [95] In an empirical study, pharmacological enhancement was viewed more negatively than brain stimulation, which might be due to the greater familiarity with smart drugs than brain stimulation and, thus, more negative views among

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91 See Grinschgl, Sandra/Ninaus, Manuel/Wood, Guilherme/Neubauer, Aljoscha C.: To enhance or not to enhance: A debate about cognitive enhancement from a psychological and neuroscientific perspective. Unpublished manuscript.

92 See Wexler, Anna: The Social Context of "Do-It-Yourself" Brain Stimulation: Neurohackers, Biohackers, and Lifehackers. In: Frontiers in Human Neuroscience, 11, 2017, p. 224.

93 For example, Maier, Larissa J./Ferris, Jason A./Winstock, Adam R.: Pharmacological cognitive enhancement among non-ADHD individuals – A cross-sectional study in 15 countries. In: International Journal of Drug Policy, 58, 2018, pp. 104-112.

94 Dijkstra, Anne M./Schuijff, Mirjam: Public opinions about human enhancement can enhance the expert-only debate: A review study. In: Public Understanding of Science, 25/5, 2016, pp. 588-602.

95 See Grinschgl, Sandra/Tawakol, Zadaf/Neubauer, Aljoscha C.: Human enhancement and personality: A new approach towards investigating their relationship. In: Heliyon, 8, 2022, p. e09359.

the public.[96] [97] Non-users of enhancement, especially, seem to have concerns about enhancement, relating to its medical safety and fairness.[98]

Additionally, for pharmacological enhancement, Bergström and Lynöe (2008)[99] showed that natural substances are more accepted in enhancement than pharmaceuticals. Relatedly, Conrad et al. (2019) showed a greater approval of pharmacological enhancement for others than for oneself.[100] Moreover, approval of pharmacological enhancement for oneself was greater when it was presented in an athlete context rather than an employee or student context.

A study conducted by McCabe et al. (2005) surveyed college students across the US regarding their non-medical drug use.[101] The findings indicated that drug use was more prevalent among male students, white students, members of fraternities and sororities and those with lower average grades. Additionally, the survey revealed that the use of such drugs was more common in colleges located in the northeastern US and at institutions with highly competitive admission criteria. Pharmacological enhancement behaviour was also shown to be oftentimes accompanied by other risky behaviours such as binge drinking and the intake of illicit drugs – which is especially dangerous as pharmaceuticals might detrimentally interact with other substances. Inter-

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96 Grinschgl, Sandra/Tawakol, Zadaf/Neubauer, Aljoscha C.: Human enhancement and personality: A new approach towards investigating their relationship. In: Heliyon, 8, 2022, p. e09359.

97 See Schönthaler, Elena M. D./Hofer, Gabriela/Grinschgl, Sandra/Neubauer, Aljoscha C.: Super-Men and Wonder-Women: the Relationship Between the Acceptance of Self-enhancement, Personality, and Values. In: Journal of Cognitive Enhancement, 6, 2022, pp. 358-372.

98 See study on pharmacological enhancement, Schelle, Kimberly J./Faulmüller, Nadira/Caviola, Lucius/Hewstone, Miles: Attitudes toward pharmacological cognitive enhancement: a review. In: Frontiers in Systems Neuroscience, 8, 2014, p. 53.

99 Bergström, Lena/Lynöe, Niels: Enhancing concentration, mood and memory in healthy individuals: An empirical study of attitudes among general practitioners and the general population. In: Scandinavian Journal of Public Health, 36/5, 2008, pp. 532-537.

100 Conrad, Erin C./Humphries, Stacey/Chatterjee, Anjan: Attitudes Toward Cognitive Enhancement: The Role of Metaphor and Context. In: AJOB Neuroscience, 10/1, 2019, pp. 35-47.

101 McCabe, Sean E./Knight, John R./Teter, Christian J./Wechsler, Henry: Non-medical use of prescription stimulants among US college students: Prevalence and correlates from a national survey. In: Addiction, 100/1, 2005, pp. 96-106.

estingly, this study shows that both individual differences with regard to the characteristics of students (e.g. their gender) and surrounding factors (e.g. being part of fraternities or certain highly competitive colleges) might foster the intake of drugs for pharmacological enhancement.

A more recent study by Bagusat et al. (2018) found that higher perceived stress levels are linked to the use of enhancement drugs.[102] However, Mayor et al. (2020) showed that individuals' competitiveness is not linked to attitudes toward pharmacological enhancement.[103] This suggests that stressful situations, rather than individuals' competitiveness, may be one factor driving the use of these drugs. With regard to microdosing, Cameron et al. (2020) observed that men are almost twice as likely to use this form of enhancement than women.[104] This finding is further supported by a study from Conrad et al. (2019) showing a greater approval of pharmacological enhancement by men than women. [105] In contrast, an Austrian survey showed no differences between male and female students in the respective prevalences.[106]

In an experimental study, Maier et al. (2015) compared healthy individuals who are regular users of pharmacological enhancement to a control group against different cognitive and personality measures.[107] While the two groups

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102 Bagusat, Christiana/Kunzler, Angela/Schlecht, Jennifer/Franke, Andreas G./Chmitorz, Andrea/Lieb, Klaus: Pharmacological neuroenhancement and the ability to recover from stress – a representative cross-sectional survey among the German population. In: Substance Abuse Treatment, Prevention, and Policy, 13/1, 2018, p. 37.

103 Mayor, Eric/Daehne, Maxime/Bianchi, Renzo: The dark triad of personality and attitudes toward cognitive enhancement. In: BMC Psychology, 8, 2020, pp. 1-12.

104 Cameron, Lindsay P./Nazarian, Angela/Olson, David E.: Psychedelic Microdosing: Prevalence and Subjective Effects. In: Journal of Psychoactive Drugs, 52/2, 2020, pp. 113-122.

105 Conrad, Erin C./Humphries, Stacey/Chatterjee, Anjan: Attitudes Toward Cognitive Enhancement: The Role of Metaphor and Context. In: AJOB Neuroscience, 10/1, 2019, pp. 35-47.

106 Dietz, Pavel/Iberl, Benedikt/Schuett, Emanuel/Van Poppel, Mireille/Ulrich, Rolf/Sattler, Matteo C.: Prevalence Estimates for Pharmacological Neuroenhancement in Austrian University Students: Its Relation to Health-Related Risk Attitude and the Framing Effect of Caffeine Tablets. In: Frontiers in Pharmacology, 9, 2018, p. 494.

107 Maier, Larissa J./Wunderli, Michael D./Vonmoos, Matthias/Römmelt, Andreas T./Baumgartner, Markus R./Seifritz, Erich/Schaub, Michael P./Quednow, Boris B.: Pharmacological Cognitive Enhancement in Healthy Individuals: A Compensation for Cognitive Deficits or a Question of Personality? In: PLoS One, 10/6, 2015, e0129805

mostly showed no differences in the cognitive tasks, users of pharmacological enhancement showed a higher tendency towards novelty seeking, negativistic and antisocial personality traits, as well as Machiavellianism than the control group. Furthermore, they showed lower levels of social reward dependence and had fewer social contacts in comparison to the control group. No differences in narcissism between the groups were observed. Mayor et al. (2020) observed similar results with regard to the Dark Triad traits (grandiose narcissism, psychopathy and Machiavellianism) and attitudes towards pharmacological enhancement.[108] While narcissism and psychopathy were not related to positive attitudes towards this form of enhancement, increased Machiavellianism was related to more positive attitudes. Taken together, certain personal characteristics such as Dark Triad traits might impact the willingness to use pharmacological enhancement.

When it comes to brain stimulation, researchers express greater reservations about using tDCS for cognitive enhancement than in its application in clinical or research contexts.[109] Interestingly, about one third of these participants indicated they would consider using tDCS for enhancement. The likelihood of wanting to use tDCS for enhancement was positively associated with the belief in its effectiveness, while heightened ethical concerns were linked to a reduced willingness to pursue this form of enhancement.

These studies give an initial impression of individuals' views on pharmacological enhancement and brain stimulation methods. Certain surrounding factors as well as personal characteristics might foster the willingness to apply specific enhancement methods.

Not only focusing on one enhancement method, but instead incorporating a range of different passive and active enhancement methods, Grinschgl et al. (2023) observed that people's intelligence does not predict the acceptance

108 Mayor, Eric/Daehne, Maxime/Bianchi, Renzo: The dark triad of personality and attitudes toward cognitive enhancement. In: BMC Psychology, 8, 2020, pp. 1-12.

109 Riggall, Kate/Forlini, Cynthia/Carter, Adrian/Hall, Wayne/Weier, Megan/Partridge, Brad/Meinzer, Marcus: Researchers' perspectives on scientific and ethical issues with transcranial direct current stimulation: An international survey. In: Scientific Reports, 5/1, 2015, p. 10618.

of either enhancement type.[110] Acceptance of passive enhancements was linked to a younger age[111] , less conscientiousness and a stronger interest in science fiction[112]. For active enhancements, acceptance was associated with a younger age, elevated openness and a greater interest in science fiction.

Taken together, these (mostly psychological) studies highlight laypersons' views on cognitive enhancement and characteristics of potential enhancement users. However, additional research is necessary to test a range of different personal characteristics and environmental factors in order to find strong predictors of the willingness to apply cognitive enhancement. Knowing which persons might enhance themselves can help in targeting those persons to inform them about the potential up- and downsides of cognitive enhancement. Additionally, in applying cognitive enhancement within organisations such as the military, it is important to know which individuals might be willing to use those methods and which are not.

3. Current challenges – what can and should be done with regard to cognitive enhancement

In public discussions pertaining to cognitive enhancement, it seems that the effectiveness of different methods is rather over-estimated[113] [114] and psycho-

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110 Grinschgl, Sandra/Berdnik, Anna-Lena/Stehling, Elisabeth/Hofer, Gabriela/Neubauer, Aljoscha C.: Who wants to enhance their cognitive abilities? Potential predictors of the acceptance of cognitive enhancement. In: Journal of Intelligence, 11/6, 2023, p. 109.

111 See also Breivik, Gunnar/Sagoe, Dominic/Loland, Sigmund: Personality and willingness towards performance enhancement and body modification: A cross-sectional survey of a nationally representative sample of Norwegians. In: Frontiers in Sports and Active Living, 4, 2022, p. 906634.

112 See also Koverola, Mika/Kunnari, Anton/Drosinou, Marianna/Palomäki, Jussi/Hannikainen, Ivar R./Jirout Košová, Michaela/Kopecký, Robin/Sundvall, Jukka/Laakasuo, Michael: Treatments approved, boosts eschewed: Moral limits of neurotechnological enhancement. In: Journal of Experimental Social Psychology, 102, 2022, p. 104351.

113 For example, Kourany, Janet A.: Human Enhancement: Making the debate more productive. In: Erkenntnis, 79, 2014, pp. 981-998.

114 For example, Partridge, Bradley J./Bell, Stephanie K./Lucke, Jayne C./Yeates, Sally/Hall, Wayne D.: Smart Drugs "As Common As Coffee": Media Hype about Neuroenhancement. In: PLoS ONE, 6/11, 2011, e28416.

logical as well as neuroscientific research is misinterpreted or ignored.[115] [116] This could, in return, also lead to an overestimation of enhancement possibilities in critical governmental organisations, such as security forces (i.e. the police, military). Potentially, those might aim to apply enhancement to supposedly increase performance among their employees (as, for instance, has at least been tested in the US army)[117], without actually understanding the up- and downsides as derived from scientific studies.

In fact, what can be done for healthy individuals using the outlined cognitive enhancement methods at the moment is almost nothing. Pharmacological enhancement has shown, at most, moderate effects on cognitive abilities[118] and entails many open questions such as the risks of addiction and consequences of repeated drug intake. Similarly, non-invasive brain stimulation has negligible effects on cognition for healthy individuals.[119] Invasive brain stimulation techniques come with severe risks as they require surgery and a heavy reliance on the brain chip providers. Therefore, in the current state of research and technical as well as medical possibilities, I would advise against applying those methods or planning to apply them in the foreseeable future – for the general public but also for organisations like the military.

Before a broad application of cognitive enhancement may be rationally warranted, the following steps should be taken from a psychological and neuroscientific perspective:

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115 See also Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne: Introduction. In: Ter Meulen, Ruud/Mohamed, Ahmed D./Hall, Wayne (ed.): Rethinking Cognitive Enhancement. Oxford 2017, pp. 3-14.

116 See also Pauen, Michael: Autonomie und Enhancement. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 89-114.

117 Brunyé, Tad T./Brou, Randy/Doty, Tracy J./Gregory, Frederick D./Hussey, Erika K./Lieberman, Harris R./Loverro, Kari L./Mezzacappa, Elizabeth p./Neumeier, William H./Patton, Debra J./Soares, Jason W./Thomas, Thaddeus P./Yu, Alfred B.: A Review of US Army Research Contributing to Cognitive Enhancement in Military Contexts. In: Journal of Cognitive Enhancement, 4/4, 2020, pp. 453-468.

118 For example, Repantis, Dimitris/Schlattmann, Peter/Laisney, Oona/Heuser, Isabella: Modafinil and methylphenidate for neuroenhancement in healthy individuals: a systematic review. In: Pharmacological Research, 62, 2010, pp. 187-206.

119 Jaušovec, Norbert/Pahor, Anja: Increasing intelligence. London 2017.

a) More research is needed to explore individual differences with regard to the effectiveness of cognitive enhancement methods. For instance, whether certain enhancement methods might be effective for some individuals or groups, but not for others, has remained mostly unexplored.
b) For the safe application of cognitive enhancement, longitudinal studies are necessary to explore the potential long-term effects. For instance, the consequences of repeated drug intake, such as the risk of addiction and potential brain damage, are unknown. Some methods should only be applied under medical supervision and regulations/guidelines by, for instance, the government or World Health Organization.
c) For both step a) and b) it is important to carefully distinguish between clinical research and enhancement research using healthy individuals as samples. The direct transfer of findings in one area to the other might prove a dangerous fallacy.[120] Similarly, we – as researchers but also central actors among the public – must work towards correcting the misinterpretation of neuroscientific and medical findings. Such avoidance of misinterpretation is especially important for governmental organisations such as the military.[121]
d) Ethical considerations about successful (i.e. effective) enhancement need to be explored and taken into account in the development of those methods. For instance, the question arises as to who has access to which enhancement methods as well as to the reasons why those would be applied (e.g. risk of coercion). For a number of additional, important ethical questions, see Neubauer (2021).[122] Interestingly, Gyngell and Easteal (2015)[123] even suggested that cognitive enhance-

[120] For a deeper exploration of this problem, see Grinschgl, Sandra/Ninaus, Manuel/Wood, Guilherme/Neubauer, Aljoscha C.: To enhance or not to enhance: A debate about cognitive enhancement from a psychological and neuroscientific perspective. Unpublished manuscript.

[121] See Sturma, Dieter: Subjekt sein: Über Selbstbewusstsein, Selbstbestimmung und Enhancement. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 115-147.

[122] Neubauer, Aljoscha C.: The future of intelligence research in the coming age of artificial intelligence – With a special consideration of the philosophical movements of trans- and posthumanism. In: Intelligence, 87, 2021, p. 101563.

[123] Gyngell, Chris/Easteal, Simon: Cognitive Diversity and Moral Enhancement. In: Cambridge Quarterly of Healthcare Ethics, 24/1, 2015, pp. 66-74.

ment should go hand in hand with moral enhancement, as cognitive enhancement might increase diversity among people whose acceptance requires a higher morality.

e) Finally, to tackle the topic of cognitive enhancement, different disciplines need to work together and research enhancement-related issues. Not only psychologists and neuroscientists, but medical doctors, technicians, philosophers and other researchers should also work together to paint a comprehensive picture of cognitive enhancement.

Only if those steps are taken and enhancement methods are shown to be effective as well as safe for the targeted group, it might be advisable to think about applying cognitive enhancement in critical institutions such as the military. However, I would also argue that efforts towards (passive) cognitive enhancement methods such as pharmacological enhancement and brain stimulation might not be successful at all. Thus, it is questionable whether research efforts should be made in that direction in the first place.

4. Outlook – Cognitive enhancement in the short, medium and long term

In the previous sections of this chapter, I presented the current state of cognitive enhancement methods from a psychological and neuroscientific perspective. Of course, I cannot foresee the future, but I want to provide some suggestions on future developments of cognitive enhancement.

<u>Short term (until 2025)</u>

In the short term, I do not expect scientific, technical and/or medical advancements which would have the potential for effective cognitive enhancement. Instead, I hope that in the coming years we – as a scientific community – will work on reducing misinterpretations of scientific findings and presenting scientifically accurate evidence to the public with regard to cognitive enhancement. As we can see from this book, governmental organisations such as the military are already thinking about this topic; thus, now is the time to correct views on enhancement and to properly disseminate respective research findings for this purpose.

Medium term (until 2030)

For the medium term, I believe that this (i.e. correcting views on enhancement) needs to continue. Furthermore, I believe that in the coming years more research on cognitive enhancement will be done – both by universities and commercial companies – and some of my points raised in the previous section (3.) will potentially be addressed. Nevertheless, I cannot imagine that the forms of cognitive enhancement described here will actually become effective and – even more importantly – safe by the year 2030.

Long term (from 2030)

I do not know what the distant future will look like, but I want to mention two (of many) possible scenarios.

First, the substantial enhancement of human cognition might still not be possible by technological and medical means. At the same time, AI systems will probably gain more and more abilities. Thus, in the distant future, we – as humans – might need to adapt to those technologies and learn how to successfully incorporate them into our lives. Due to the use of AI, we might be able to perform more accurately, faster and more reliably in the future. Thus, AI systems could be an indirect way to enhance human performance – even more so in the future than already is the case.[124]

Second, we could indeed imagine effective cognitive enhancement methods in the future. For instance, through pharmacological enhancement we might become extremely attentive and be able to absorb large amounts of information in a short time frame. But what would that mean for individuals, society and governmental organisations such as the military? As mentioned in section 3, successful enhancement comes with many ethical questions that would need to be tackled. For instance, the question arises as to who has access to enhancement methods and how expensive is it to use them? Who

[124] See Grinschgl, Sandra/Neubauer, Aljoscha C.: Supporting cognition with modern technology: Distributed cognition today and in an AI-enhanced future. In: Frontiers in Artificial Intelligence, 5, 2022, p. 908261.

can decide whether a person gets enhanced? Are humans losing their autonomy, free will and motivation if they get enhanced?

These are just a few of the many ethical questions that successful enhancement would entail. In a techno-optimistic future as described by Makridis (2013)[125], pharmaceuticals might increase employees' productivity and military troops might be enhanced. Pustovrh et al. (2018) suggest that pharmacological enhancement might make people become more successful, capable and, thus, make them more competitive in rapidly changing work environments.[126] However, so far, this seems to be an optimistic fantasy.

I believe that even if enhancement becomes effective in the future, there are many difficult ethical questions that still need to be tackled before cognitive enhancement should be made available to the public or applied within governmental organisations such as the military.

5. Recommendations and conclusions

Taken together, I want to endorse a less positive outlook on cognitive enhancement than is oftentimes portrayed in transhumanist publications but also in other media reports. More interdisciplinary research is needed to test potentially promising cognitive enhancement methods and – most importantly – to test short- and long-term risks of those methods as well as to develop safe protocols and regulations on their use.

In the current state of research, the promises of cognitive enhancement methods such as pharmacological enhancement and brain stimulation seem overestimated, which could lead to dangerous fallacies. For instance, enhancement might be applied – but without creating performance gains and instead only generating risks. This should be avoided. Thus, I also advise against applying those methods in critical institutions at this time – such as the police and military. However, even if not effective, the European Union

125 Makridis, Christos: Converging Technologies: A Critical Analysis of Cognitive Enhancement for Public Policy Application. In: Science and Engineering Ethics, 19, 2013, pp. 1017-1038.

126 Pustovrh, Tony/Mali, Franc/Arnaldi, Simone: Are Better Workers Also Better Humans? On Pharmacological Cognitive Enhancement in the Workplace and Conflicting Societal Domains. In: NanoEthics, 12/3, 2018, pp. 301-313.

and governments themselves should think about stricter regulations on applying enhancements – potentially similar to doping regulations in sports.

As mentioned at the beginning of this chapter, humans have always tried to enhance themselves.[127] Thus, they will continue to do so. However, instead of applying passive enhancement methods as described in this chapter (e.g. pharmacological enhancement, brain stimulation), I would recommend putting effort into active methods such as cognitive training. Cognitive training may have the potential to both increase people's cognition (at least for certain cognitive tasks) and well-being, while being accompanied by negligible risks. Indeed, cognitive training has also been tested in the military. Blacker et al. (2019) outline some practical considerations for testing and implementing cognitive enhancement within the military.[128] Most importantly, standardised experimental research designs are needed to test the effectiveness of different cognitive enhancement methods within the military context.

Finally, I want to stress again that potentially successful cognitive enhancement does not end with its development but also requires addressing many more open questions for which interdisciplinary contributions are necessary. Thus, in order for cognitive enhancement to be a positive outcome for humanity, psychology, neuroscience, technology-related fields, medicine, philosophy, sociology and other fields need to work together.

[127] See Pauen, Michael: Autonomie und Enhancement. In: Viertbauer, Klaus/Kögerler, Reinhart (ed.): Neuroenhancement: die philosophische Debatte. Berlin 2019, pp. 89-114.

[128] Blacker, Kara J./Hamilton, Joseph/Roush, Grant/Pettijohn, Kyle A./Biggs, Adam T.: Cognitive training for military application: a review of the literature and practical guide. In: Journal of Cognitive Enhancement, 3, 2019, 30-51.

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Chapter III – Ethics

andranik123/Adobe Stock

Ethics. Chapter Summary

This chapter examines the elements of ethics and morality pivotal in the context of human enhancement (HE). The phenomenon of human enhancement has ramifications that extend beyond the individual to encompass the social realm. This is a matter pertaining to the human being, and thus to the perception of the human being in different cultures. This entails an ethical evaluation of the conditions, development and application of human enhancement. The evaluation of human enhancement practices is informed by a range of basic ethical concepts, including ethics, morality, values, norms, autonomy, freedom, human dignity, human rights, equality and justice. In addition, philosophical theories, including deontology, virtue ethics and utilitarianism, as well as ethical concepts which can be found in faiths such as Christianity, Judaism, Islam, Hinduism, Buddhism and Atheism, provide a basis for evaluation.

The utilisation of AI systems in the context of human enhancement can be achieved through the implementation of non-invasive and invasive systems. It is imperative that the application of artificial intelligence, robotics and computer science considers the moral, social and legal implications. The future will see growth in the complexity and autonomy of artificial intelligence, with the capacity for independent development, self-control and automated decision-making becoming increasingly prevalent.

Furthermore, the concept of human enhancement has implications for the armed forces. The optimisation of the soldier, in conjunction with new technologies with the objective of increasing their combat capability, performance, endurance, strength, stress resistance and information processing, results in the emergence of a new quality of soldiers and warfare. The potential applications of different human enhancement technologies in the military are examined. Ethical considerations are brought to the fore when the efficacy, urgency and cost-benefit analyses of a given course of action impinge upon the physical integrity of the individual. This poses a question regarding military ethics, as well as the autonomy and freedom of the soldier within a hierarchical framework and subject to the fulfilment of directives.

Furthermore, the study identifies ethical test questions that can be used to evaluate decisions and actions regarding human enhancement. It also presents conclusions and recommendations for development and application in social and military spheres.

Human enhancement – An ethical perspective

Dieter Budde, Stefan Pickl

1. Introduction

The pursuit of improvement is an essential constant in the development of mankind. People are not only concerned with improving society, but also with improving themselves. "Enhancement" does not refer to improvement in the sense of *enlightenment* and humanism, but to the endeavour to improve people's capabilities through various measures. Human enhancement[1] is about improving the human body. While healing is about restoring or maintaining existing abilities, human enhancement strives to improve or perfect physical, psychological, cognitive or emotional performance beyond therapeutic or biotechnical intervention. It is about the human being as a rational and moral being and as a social and political being (*zõon politikón*). Improvement aims to change human nature in the respective realisation of their being and the human condition (*conditio humana*). It is about efficiency and effectiveness of humans for their own self or for a purpose. It is about maximising utility and optimisation.

It is about the human being and therefore about the concept of the human being. This means that the ethical and moral conditions of enhancement are also relevant. What does it mean for people to make use of the possibilities of enhancement? What influence does enhancement have on the human being? The following section deals with the fundamentals of the ethical and moral justification of human enhancement. Conclusions and recommendations are developed that are relevant to discourse (*philosophical discourse*) on the possibilities and limits of enhancement.

1 The following working definition is used: "Human enhancement refers to the use of technologies, methods or substances to improve a person's physical or cognitive abilities beyond what is considered normal and natural."
Translations by the authors are indicated by (a. t.).

These enhancements can cover a wide range of possibilities such as behavioural enhancement, neuroenhancement, technical enhancement, genetic enhancement and transhumanism.[2]

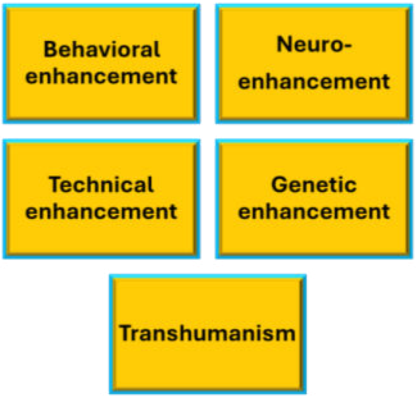

Figure 1: Methods of human enhancement. Author's illustration.

Improving and optimising behaviour can lead to an increase in performance and an improvement in living conditions. This can include cognitive, mental or physical training, for example.

Neuroenhancement is about improving cognitive performance. This can be achieved by enhancing the emotional state or increasing potential.

Technical enhancement is used to restore the ability to live and perform through the non-invasive or invasive use of prostheses in the broadest sense. This includes prostheses for restoring mobility, hearing and vision, for example. Passive and active exoskeletons can also be used. The dynamic development of computers, chips and other electronic parts as well as artificial intelligence make it possible to use these on or within the body to improve or optimise abilities. These can be controlled by using a brain-computer interface (BCI).

2 Jotterand, Fabrice/Ienca, Marcello (Ed.): The Routledge Handbook of the Ethics of Human Enhancement. New York: Routledge (Routledge Handbooks). 2023. Intr. and Part I; UK Ministry of Defence: Human Augmentation - The Dawn of a New Paradigm. A strategic implications project. Development, Concepts and Doctrine Centre (DCDC). Shrivenham 2020.

Genetic enhancement involves introducing gene elements to tissue or cells. These can be introduced, for example, to support healthy cells, replace diseased cells or deactivate pathogenic cells. A germline modification (clustered regularly interspaced short palindromic repeats (CRISPR)) can be used for this purpose. The cells can be introduced therapeutically or preventively.

Further possibilities of enhancement can be achieved through transhumanist procedures. The aim is to remove biological limitations and fully develop human capabilities. It is about the transition from human to posthuman. In these beings of the future, improvements should be possible within them, their brain and body, as well as in all their other aspects. This will create a new concept of mankind, in which it can develop according to their own ideas. This is the path from human to cyborg.

Pharmacological and technical developments and innovations are essential prerequisites for improvement. This is where feasibility reaches its limits. Proponents, liberals and critics of this development can be identified. Proponents and critics of human enhancement refer to different ideas about people and the human body. In their arguments, proponents follow a naturally determined type of human being, while critics describe the body as inherently deficient and limited in its options.[3] The respective attitudes are shaped by the respective view of man, the world and society as well as by the assessment of medical and technical potentiality for development. However, they are also influenced by ethics and morals.

2. General conditions

The ethical and moral assessment of human enhancement is influenced by various framework conditions. These include the conditions of society, the structure of the law, the possibilities of using artificial intelligence, attitudes towards the dangers of the cyber domain and the relationship between the individual and society.

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[3] Borrmann, Vera/Coenen, Christopher/Gerstgrasser, Luisa/Albers, Eva/Muller, Oliver/ Kellmeyer, Philipp: Resurrecting the 'body': Phenomenological perspectives on embodiment. In: Jotterand, Fabrice and Ienca, Marcello (Ed.): The Routledge Handbook of the Ethics of Human Enhancement. New York: Routledge (Routledge Handbooks). 2023, p. 98.

A society and its political constitution are characterised by conditions that are common to all or most citizens. This is expressed, among other things, in its value structure. The *structure of values* of a society is essentially determined by philosophical, religious and legal views/conditions as well as traditions. It describes the totality of *moral judgements*, norms, ideals, virtues and institutions. It establishes the rules that are universally recognized as binding and must be adhered to within a society. Every form of morality is therefore a historically developed and changing *canon of rules*. It is always a group morality (*moral status of groups*) and applies exclusively to the members of the group. It therefore encompasses all systems of order and meaning (rule systems) that have emerged partly naturally, partly through convention, partly through tradition and partly through mutual recognition processes.

In view of the plurality of ideological standpoints, private opinions and religious convictions, as well as rapidly advancing socio-cultural development and the associated ongoing change in economic, political and social objectives, a consensus on matters of morality in modern societies and in the future can no longer be taken for granted.

The *concept of values* and the ethical and moral orientation of people in society are subject to dynamic processes that are based on religious, philosophical, historical, legal and political developments. In this context, questions of equality, justice and equal opportunities in social, professional, economic and moral terms as well as their ethical evaluation arise.

There is a risk that inequalities will increase and lead to conflicts. Attitudes towards the methods and scope of human enhancement are also influenced or determined by the economic interests of business, the political interests of political parties and the interests of state power.

Economic regulations are also important in the ethical evaluation of human enhancement. This raises questions such as: will the costs of enhancement be covered by the state or health insurance companies? Can everyone afford enhancement or only the rich? Does the state force people to undergo human enhancement or is it only done on a voluntary basis?

With regard to ethical and moral evaluation, this also involves the question of justice in society. Different ways of realising justice can be found in societies. For example, there are forms of compensatory justice (*iustitia communicativa*), exchange justice (*iustitia distributiva*) or contractual forms of justice that result from fair debate as described by John Rawls in his work "A Theory of Justice". Attitudes towards justice have an influence on the values of a society.

Artificial intelligence (AI) will play an important role in the development of enhancement in the future. AI is dependent on the data and information it collects. Regarding possible enhancement, the ethical and moral question is the extent to which people are still in control of this data or whether they are at the mercy of it through the automation of processes, and whether their moral behaviour is thus determined by others.

In April 2019, a "High-Level Expert Group on Artificial Intelligence" published "Ethical Guidelines for Trustworthy AI" on behalf of the EU Commission. These guidelines formulate seven requirements:

1. Human agency and oversight […]
2. Technical robustness and safety […]
3. Privacy and data governance […]
4. Transparency […]
5. Diversity, non-discrimination and fairness […]
6. Societal and environmental wellbeing […]
7. Accountability […][4]

The EU AI Act states the unacceptable risks of artificial intelligence:

> Unacceptable risk AI systems are systems considered a threat to people and will be banned. They include:
>
> - Cognitive behavioural manipulation of people or specific vulnerable groups: for example, voice-activated toys that encourage dangerous behaviour in children
> - Social scoring: classifying people based on behaviour, socio-economic status or personal characteristics
> - Biometric identification and categorisation of people
> - Real-time and remote biometric identification systems, such as facial recognition.[5]

[4] High-Level Expert Group on Artificial Intelligence: Ethics guidelines for trustworthy AI. 2019, p. 14. https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai.

[5] EU Parliament: EU AI Act: first regulation on artificial intelligence. 2023. https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence.

An essential element of the ethical evaluation of artificial intelligence is the testing of algorithms and training data. This has a significant influence on the acceptance of an AI with regard to its application and moral evaluation. This applies, for example, when humans are equipped with a brain-computer interface (BCI). They are thus participating in an Internet of Things (IoT). This may result in a two-way exchange of data. If this data exchange can determine people's thoughts and actions, they lose their dignity, freedom, equality, autonomy and self-determination.

By connecting to the internet, it is possible to influence or control the technical means of enhancement. This is the case, in particular, if the enhancement must necessarily be connected to the internet. This applies if the technical systems are used non-invasively (*outside the body*) or invasively (*inside the body*), reversibly or non-reversibly. It also concerns the protection of brain-computer interfaces (BCI) and all IT systems connected to a cyborg.

When applying artificial intelligence, robotics and computer science, one must take into account that people must be treated not as things but as persons, as *ends* and not as *means (*Kant).

3. Ethical principles

Ethics not only concerns the descriptive and explicative study of moral questions, but also the generation, examination and justification of *normative* statements. They do not primarily concern what *is,* but *action.* Ethics seek answers to the question: **what should we do?** Morality seeks answers to the question: **how should we live? How should we act?** Norms or principles of what is morally right make a *universal* and *categorical* claim to validity. These norms also include human dignity and autonomy as well as human rights. They are inherent to human beings. This leads to the demand that human enhancement should not harm people. Individual enhancement also has an influence on people as a community and on the relationship between people. The basis of human enhancement should not be to harm people. This means not causing harm, but also alleviating or avoiding harm.

In the ethical evaluation of human enhancement, it is first necessary to clarify what characterises a "human being" and which concept of humanity is decisive. If human enhancement also includes human-machine integration, the question of what is meant by "machine" in this context must also be clarified.

Man is an individual, a person and a social and politicalbeing (*zõon politikón*). These characteristics are in a reciprocal, often conflicting relationship. Individuals and people are characterised by their dignity, autonomy, freedom and equality. As members of a community, people are defined by their social position, interdependent relationship with others, legal status and the pursuit of justice within society.

So, when it comes to the question of human enhancement, these criteria must be included in an ethical assessment. The following terms and spheres are essentially relevant in the evaluation of enhancement: ethics, morality, values, autonomy, freedom, human dignity, human rights, equality and justice.

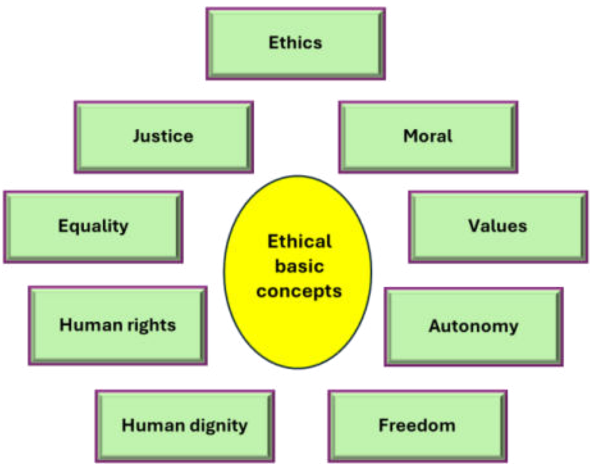

Figure 2: Basic ethical concepts. Author's illustration.

The human being is the central theme in ethics. It is considered in its naturalness and its intellectual possibilities and limitations. The main focus lies on reason and rationality. The major theories of ethics are applicable to the question of an ethical and moral evaluation of human enhancement. In the following, the human being is understood as a rational individual and social being.

4. Philosophical theories

Philosophical theories deal with people's views of existence and reality. They seek an understanding of ethical and moral issues and individual decisions. In the following, deontology, virtue ethics and utilitarianism are examined as the foundations of ethical and moral decisions.

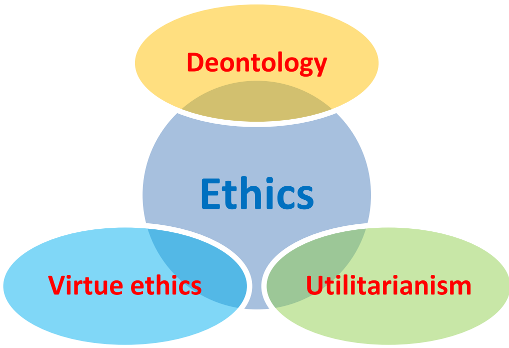

Figure 3: Philosophical theories. Author's illustration.

4.1 Deontological ethics

Deontological ethics (ethics of *duty*, ethics of *ought*) require or prohibit an action according to certain criteria. They are based on the autonomy, freedom, self-determination and personal responsibility of human beings. They describe a class of ethical theories that attribute goodness or badness to actions regardless of their consequences due to intrinsic incentives in the matter or the individual. The moral value of an action results solely from its motives. Only if the person acting has decided to act out of moral obligation is this action good. The aim of ethics is to follow what is ethically right, regardless of the consequences.

Kant describes an action whose sole motive is the *moral law* and in which one's own inclination (interest) plays no role as an act out of duty. Merely acting dutifully, however, is to act according to the moral law but with selfish motives. The *obligatory provisions* of deontological ethics are simple and straightforward ethical rules that are easy to apply and manage. In deontological ethics, only the intended outcome is decisive for the moral value of an action. The ethical intention is independent of the factual intention. *The* ethical *ought* can be directly derived from rational subjectivity.

The *universalizability principle* (Kant) is important in this context. This becomes clear in the principle of pure practical reason, the categorical imperative: "Act in such a way that the maxim of your will can at all times be regarded as the principle of general legislation."[6] The "Golden Rule" is derived from this: "Do not do to others what you would not like done to yourself." This establishes an *ought reference* between individuals that is valid in a general approach. In his *formula of the end in itself,* Kant says: "Act in such a way that you need humanity both in your person and in the person of everyone else at all times as an end, never merely as a means."[7]

The application of deontology to human enhancement opens up the possibility of examining the rightness or wrongness of decisions or actions on the basis of principles. According to Kant, it demands a duty of "respect for the law" and thus respect and consideration of the dignity of one's own person as well as that of all other persons. However, it does not allow a decision or action to be taken in the case of conflicting norms and duties, i.e. in the case of a conflict of duties. It is also difficult to apply in different cultures and societies.

4.2 Virtue ethics

Virtue ethics have a long tradition. Throughout history and cultures, "virtue" has often been interpreted in different ways. Virtue (*arete*) generally means individual suitability or efficiency with regard to individual decisions or behaviour. It explores the requirements under which people strive for the good that their reason dictates. It is a general practical philosophy that opposes an imperative or duty-based view of morality. The good unfolds through the pursuit and realisation of virtues such as mindfulness, justice and selflessness. If an ethically and morally better state can be achieved for people in the context of an enhancement, such as maintaining or restoring health, we can

[6] Kant, Immanuel: Kritik der Praktischen Vernunft. Stuttgart: Reclam. 2012. I, 1, §7. a.t.
[7] Kant, Immanuel (ed.): Grundlegung zur Metaphysik der Sitten. Meiner (Philosophische Bibliothek, 519). Hamburg 1999. 429, 10-12. a.t.

speak of the good. The aim of virtue ethics is to acquire an ethically good, virtuous character. The acquisition of such a character is both the result of and the condition for a good life. This good life is not to be seen individually, but in its social dimension.

Virtue ethics are characterised by the constant orientation of the will towards the morally and ethically good. The basic orientation towards the good applies in two respects: to the individual life and to the commitment to society and the state. It is not a question of individual self-realisation, but of people in their personal conduct of life and as social and political beings as described by Aristotle's concept of *zõon politikón*. What is right is teleology, the aiming for and working towards values. These are formed through justice, law and social norms.

The application of virtue ethics to human enhancement seeks an internalised, moral attitude, but does not develop a solution for current problems or specific individual cases. It can be a guideline for behaviour based on a catalogue of virtues.

4.3 Utilitarianism

Utilitarian ethics constitute a normative ethical theory that aims to increase the benefit of all, the general welfare, through individual or collective action. It views human action from the perspective of the goal and expediency in the sense of a means-end relationship.

Utilitarianism as a form of consequentialism comprises the main theories of act utilitarianism, negative utilitarianism and rule utilitarianism. Act utilitarianism evaluates the respective consequences of an individual action in terms of the greatest possible benefit. In negative utilitarianism, the criterion of evaluation is not the maximisation of benefit, but the reduction of suffering, such as injury or death of non-combatants or innocents. In rule utilitarianism, it is the reference to a rule, such as the protection of human rights or international law. The action is evaluated in terms of its morality by following the rule that is meant to maximise the benefit of all. Rules therefore play a central role in moral action.

The actual consequences of the action resulting from the pursuit are evaluated from the point of view of what is morally right and not which norm is morally good. However, what is morally right depends on the determination of an extramoral highest value. This is usually determined by the fact that people or society generally evaluate these values positively. When acting, the options that have the best consequences should be chosen. The benefit for the general public that an action brings is made the yardstick for its moral evaluation. Utilitarianism also evaluates the risk-benefit ratio. In its implementation, the principle of risk shifting often arises, i.e. the achievement of one's own benefit and the reduction of one's own risk is achieved by shifting it to others.

4.4 Application of philosophical ethics

The application of deontological ethics to human enhancement determines morally correct action based on norms or principles. It enables a thought connection between freedom, autonomy, norms, maxims, will and duty. They establish a connection between action and the person acting and thus make it possible to find criteria for moral action. The categorical imperative establishes a universal, duty-theoretical requirement based on two principles: generalisation and duty. According to Kant, the latter is an absolute, unconditional supreme moral principle that applies to all rational beings. However, it is not an instruction for action. Individuals must use their reason to recognise the correct principles of their actions and act accordingly. This also applies to enhancement.

The application of virtue ethics to human enhancement is based on an internalised moral attitude. Through their virtues, regardless of the content of the canon of virtues, people can recognise what is right and act accordingly. Virtues contain a disposition to ought. The ought results from the values of the respective society. The application of virtue ethics requires an individual decision or behaviour that corresponds to socially relevant norms, customs and demands. Virtuous behaviour also requires knowledge of the good. However, virtue ethics do not develop a solution for current problems or specific individual cases. They can be a guideline for behaviour based on a catalogue of virtues.

The application of utilitarianism to human enhancement considers the usefulness of consequences. The consequences for the person and society are evaluated. The basis for the evaluation is the consequence that results from decisions and actions. It should be noted that a large number of factors must be considered due to the complexity of the conditions and possibilities involved in deciding on an enhancement or its implementation. In addition, the assessment of benefits differs between cultures, regions and groups.

5. Faith-based ethics

Ethical and moral assessments of decisions and actions, such as enhancement, are also based on religiously established values in individuals and societies. In the course of the cultural development of the respective society, these have shaped the assessments with varying degrees of intensity. In many areas today, values that were previously considered correct are changing.

Christianity, Judaism, Islam, Hinduism, Buddhism and Atheism are covered below.

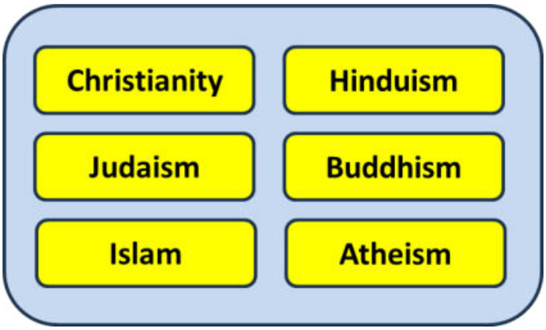

Figure 4: Faith-based ethics. Author's illustration.

5.1 Christianity

The Christian view of humanity is essentially shaped by the Bible and the revealed faith. It is of particular importance that man was created in the image of God. This is stated in Genesis 1:27: "So God created man in his own image, in the image of God he created him. He created them male and female."[8] As the image of God, man is a natural unity of immortal soul, spirit and body and possesses reason as well as freedom of will and action. He bears responsibility for shaping the world and thus for life and creation (Genesis 2:15). It says in the Bible (Genesis 1, 3:4-5): "[...] you will become like God and know good and evil".[9] As a result of the fall into sin, man is therefore able to distinguish between good and evil. This gives him the freedom to make decisions. However, he is also responsible for his actions. Man's likeness to God, which he lost through the fall of man, was restored through Jesus Christ. Through his grace and love, man once again became "partaker [...] of the divine nature" (2 Peter 1:4). However, the Christian view of man has changed over the centuries. The image of God remains a central concept of Christianity.

Since human beings are given freedom of will and action, they can develop in the spirit of likeness. The joint declaration of the Council of the Protestant Church in Germany and the German Bishops' Conference states, for example, that "The fact that human life is the gift of God does not exclude the possibility that man himself, acting, takes responsibility for life and shapes it. However, this can only be done with respect for the inviolable dignity that is assigned to human beings as an inalienable value, from their beginning to their end."[10]

The likeness of God and traditional Christian values and norms thus set the framework for possible enhancement. If this corresponds to the Christian conditions, the unity of mind and body based on nature, it is ethically acceptable. At the same time, the right to self-determination and human dignity must be respected.

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8 Die Bibel. Altes und Neues Testament. Einheitsübersetzung. Unter Mitarbeit von Bischöfe Deutschlands, Österreichs, der Schweiz, des Bischofs von Luxemburg, des Bischofs von Lüttich, des Bischofs von Bozen-Brixen (Auftrag). Stuttgart: Katholische Bibelanstalt 1980.

9 Ibid.

10 Gemeinsame Erklärung des Rates der Evangelischen Kirche in Deutschland und der Deutschen Bischofskonferenz (..): Gott ist ein Freund des Lebens, Herausforderungen und Aufgaben beim Schutz des Lebens. https://www.dbk.de/fileadmin/redaktion/veroeffentlichungen/arbeitshilfen/AH_076.pdf, accessed 10.05.2024, a.t.

In transhumanism, however, the natural unity of soul, mind and body is abolished. The human being and therefore the human mind and body are treated as a thing, in Kant's terms as a means and not as an end. This leads to the dualism of mind and body. Mind and body are seen as the result of human-directed evolution.

5.2 Judaism

In Judaism, man is understood in his unity as the image of God. Thus, it says in the Book of Bereshit of the Torah: "And God created man in his own image, in the image of God created he him; male and female created he them." This is confirmed again: "[...] for in the image of God he made man" and also in the following passage: "On the day that God created man - in the likeness of God he made him - he created them male and female, and blessed them and called their name Man, on the day that they were created."[11] This means that man is a person and must not be made a thing. With his creation, God also obliged man to obey the divine laws. Man is endowed with free will and can choose between good and evil. Since man is an image of God, he must not be placed on the same level as a thing. He remains a person with inalienable dignity and inalienable rights. Navon explains this:

> "Human dignity (kavod habriyot) is an ethical/legal category taken very seriously in Jewish thought, allowing for great leniencies to ensure that it is preserved. It entails honouring people as a'lhou, relating to them as a subject and appreciating their inherent worth simply as human beings."[12]

The way in which technology and AI are developed and used is significant and important in observing the Torah. Not everything that is possible is therefore morally and ethically permissible. This makes it clear that there are ethical and moral limits to the manner and scope of human enhancement.

[11] See Die Torah – eine deutsche Übersetzung. https://www.talmud.de/tlmd/die-torah-eine-deutsche-uebersetzung/, a.t.

[12] Navon, Mois: Autonomous Weapons Systems and Battlefield Dignity. In: Klinge, Hendrik/Kunkel, Nicole/Puzio, Anna (eds.): Alexa, wie hast du's mit der Religion? Theologische Zugänge zu Technik und Künstlicher Intelligenz. Darmstadt: Wissenschaftliche Buchgesellschaft (wbg) (Theologie und Künstliche Intelligenz, 1). 2023. p. 221.

Humans have limited freedom, not machines and cyborgs. The way in which technology and AI are developed and used is significant and important in observing the Torah. Not everything that is possible is therefore morally and ethically permissible. This makes it clear that there are ethical and moral limits to the manner and scope of human enhancement.

5.3 Islam

The foundations of Islam are the Qur'an, the Sunnah and the hadiths. The Qur'an is the most important foundation of Islam. As a revelation, it represents the unadulterated word of Allah. The Sunnah is based on the habits of the Prophet, which are attested to by word and deed. The hadiths refer to sayings of the Prophet that can be traced back to Muhammad via a chain of information. Regarding man, it says: "And surely We created man from clay, from black mud, moulded into a form" (15:26) and "And when I have finished him and breathed into him of My Spirit, fall down and bow down before him" (15:29). Man is a creature of God. As a creature of God, he is obliged to thank and obey his Creator. This obliges him to follow God's intentions. Man is described as God's representative.

Man was created strong on the one hand, "Surely We have created man in the best form" (Sura 95:4), and weak on the other, "Allah desires to lighten your burdens and man has been created weak" (Sura 4:28). Thus, he was also given the free will to distinguish between good and evil, whereby he stands between the possibility of free will and the regulations of Allah. This places limits on the type of enhancement he can choose. A person's decision of will in favour of enhancement must not violate the commandments of Allah. This would not only violate the commandments of Allah but would also be morally wrong. Man has the opportunity and an obligation to develop further. He is equipped with many abilities for this purpose. This gives man the opportunity to improve his condition and strive for perfection. Man should cultivate his self and maintain moderation, as the Qur'an says: "[...] certainly He does not love the intemperate" (Sura 7:31).

The importance of human life is emphasised in Sura 5:32: "[...] whoever kills a human being, except (that it is in retaliation) for murder or corruption on earth, it is as if he had killed all human beings." In this context, the question arises as to whether, in the context of transhumanism, the development of a cyborg should be regarded as killing a human being. However, it also states:

> "Every event in the world is therefore a creative act of God. Man's awareness that he can act freely and is responsible for his actions does not speak against this, because this is also a moment in God's world plan: God has already taken everything into account in his providential management of the world."[13]

This would also open up the possibility of comprehensive human enhancement, as God has also provided for this in his world plan. The extent to which the various religious scholars and denominations of the Sunnis, Shiites or Wahhabis agree with this has not yet been determined.

5.4 Hinduism

Hinduism is a religious social system with rites, religious customs, holy books, rules and social conditions. It sees people as members of a caste. It has no creator god for man or founder of a religion such as Christianity, Judaism, Islam or Buddhism. There are a large number of gods. The main gods are Brahma, who created the world, Vishnu, who sustains the world, and Shiva, who destroys the world before it is recreated.

> "Hindu theology recognises the principle unity of God, but understands him under very different aspects that allow us to see the differences in the unity: God is transcendent (*para)*, embodied (*vibhava)*, incarnate (*avatära*), indwelling as an individual soul (*an-taryämin*), present in the divine image (*arcä)* or creating the world out of himself (*srsti*)."[14]

There is no punishing God in Hinduism. After the rebirth of the soul, a person's deeds in the present determine their later fate and their position in society.

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13 Glasnapp, Helmuth: Die fünf Weltreligionen. Hinduismus, Buddhismus, chinesischer Universismus, Christentum, Islam. Sonderausg. Kreuzlingen. Hugendubel (Diederichs, 170). Munich 2001. pp. 408-409.

14 Hierzenberger, Gottfried: Der Hinduismus. 1st ed. Wiesbaden: Marix Verlag (marixwissen). 2011. https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=6266169. p. 82, a.t.

Dharma is an essential element of Hinduism. Dharma refers to the eternal law of the world. "It manifests itself as *natural* order, *moral* order and *magical-ritual* order".[15] An essential element is the observance of the duties of the castes. People are required not to accumulate bad dharma and to achieve good reincarnation through good deeds.

Dharma is essential for people. Their life is determined by it and they can shape their own destiny. Thus, it can be stated:

> "The eternal law (*dharma)* is effective in all things and beings. It manifests itself as *natural* order, *moral* order and *magical-ritual* order. For many Hindu systems of thought and religion (classical *Samkhya, Mimamsa, Jainism, Buddhism,* etc.), *dharma is* the eternal law of the world, upon which the gods are also dependent. "[16]

"*Dharma* means duty, justice, virtue. Like Western 'morality', it refers to both religious and social duties of conduct. "[17] People must be careful not to build up bad karma by giving in to the desires of the ego without restraint. This also applies to possible enhancement.

Hinduism's view of man is characterised by a mystical devotion to the *One* and an integration into the social structure. It is related to individuals in their endeavours for their individual self (*atman*) and thus the awareness of their self around the real objects of their being.

As Hinduism is not a uniform religion with a central authority, such as the Catholic Church, the development potentialities of individuals are largely determined by the caste environment or social stratification. Despite being integrated into a caste that regulates many areas of life, the individual is nevertheless able to lead a self-determined moral life. This results in different development potentialities, which are also reflected in the context of human enhancement.

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15 Ibid., pp. 105-106, a.t.

16 Ibid., a.t.

17 Hawkins, Bradley K./Wilson, Brian/Shattuck, Cybelle/Elias, Jama, J./Cohn-Sherbok, Dan: Die fünf Weltreligionen. Geschichte, Lehren, Perspektive. HOHE GmbH. Freiburg 2008, p. 270, a.t.

For Hierzenberger, the development of the human being is a constant task, which is first and foremost a spiritual development, but also affects the body. Hierzenberger quotes from the Purna Juga by Sri Aurobingo Gosh (1872-1950), a philosopher, Hindu mystic, yogi and guru:

> "The history of evolution is not yet over. Reason is not the last word and the rational animal is not the highest form of nature. Just as man emerges from the animal, so the super-human [Übermensch] emerges from man [...] the supernatural man is the luminous transcendent goal of our human race."[18]

The emergence of the "Übermensch" from the human is a connection to Nietzsche's statements on the super-human. This provides a possible path for enhancement.

Hinduism does not make any statements on human enhancement or transhumanism. It can be assumed that the corresponding answers differ in the various forms of religion. It can be assumed that Hinduism takes a more positive attitude towards human enhancement in the broadest sense than Christianity, for example.

5.5 Buddhism

Buddhism's view on man differs fundamentally from the Western Christian view on man. In contrast to the Western Christian view of man, it considers man to be fundamentally good. The decisive factor is that Buddha does not have the position of a god or a messenger of God.

The core of Buddhist teaching, as in Hinduism, is the dharma, the teaching of the factors of existence. These factors also enable people to develop further in the sense of human enhancement. This further development primarily relates to their mental and spiritual sphere but does not exclude their physicality.

In Buddhism, a person is defined by several elements.

[18] Hierzenberger, Gottfried: Der Hinduismus. 1st ed. Wiesbaden: Marix Verlag (marixwissen). 2011. https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=6266169. p. 144, a.t.

"For the Buddhist a person is a conglomeration or 'aggregate' of five elements that give rise to the 'notion' of a person: (1) matter, or body (*rüpa*), the manifest form of the four elements - earth, air, fire and water; (2) sensations, or feelings (*vedanā*); (3) perceptions of sense objects (Sanskrit: *samjnā/Päli*: saññā) (4) mental formations (*samskāras/sankhäras*); and (5) awareness, or consciousness, of the other three mental aggregates *(vijñānalviññāna)*."[19]

The elements of matter or body, sensations or feelings and perceptions of sensory objects are important in the context of human enhancement. This also enables people to develop further in these areas.

With the possibility of personal development without being bound to the likeness of a god, Buddhists have more options for human enhancement than members of monotheistic religions.

5.6 Atheism

Atheism refers to the absence, denial or rejection of the existence of a personal God, gods or the divine and the imprint of a religion on humanity. It is the negation of God. The human being is not seen in the natural unity of body and spirit. Body and mind are understood as objects of development and for further development. This also eliminates the natural law justification of human rights. The mind is not seen as God's creation, but as the result of permanent evolution and improvement. This leads to a process of selection.

According to Feuerbach, God did not create man; God is a creation of man.

"For God did not create man in his own image, but man created [...] God in his own image. [...] Every God is a being of the imagination, an image, and indeed an image of man, but an image that man sets outside himself and imagines as an independent being."[20]

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[19] Soni, Jayandra: Some Aspects of Being Human in Indian Thought. In: Oberprantacher, Andreas/Siegetsleitner, Anne (eds.): Beiträge zum 10. Internationalen Kongress der Österreichischen Gesellschaft für Philosophie in Innsbruck 2017, pp. 121-122. https://library.oapen.org/bitstream/id/1a3c8579-cf59-43d1-9af8-79be3b6ca6d4/10.152033122-79-6.pdf.

[20] Feuerbach, Ludwig: Sämtliche Werke, Vorlesungen über das Wesen der Religion, nebst Zusätzen und Anmerkungen, Vol. 8. 1851. XX, 241, a.t.

God is therefore a projection of man. The image of God thus reflects humanity's ideas about their perception of mind and body. They are therefore not dependent on the specifications of a god but can shape themselves. They can also determine the nature and extent of their self-design. Thus, according to Feuerbach, they can develop towards perfection. "The pure, perfect, flawless divine being is the *self-consciousness of the intellect, the consciousness of the intellect* of its *own perfection*."[21]

Nietzsche writes in *Die fröhlichen Wissenschaften*: "Where is God? he cried, I will tell you! We have killed him - you and I".[22] Elsewhere he writes: "When Zarathustra was alone, he said to his heart: Should it be possible! This old saint has heard nothing in his forest that God is dead!"[23] Under these conditions, man should strive for higher things and develop into a "super-human" who shows courage, toughness and uncompromising action by destroying weaknesses and being a servant. Further development is therefore a *conditio sine qua non* for man's striving for perfection.

Atheism rejects all beliefs and religions. It also rejects the ethical and moral conditions and dogmas of religions. Instead, in Western culture, morality is based on human nature and education in the terms of the Enlightenment. Theological approaches are thus pushed back. With the rise of materialism and proletarian atheism in the form of dialectical and historical materialism, economic and social atheism emerged alongside philosophical atheism. Practical atheism sees nature and science as a possibility for the benefit of mankind. It is about solving the problems of man and society. It serves as a condition for the possibilities of human self-development. As atheists do not have a monolithic structure or centralised organisation, it is not possible to classify the type and scope of views on human enhancement. However, it can be assumed that, as with religions, there are different views on the sub-

21 Ibid., Part One, Chapter Three, a.t.

22 Nietzsche, Friedrich: Die fröhliche Wissenschaft. In: Colli, Giorgio/Montinari, Mazzino (eds.): Sämtliche Werke: kritische Studienausgabe in 15 Einzelbänden. 3rd ed., third book. Dt. Taschenbuch-Verl.; De Gruyter. Munich, Berlin 2009, p. 125, a.t.

23 Nietzsche, Friedrich: Also sprach Zarathustra. In: Colli, Giorgio/Montinari, Mazzino (eds.): Sämtliche Werke: kritische Studienausgabe in 15 Einzelbänden. 3rd ed., fourth book. Dt. Taschenbuch-Verl.; De Gruyter. Munich, Berlin 2009, p. 14, a.t.

ject. These can and will be incorporated into the social discourse with regard to a possible view of society as a whole.

5.7 Application of faith-based ethics

The different religions and their schools of thought influence not only the concept of man and the associated objectives, but also the respective social discourse and thus the socio-ethical view in a society. The scriptures of religions such as the Bible, the Koran, the Torah or the Hindu and Buddhist scriptures do not make any statements on human enhancement. These would have to be derived from the scriptures and the historically developed interpretations.

An essential characteristic of the Abrahamic religions is their reference to God. They tend to view the nature of man, however it is seen, and his likeness to God, the derivation and content of which is understood differently, as the basis of their philosophy of life. This means that the production of man's natural abilities and the improvement of his abilities within his naturalness can be accepted. The Abrahamic religions are theocentric and less open to the possibilities of enhancement than, for example, Hinduism and Buddhism due to their relationship with God and their likeness to God.

Hinduism does not make any statements on human enhancement or transhumanism. It can be assumed that the corresponding answers differ in the various forms of religion. It can be assumed that Hinduism has a more positive attitude towards human enhancement in the broadest sense than Christianity, for example.

With the possibility of personal development without being bound to the likeness of a god, Buddhists have more options for human enhancement than members of monotheistic religions.

Atheism fundamentally enables human enhancement within the framework of society's value and legal structures. Its ethical and moral principles therefore offer the broadest possibilities for human enhancement.

However, some problems arise with ethical and moral judgements based on religion, such as the is-ought problem. An is-ought problem ("Hume's Law") occurs when it is deduced from the real existence, e.g. a person at a certain time in his/her existence, that he/she also should exist in this form. This means that no norms can follow from facts, or no statements of ought can follow from statements of existing, i.e. the conclusion of ought follows directly from the premise of existing. This results in the relativity of the validity of ethical and moral norms that are based on a religion. Under these aspects, the premises and statements on ethical and moral norms can only be based on values shared within the respective culture and society.

6. Impact on the armed forces

The further development of artificial intelligence will have an impact on many areas of the military. These include, for example, situation assessment processes, military command processes, the development and deployment of weapon systems, use in cyber and hybrid warfare. It can be assumed that wars of all kinds will be waged in the near future. This also means that weapon systems will be further developed according to technical possibilities. At the same time, soldiers will have to adapt to the new challenges. The following can be stated: "Future wars will be won, not by those with the most advanced technology, but by those who can most effectively integrate the unique capabilities of both people and machines."[24] It therefore depends on the improvement of weapon systems, the improvement of people and cooperation in the combination of man and machine. The extent to which adaptation can or should take place depends on a variety of factors. These include ethical and moral factors, the content and scope of which are determined by the respective societies. It must be borne in mind that the improvements affect the individual and therefore also the individual soldier, as well as society and the military.

Technological progress in the context of enhancement offers the armed forces the opportunity to increase human performance and give soldiers better capabilities in combat. These technologies have considerable potential for

[24] UK Ministry of Defence: Human Augmentation - The Dawn of a New Paradigm. A strategic implications project. Development, Concepts and Doctrine Centre (DCDC). Shrivenham, 2020, p. 11. https://modgovuk.sharepoint.com/sites/defnet/JFC/Pages/dcdc.aspx.

combat. However, their realisation has an impact on the individual soldier as well as on the unit.

In the hierarchical system of the military, the soldiers are subject to orders and commands. This partially restricts their autonomy and freedom in the realisation of their existence. Even if autonomy and freedom are restricted, soldiers still have free will. A distinction must also be made as to whether the soldier enlists voluntarily or has decided to serve as a professional soldier, regular soldier, volunteer or militia soldier, or has been drafted into the military as part of a conflict or war.

6.1 Human enhancement for soldiers

The pursuit of improvement can also affect soldiers. The basic framework conditions are similar to those in society as a whole. One major difference, however, is that the soldier must obey orders. The hierarchical system of the military, authority relationships and group cohesion have an influence. The acceptance of enhancement technologies can therefore have the effect of accepting improvements that would be rejected for personal reasons. This results in restrictions on the individual's ability to freely consent. This is an encroachment on personal autonomy.

By joining the military, the soldier commits to following the regulations. This also means that, to a certain extent, they must accept enhancement as part of their duties. The extent to which an order for human enhancement is morally justified in the case of compulsory military service in peacetime and conscription in the event of tension or war needs to be examined.

The extent to which the soldier must obey orders or has the option to legally disobey orders varies from state to state. There are states that require absolute obedience to orders and those that allow exceptions. An exception could be if the order violates human dignity or if obeying it would constitute a criminal offence.

Enhancement in soldiers has different effects on their person and their abilities. Latheef and Henske have established this:

> "Technological advancements have provided militaries with the possibility to enhance human performance and to provide soldiers with better warfighting capabilities. Though these technologies hold significant potential, their use is not without cost to the individual."[25]

This also means that the military has to deal with technical developments and incorporate them into its planning and developments. For example, a future analysis of the Bundeswehr states:

> "In terms of technology, future developments could lead to different HE approaches or combinations of HE and other - currently rather competing - technologies being combined and coordinated with each other. [...] Non-invasive HE technologies that serve the protection and survival of our soldiers should certainly be considered for their own benefit - taking into account ethically and legally justifiable aspects."[26]

The costs or effects for the soldiers depend on the type of enhancement. The framework conditions are decisive. These include whether certain enhancements may be ordered or whether the soldier's consent is required for the enhancements. In this context, the values and norms of the respective society are decisive.

Armed forces that do not make use of enhancement have potential disadvantages compared to those that do. This can lead to greater or lesser advantages in strategic, operational or tactical areas. Existing pressure to adapt forces other armed forces to carry out enhancement. This creates reciprocity.

The central ethical question of surgical management is whether people with a brain-computer interface (BCI) and possibly a cyborg should be allowed to make decisions about the life and death of real people. If these decisions are delegated to algorithms and machines, this contradicts the dignity of those affected. The extent to which the use of these technical possibilities can still be acceptable needs to be examined.

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25 Latheef, Sahar/Henschke, Adam: Can a Soldier Say No to an Enhancing Intervention? Philosophies, 2020, p.5, 13. https://doi.org/10.3390/philosophies5030013.

26 Planungsamt der Bundeswehr (ed.): Streitkräfte, Fähigkeiten und Technologien im 21. Jahrhundert. Human Enhancement. Eine neue Herausforderung für Streitkräfte? Berlin 2013, p. 10, a.t.

6.2 Soldiers and ethics

The military environment and integration into ethical and moral frameworks are crucial for soldiers. They reside within their cultural and societal spheres.

> "For the military of Western democratic provenance, the good is accordingly the functioning constitutional state, its organisations and institutions that protect the lives of citizens and steer them onto predictable, just paths in the broadest sense."[27]

Ertl states this for Austria:

> "In Austria, the military is functionally interwoven with society due to the militia system and is therefore a democratically controlled political instrument embedded in society. The ÖBH is therefore a subsystem of Austrian society. It is embedded in it and at the same time derives its legitimacy from its potential vulnerability to action in a state of emergency."[28]

The soldiers also live and fight in their unit. This creates an *esprit de corps*, a camaraderie, and leads to a sense of community. Thus, it can be said:

> "Unit cohesion is founded on social relationships, shared experience and training - it is a critical part of the willingness to fight. Human augmentation has the potential to change the foundations of unit cohesion and could, if not handled carefully, undermine it. For example, differing levels of augmentation within units could introduce stigma, suspicion or resentment of enhanced personnel."[29]

A key consideration is the extent to which soldiers can maintain autonomy and freedom within the military structure.

The acceptance of an enhancement also depends on how the person is accepted in the military and on the necessity of carrying out a mission. There is a dynamic relationship between person, enhancement and mission, which

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[27] Ertl, Paul: Die Krise, die Ethik und das Österreichische Bundesheer: Eine militärphilosophische Legitimation des Militärischen im Ausnahmezustand. In: Ertl, Paul (ed.): Ethik in der Krise. Vienna: National Defence Academy (13/2020), p. 7.

[28] Ibid., p. 11.

[29] UK Ministry of Defence: Human Augmentation - The Dawn of a New Paradigm. A strategic implications project. Development, Concepts and Doctrine Centre (DCDC). Shrivenham 2020, p. 66.

can be conflictual. In this context, the possibility of being able to reject an enhancement plays an important ethical role.

Any enhancements a soldier undergoes must first be evaluated based on their functional necessity and personal implications within the military context. Upon conclusion of service, these enhancements should be assessed against societal norms and criteria. These may differ significantly from those of the military:

> "In addition to preparing personnel for operations they will need to be prepared for life after the military. For example, the use of invasive human augmentation may require surgery to remove or downgrade implants that may not be permitted in civilian life. Reintegration in society could be complicated from a technical perspective but learning to live without military-grade augmentations could present even bigger mental health challenges."[30]

When introducing enhancement to soldiers, this already requires a determination of the framework conditions for the possible restoration of the original capabilities and framework conditions.

Ethical decision-making and moral action within the military sphere are based on extensive factors and prerequisites. One of these factors are the military ethics of the respective state.

Military ethics are not about ethics that are detached from the political and social ethos. In a free and democratic society, it is not about the independence of military ethics, but about ethics that meet the special challenges of the military profession.

> "Military ethics, in general, establish a normative standard specifically for armed forces personnel who are authorised to use force on behalf of the state. [It is] an ethic that relates to the nature, content, value and impact of morality in a military context. In this sense, military ethics encompass both the conceptual formation of a scientific theory and applied ethics, including casuistry."[31]

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[30] UK Ministry of Defence: Human Augmentation - The Dawn of a New Paradigm. A strategic implications project. Development, Concepts and Doctrine Centre (DCDC). Shrivenham 2020, p. 66.

[31] Peperkamp, Lonneke et. al.: Kernthemen europäischer Militärethik. Edited by Zebis Centre for Ethical Education in the Armed Forces. (Ethik und Militär, 02/2023). Hamburg 2023, p. 4. https://www.ethikundmilitaer.de/kernthemen-europaeischer-militaerethik.

The legal system is of paramount importance for the actions of the armed forces and their members. The constitution of the democratic, liberal constitutional state forms the framework and conditions and is an essential basis for military ethics within the armed forces. Fundamental rights and freedoms are the cornerstones of mission fulfilment.

Political, social and technological values are changing. This has an impact on soldiers. It is important for the army leadership and superiors to react to these changes early and actively and to take the necessary measures for the army. This also applies to the questions posed on using human enhancement.

Soldiers, especially the leaders, are duty bearers in the field of ethics due to their responsibility within the state executive. It is about the fundamental ethical questions to which military ethics should make a significant contribution.

A soldierly profession and soldierly ethos are determined - differently in the armies - by values. For soldier, several values are important in their self-image. With regard to enhancement, these are essentially the following: ability to fit in and cooperate within the unit, obedience, integrity, esprit de corps, human dignity, moral judgement, courage, performance of duty, observance of the law, bravery, moral courage and a sense of responsibility, as well as virtues defined in a possible virtue catalogue. This means that a wide range of factors must be taken into account when deciding upon enhancement. The individual remains responsible. Navon explains:

> "In order to make a moral judgement to take a life, while respecting human dignity, it is minimally required that a moral agent can (1) recognise a human being as a human, not just distinct from other types of objects and things but as a being with rights that deserve respect; (2) understand the value of life and the significance of its loss; and (3) reflect upon the reasons for taking life and reach a rational conclusion that killing is justified in a particular situation."[32]

[32] Navon, Mois: Autonomous Weapons Systems and Battlefield Dignity. In: Klinge, Hendrik/Kunkel, Nicole/Puzio, Anna (eds.): Alexa, wie hast du's mit der Religion? Theologische Zugänge zu Technik und Künstlicher Intelligenz. Darmstadt: Wissenschaftliche Buchgesellschaft (wbg) (Theologie und Künstliche Intelligenz, 1). 2023, p. 210.

Regarding an ethical assessment of enhancement measures, it is crucial whether there is an acceptable risk-benefit ratio and autonomous consent of the person concerned.

The question of the development and use of human enhancement in the military can be based on philosophical, religious and social values and norms. Morality can be tested with the help of questions regarding the introduction and application. The following test questions can be used for this purpose:

- Are autonomy, freedom, human dignity and human rights respected?
- Is the exercise of military virtues and values impaired?
- Are the military profession and ethos respected?
- What rules apply and determine the decision?
- Are these rules consistent or do they contradict each other?
- Do these rules apply to the present situation?
- What are the consequences of the intended decision?
- Is the proportionality of enhancement and resources observed?
- Are non-combatants and innocents spared?
- Do the decisions and actions achieve the intended protection of people?

These test questions can be used to ethically evaluate decisions and actions regarding human enhancement. Uncertainties in the assessment may arise from the real internal and external conditions of the potential decision and action, which are unavoidable. Absolute certainty in the evaluation of moral action may be possible in theory but cannot be achieved in practice.

7. Summary

Human identity is shaped by the interaction of mind, will and nature. The purpose (telos) of an individual guides the principles of their design and their potentialities.

It is about the human being and thus about the concept of man.

In the religions of Christianity, Judaism, Islam, Hinduism, Buddhism and atheism, which is counted as a religion here, the concept of humanity is different.

Societies have different perceptions of norms, values and the position of people and the individual within them. Individual-oriented societies are opposed to community-oriented societies and authoritarian societies are opposed to liberal societies. This shapes the awareness of the people living in the respective society and thus also their possible assessment of enhancement.

The increasing possibilities of using algorithms, the internet and the Internet of Things (IoT) enable the development of non-invasive and invasive technologies and their application on or in humans. As a result, data and their generation are becoming increasingly important. If they become the basis of a brain-computer interface (BCI) or a man-machine system (MMS) in trans- and post-humanism, such as in a cyborg, they will influence human behaviour. In this way, they influence or determine ethical and moral concepts of enhancement.

7.1 Evaluation of enhancement

For an ethical and moral evaluation of enhancement, the human being, the person, the concept of the naturalness of the human being, the idea of a machine in connection with a machine-human being and the nature of medical and technical systems are relevant. For the ethical and moral evaluation of enhancements, concepts of essence, i.e. that which is peculiar to human beings, such as autonomy, dignity and freedom, as well as risk-benefit assessment, appear to be appropriate. Norms in their manifold definitions influence an evaluation.

When assessing enhancement from a philosophical perspective, deontology, virtue ethics and utilitarianism can be essential foundations:

Deontology with Kant's Categorical Imperative, the concept of man and person, the understanding of law and the concept of duties form the framework and guideline. Virtue ethics provide a framework directing the will towards the good, internalising basic attitudes within individuals and societies, including the military. Utilitarianism offers a rational approach, particularly in forms such as trade and regulatory utilitarianism. However, this requires a society, state or cultural group to establish a broad consensus on rules. Rule utilitarianism can be globally compatible given the will and opportunity for discourse, yet it is crucial to acknowledge that power dynamics influence such discourse and ethical principles. Commercial and legal forms of utilitarianism are suited to practical moral evaluations, incorporating elements from deontology and virtue ethics. It is important to consider that societal norms and values shape attitudes towards enhancement.

In this context, it should also be noted that not only rational justifications, but also emotional dispositions influence people's judgement.

The ethical and moral framework conditions, as defined by political, social, religious and philosophical ideas, can be applied to the methods of human enhancement. Not everything that is medically possible is ethically justifiable. If we consider the possibilities of behavioural enhancement, neuroenhancement, technical enhancement, genetic enhancement and transhumanism from these perspectives, we find guidelines that can be applied when making a decision on enhancement. If the philosophical, religious and social dimensions are analysed based on previous explanations, three categories of enhancement measures can be defined: ethically and morally unacceptable, acceptable and indifferent. This classification can be a sufficiently precise way of evaluating human enhancement.

Accordingly, the following enhancement measures are ethically and morally unacceptable:

- restrict autonomy, dignity and fundamental human rights
- take away the freedom to decide on enhancement
- involve brain-computer interface (BCI) methods, a man-machine system (MMS) or a cyborg which is used to determine human decisions
- are invasive and permanent
- force people to agree to enhancement through political, socio-political and group political measures
- violate the principles of equality and justice.

Ethically and morally acceptable measures are those that are freely decided by the person concerned. They:

- prevent or alleviate suffering
- restore lost skills
- let people cope with difficult tasks
- are essentially available to all within a society
- are non-invasive and reversible
- comply with autonomy, dignity and basic human rights.

Ethically and morally indifferent are measures that:

- do not change anything about being human and a person
- enable the use of systems in an improved form
- offer protection from threats and death.

Based on the norms and values of a society, a jointly shared list of criteria and test questions could provide practical guidelines for the development, decision and implementation of human enhancement measures.

The introduction and use of human enhancement should be based on clear, ethically justifiable objectives. Society should identify its values in a discourse and apply them in the context of human enhancement. Particular interests, such as economic interests aimed at maximising profits, must not determine this discourse. It must be based on ethical and moral categories. Moral action presupposes deliberate action, the freedom to choose between different alternative courses of action, the ability to assess one's own consequences and the perception of a personal identity (in relation to oneself and others). Only when these conditions are met can one assume moral action.

7.2 Conclusions and recommendations

Conclusions and recommendations for the social and military sector arise from the examination of human enhancement. In the context of the approach discussed here, these include ethical and moral issues.

The following conclusions can be drawn – there is a need for:

- the identification of attitudes, perspectives, reactions, acceptance and readiness of politics, society and the military towards ethically controversial issues with social and regulatory implications
- a discussion in the individual areas of society on human enhancement, and
- the development of a multi-generational shared understanding of norms and values.

After considering the conclusions, the following recommendations are proposed for the military sector:

- adaptation of Austrian Armed Forces' (ÖBH) military ethics to the new challenges
- development of a curriculum and teaching materials related to human enhancement
- integration of ethical principles regarding human enhancement in the training of leaders
- adaptation of the principles of use to the enhancement systems.

People's desire to improve their environment, their living conditions and themselves requires future-oriented ideas and objectives. The demands for human enhancement from different areas of life call for an ethical examination of the fundamental questions of human existence.

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Human enhancement for military purposes: Ethical considerations

Lisa Tragbar, Rodrigo Lagos Berríos

Abstract

The concept of "super soldiers", whose capabilities are modified by NBIC technologies (nanotechnology, biotechnology, information technologies, and cognitive sciences) to enhance their performance, raises ethical challenges about the future of warfare.

In this article, we first philosophically examine definitions of human enhancement (HE) and then provide an overview of selected ethical barriers related to its use. We conclude by reviewing ethical challenges that should be considered when evaluating HE for military purposes.

1. Introduction: A thought experiment

Imagine yourself fighting on the front lines as a super soldier. Your superhuman sense of smell allows you to detect substances such as iron, steel, gunpowder, and other materials. Just a few weeks ago, you acquired this extraordinary ability by undergoing nasal surgery that employed advanced nanotechnology, enhancing your olfactory capabilities beyond those of trained detection dogs. Now, your new capabilities provide your military unit with substantial advantages on multiple levels: improving operational planning, reducing expenditures on costly equipment, and even facilitating more humane warfare. Your sense of smell enables you to detect enemy explosives from hundreds of meters and kilometres away. You can now determine the direction of the enemy and the number of armed combatants solely by scent. Even if you are not deployed on the front line, you can detect mines left behind in minefields, rendering the use of mine detection dogs or expensive technologies obsolete. Moreover, your skills foster creative problem-solving and contribute to ethical warfare. Since you can now more easily distinguish between armed combatants and unarmed individuals, you can adhere to the distinction principle outlined in the Geneva Conventions with greater precision. You and your enhanced capabilities have thus become essential components of a modern and ethically responsible military strategy.

The thought experiment of the super soldier may initially seem like science fiction since the described nanotechnology enabling a superhuman sense of smell does not align with current technological realities. Furthermore, it overlooks numerous practical and labour-related issues. Nevertheless, this scenario effectively highlights the strategic military advantages linked to human enhancement (HE) in the context of defence. It appears that some technologies are already being implemented to enhance military capabilities.[1] In this study, we will critically examine the ethical limitations surrounding the use of HE for military purposes.

Particularly the transhumanist (TH) thinkers, a school of thought[2] aiming to expand the boundaries of humanity by enhancing human capabilities, show a particular interest in HE. Natasha Vita-More illustrates the potential advantages of HE vividly:

> The body, as we transform ourselves over time, will take on different types of appearances and designs and materials. (…) For hiking a mountain, I'd like extended leg strength, stamina, a skin-sheath to protect me from damaging environmental aspects, self-moisturizing, cool-down capability, extended hearing and augmented vision (…) For a party, I'd like an eclectic look - a glistening bronze skin with emerald green highlights, enhanced height to tower above other people, a sophisticated internal sound system so that I could alter the music to suit my own taste, memory enhance device, emotional-select for feel-good people so I wouldn't get dragged into anyone's inappropriate conversations. And parabolic hearing so that I could listen in on conversations across the room if the one I was currently in started winding down.[3]

Vita-More's example does not emphasize currently available technologies; instead, she presents a forward-looking vision of potential technologies used

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1 See Gabatt, Adam: China conducting biological tests to create super soldiers, US spy chief says. In: The Guardian, 04.12.2020, https://www.theguardian.com/world/2020/dec/04/china-super-soldiers-biologically-enhanced-john-ratcliffe, accessed 29.04.2024; BBC: France to start research into 'enhanced soldiers', 09.12.2020, https://www.bbc.com/news/world-europe-55243014, accessed 29.04.2024.

2 We do not describe TH as a philosophical movement per se, although it does raise many philosophical questions.

3 Vita-More, Natasha: Who are transhumans? http://www.transhumanist.biz/interviews.html, 2000, accessed 07.04.2024, p. 5.

for HE purposes: "Human enhancement technologies include biotechnology, nanotechnology, information technology, and cognitive and neuro sciences."[4] Coeckelbergh and other TH-critical researchers also support the definition of HE as a vision facilitated by NBIC technologies.[5]

Drawing an analogy to Vita-More's statements, similar applications of HE might become relevant within a military context. Whereas Vita-More envisions shimmering skin as a social aesthetic, the military could leverage HE to achieve strategic superiority over adversaries. The objective could indeed be the creation of super soldiers, like the one described in our thought experiment, capable of optimally utilizing their enhanced capabilities in combat scenarios. Who would not desire to climb mountains faster through genetically improved stamina, possess bulletproof skin instead of relying on heavy body armor, have bionic eyes for superior night vision, possess hearing capable of intercepting enemy communications from hundreds of meters away, or develop an advanced sense of smell to detect hazardous substances? Relevant applications of HE for military purposes primarily relate to defense, focusing on equipping soldiers for optimal operational performance. This includes physical enhancements for improved combat capability, endurance, strength, and agility, as well as cognitive enhancements like increased resilience, stress tolerance, and enhanced information-processing capacities. Additionally, HE might support redeployment capabilities.[6] The range of HE applications within security policy is extensive, encompassing cognitive, physical, and genetic modifications.

The initial objective of this article is to critically interpret definitions of HE. The second objective is to provide an overview of ethical challenges that arise when enhancing soldiers through NBIC technologies. To determine the ethical barriers that should guide the military use of HE, we will categorize these technologies and present an analysis of associated ethical issues.

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4 See More, Max/Vita-More, Natasha: The Transhumanist Reader, Oxford/New York 2013, p. 25.

5 See Coeckelbergh, Mark: Cyborg humanity and the technologies of human enhancement. In: Philosophy: Technology, Macmillan Interdisciplinary Handbooks 2017, p. 143.

6 See Garren, David J.: Dirty Hands and Clean Minds: On the Soldier's Right to Forget. In: Journal of Military Ethics, Vol. 21 (2)/2022, pp. 162-182. https://doi.org/10.1080/15027570.2022.2109314.

2. About the role of HE in philosophical and ethical debates

Ethics involves the study of moral principles and values that guide human behavior. However, universal ethical frameworks, such as deontology, encounter limitations when applied to emergency scenarios. War, understood as a state of emergency, falls within the realm of emergency ethics.[7] Under specific conditions, emergency ethics can permit actions that deontological principles typically prohibit, such as lying or killing.

Applied ethics refers explicitly to the application of ethical principles to specific domains of human life, such as medicine, technology, economics, or the environment. Its primary aim is to establish practical connections and to highlight responsibilities among different fields and stakeholders. It is important to distinguish clearly between the subject areas of applied ethics and their underlying theoretical frameworks. Military ethics, for instance, can be analysed through virtue ethics, deontological, or utilitarian approaches, as discussed by Budde and Pickl.[8] In this article, we will focus exclusively on the research fields within applied ethics. As illustrated in the following figure, technologies used for HE purposes lie at the intersection of medical ethics, military ethics, and technology ethics:

[7] See Walzer, Michael: Emergency Ethics. In: Walzer, Michael: Arguing about war. New Haven 2004.

[8] See Budde, Dieter/Pickl, Stefan: Human enhancement – An ethical perspective. In chapter ETHICS in this publication.

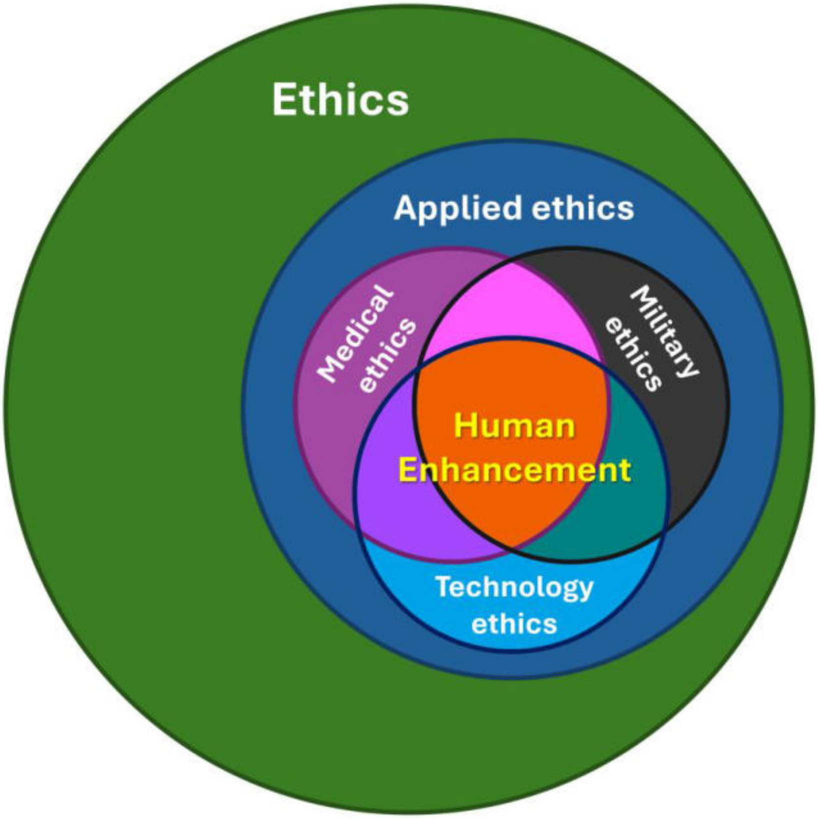

Figure 1: Human enhancement as an overarching subject area of applied ethics.
Illustration: LVAk/IFK, based on author's illustration.

It is the task of applied ethics to engage in discussions about the future of military ethics and to identify issues within the intersection between medical ethics, technology ethics, and military ethics. Military ethics is an area of applied ethics specifically concerned with the moral dimensions of military operations and decision-making within the military profession. Technology ethics addresses ethical implications and responsibilities related to the development, distribution, and utilization of technologies. Medical ethics pertains to ethical principles, guidelines, and debates emerging from medical practice and research, encompassing issues such as patient rights, medical decision-making, organ transplantation, medical experimentation, euthanasia, and – relevant to the context of HE – genetic engineering.

HE intersects to varying degrees with each of these areas. Military ethics examines moral principles that justify or constrain warfare, particularly within conflict scenarios.[9] It frequently finds itself in tension between moral idealism and political realism. Realists argue that moral principles frequently cannot be consistently upheld, emphasizing that the realities of war are governed not by morality but by interests, power dynamics, and realpolitik. According to this perspective, moral principles cannot be consistently applied in wartime, as they fundamentally conflict with the realities of armed conflicts. Realist arguments often justify violence by portraying opponents as immoral and presupposing the necessity of at least an equal level of force. Similar reasoning could be used in evaluating and implementing HE measures in warfare. While recognizing the practical realities of warfare and potential implications for (inter)national security and stability, military actions must nevertheless adhere to moral principles, including international law and established war ethics, rather than simply responding to economic or political pressures. This tension between realism and moralism brings forth the classic 'is-ought' problem, which emerges from the realist view challenging the application of moral principles to warfare.[10] The ethical question of how HE can be morally implemented for military purposes intersects with broader issues of technology ethics, particularly addressing the value alignment problem – how technologies can be designed in accordance with moral values. Although this article will not be able to resolve either the realism dilemma or the value alignment problem, it will identify ethical barriers and categorize ethical challenges arising from the use of HE within military, technological, and medical contexts.

To date, research on ethical issues at the intersection of these subject areas remains limited. Although there is considerable literature available from psychological, economic, military, technological, and medical ethics perspec-

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9 Particularly the Just War Theory, which is one of the biggest fields of research within war ethics, is based on the premise that the use of violence in war can be justified if certain conditions are fulfilled. See Frowe, Helen: The Ethics of War and Peace. An Introduction, New York 2015.

10 See Lazar, Seth: War. In: Edward N. Zalta (ed.): The Stanford Encyclopedia of Philosophy, 2016, https://plato.stanford.edu/entries/war, accessed 29.04.2024.

tives, empirical studies[11] and philosophical publications on HE are sparse.[12] Techno-philosophical discussions on HE largely reference TH[13] and include debates among scholars such as Bostrom, More, Vita-More, Kurzweil, and Savulescu. In contrast, bioconservative thinkers such as Habermas, Kass, Fukuyama, and Annas raise critical ethical concerns, notably regarding genetic engineering technologies like preimplantation diagnostics or stem-cell research.[14] There remains a clear need for further ethical analysis, and subse-

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11 Fiore states that empirical studies on HE are increasing in the field of psychology. See Fiore, Stephen M./Salas, Eduardo/Pavlas, Davin: A view on the history of use-inspired science in human performance research. In: O'Connor, Paul E./Cohn, Joseph V: Human Performance Enhancement in High-Risk Environments: Insights, Developments, and Future Directions from Military Research. Santa Barbara, CA 2017, p. 13, there is a widely criticised lack of empirical studies on the effects of technologies and drugs used for HE purposes. See Walsh, Adrian/Katinka Van de Ven: Human Enhancement Drugs and Armed Forces: An Overview of Some Key Ethical Considerations of Creating 'Super-Soldiers'. In: Monash Bioethics Review, Vol. 41 (1)/2023, pp. 22-36. https://doi.org/10.1007/s40592-022-00170-8.

12 See Allenby, Braden R.: The Implications of Emerging Technologies for Just War Theory. In: The Applied Ethics of Emerging Military and Security Technologies, 2015, pp. 3-21; Davidovic, Jovana/Crowell, Forrest S.: Operationalizing the Ethics of Soldier Enhancement. In: Journal of Military Ethics. Vol. 20/2021, pp. 180-199, https://doi.org/10.1080/15027570.2021.2018176; Goodley, Héloise: Performance enhancement and the military. Exploring an ethical and legal framework for 'super soldiers', London 2020; Henschke, Adam: Super soldiers: Ethical Concerns in Human Enhancement technologies. In: Analysis / Law and Conflict / New Technologies. 2017. https://blogs.icrc.org/law-and-policy/2017/07/03/supersoldiers-ethical-concerns-human-enhancement-technologies-2/, accessed 07.05.2024; Švaňa, Lukaš: (Military) Human Enhancement – Ethical Aspects. In: Human Affairs, Vol. 27/2017, pp. 155-165. 10.1515/humaff-2017-0014; Van Baarle, Eva M./ Damsté, Carlijn/ Bruijn, Sanne A.J. de/ Bakx, Gwendolyn C.H.: Moral Issues in Soldier Enhancement: Military Physicians' Perspectives. In: Journal of Military Ethics, Vol. 21 (3-4)/2022, pp. 198-209, DOI: 10.1080/15027570.2023.2175861; Van Baarle, Eva M./Molendijk, Tine: Resilience as the Road to Mental Readiness? Reflections from an Ethics-of-care Perspective. In: Journal of Military Ethics, Vol. 20/2021, pp. 129-144; Walsh, Adrian/Katinka Van de Ven: Human Enhancement Drugs and Armed Forces: An Overview of Some Key Ethical Considerations of Creating 'Super-Soldiers'. In: Monash Bioethics Review, Vol. 41 (1)/2023, pp. 22-36. https://doi.org/10.1007/s40592-022-00170-8.

13 See Vita-More, Natasha: The Transhumanist Manifesto. 1983. https://www.humanityplus.org/the-transhumanist-manifesto, accessed 29.04.2024.

14 See Kass, Leon R.: Beyond therapy: Biotechnology and the Pursuit of Happiness. Executive Office of the President. Washington, DC. 2003.

quently, normative guidelines, that explicitly address HE as a factor in security policy.

3. A critical philosophical assessment of 'human enhancement'

How should HE be defined, and what challenges arise within the concept? These definitions raise philosophical issues: the distinction between performance and skill, illness and health, human enhancement and human augmentation as well as the existence of specific "HE technologies". This section critically evaluates several definitions of HE from a philosophical standpoint, highlighting the inherent problems of each approach.

Definition 1: *Human enhancement refers to the extension of humans through technology.*

Riding a bicycle, driving a car, or operating a tank all constitute technologies that serve instrumental purposes for humans if we interpret the term in its broadest sense. These modes of transportation effectively enhance human mobility to enable faster movement, thus extending human capacity. However, since no biotechnical fusion occurs between humans and these technologies, meaning that we cannot classify them as HE.[15] Even if advancements lead to faster transportation technologies (e.g. more rapid tanks), this would not constitute HE but rather machine enhancement – or machine learning, if the device itself acquires new capabilities autonomously. Similarly, artificial intelligence (AI) does not necessarily qualify as HE. While AI tools such as ChatGPT can assist with tasks like writing and thereby increase efficiency, they do not directly enhance a person's cognitive capabilities. Likewise, technologies such as night vision devices, GPS navigation systems, and protective vests do not fall under the NBIC technologies framework. These listed technologies have one thing in common: they do not fit within the NBIC framework established at the beginning and therefore cannot be considered HE.

Moreover, the question arises as to what exactly is being enhanced: performance or skills. A performance-based approach to HE[16] presupposes action,

15 See Coeckelbergh, Mark: Cyborg humanity and the technologies of human enhancement. In: Philosophy: Technology, Macmillan Interdisciplinary Handbooks 2017, pp. 141-160.
16 See Ibid.

emphasizing a consequentialist perspective on the agents involved. A conceptual distinction in HE thus lies between performance enhancement – improving an individual's measurable output in specific tasks – and capability enhancement, which focuses on enhancing an individual's capabilities, irrespective of immediate performance outcomes.[17] 'Capability' refers to an individual's underlying ability to carry out a particular function, whereas 'performance' describes the actual achievement or effectiveness displayed when deploying that capability.[18] To avoid debates over whether HE should focus on skill or performance, some theorists instead refer to the concept of 'human nature' – a concept which is shown to be problematic.

Definition 2: *Human enhancement refers to the use of technologies, methods or substances to expand human capabilities (physical or cognitive) beyond what is considered 'normal' or 'natural'.*[19]

Following this definition, we can only speak of HE when 'natural' human capabilities are enhanced, for instance, NBIC technologies enable individuals to hear as acutely as a lynx, provide eagle-like vision, or create a sense of smell rivalling that of a mine detection dogs, as described in the introductory thought experiment. The concept of 'human nature', however, has been criticised in contemporary philosophy, not least because of its ambiguity.[20] One more moderate position views 'human nature' as the average level (mean value) of human ability.[21] Yet the moderate view is also problematic: not only

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[17] See Coeckelbergh, Mark: Cyborg humanity and the technologies of human enhancement. In: Philosophy: Technology, Macmillan Interdisciplinary Handbooks 2017, p. 147.

[18] See Savulescu, Julian/B. Foddy/M. Clayton: "Why we should allow performance enhancing drugs in sport". In: British Journal of Sports Medicine, 38/2004, pp. 666-670. https://doi.org/10.1136/bjsm.2003.005249.

[19] Working definition of the human enhancement project as a security policy factor, March 2024.

[20] See Birnbacher, Dieter: Wieweit lassen sich moralische Normen mit der "Natur des Menschen" begründen? In: Weiss, Martin (ed.): Bios and Zoe. Die menschliche Natur im Zeitalter ihrer technischen Reproduzierbarkeit, Frankfurt/Main 2009, pp. 219-239; Lagos Berríos, Rodrigo: La disputa por la naturaleza humana. Comentarios sobre el concepto de naturaleza humana en el contexto del transhumanismo y las mejoras biotecnológicas, ETHIKA+ Revista de Filosofía, 2022, pp. 101-117; Lewens, Tim: Human nature: the very idea. In: Philosophy & Technology, Vol. 25/2012, pp. 459-474.

[21] See Fukuyama, Francis: Our Posthuman Future: Consequences of the Biotechnology Revolution, London. 2002.

is the mean value of a human ability indeterminable in practice and imprecise in application, but it also merely represents a current state of human capacities.[22]

When trying to understand 'normality' in literature around HE, the term Human Augmentation (HA) emerges either as a synonym or as a broader concept of HE.[23] In her article, Grinschgl differentiates between optimisation, enhancement, and augmentation.[24] Schulyok et al., meanwhile, differentiate between Human Performance Optimization (HPO) and HE, both of which they categorize as forms of HA: HA refers to any improvement or augmentation of human performance; HPO involves optimization up to the biological limits of human capabilities; and HE designates augmentation that surpasses those biological limits.[25] Under their framework, HE applies only when individuals exceed records of human capacities – such as surpassing the highest IQ or the fastest distance-running times. Because the precise determination of both the mean and maximum thresholds of human potential is problematic to measure and apply, distinguishing HA from HE proves challenging for our purposes. Consequently, we will use HA and HE interchangeably. Davidovic and Crowell seek to circumvent the issue of 'human

22 However, following Kahnemann, human capabilities can be enhanced not only by NBIC technologies, but by training as well. In this sense, brain stimulation techniques have long been researched by cognitive scientists. Kahnemann's bestseller *Thinking Fast and Slow* also refers to 'average' thinkers. Using concentration and learning techniques, he explains how the greatest possible brain capacity can be achieved. See Kahneman, Daniel: Thinking, Fast and Slow. London 2012; Grinschgl, Sandra: Cognitive enhancement – A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication refers to enhancement through training as active enhancement.

23 See e.g. Raisamo, Roope et al.: Human augmentation: Past, present and future. International journal of human computer studies, 2019, Vol. 131, pp. 131-143. https://doi.org/10.1016/j.ijhcs.2019.05.008: "Human augmentation […] and related concepts Augmented Human and Human 2.0 refer to technologies that enhance human productivity or capability, or that somehow add to the human body or mind"; they define Human augmentation the following way: "Human augmentation is an interdisciplinary field that addresses methods, technologies and their applications for enhancing sensing, action and/or cognitive abilities of a human. […]".

24 Grinschgl, Sandra: Cognitive enhancement – A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication.

25 See Schulyok, Bernhard et al.: Human enhancement from a military perspective – WHY, WHAT, and HOW? In chapter MILITARY in this publication.

nature' by defining "soldier enhancement"[26] with reference to standardised military fitness levels as a mean value.

Definition 3: *Human enhancement refers to the medical modification of healthy individuals using NBIC technologies.*

When discussing HE, a common distinction is made between interventions for the ill and the healthy. When examining this third definition, we must ask why medical interventions for individuals with illnesses are not considered HE. Defining illness and health in the context of HE is challenging, as these concepts are fluid and necessitate clear operational definitions.[27] By definition, regenerative treatments do not aim to enhance human capabilities. Therapeutic interventions focus on restoring a patient's prior capabilities, rather than enhancing them, which falls under the scope of regenerative medicine. For example, antidepressants, antiallergy medications, psychotropic drugs, or laser eye surgery do not qualify as HE if their primary purpose is healing or compensation.

Two examples question whether biomedical interventions on individuals with illnesses or healthy individuals qualify as HE. Neural implants provide a first illustrative example: devices such as those developed by Elon Musk's company Neuralink enable patients, particularly those with paralysis, to control technology using their thoughts. Since this technology has thus far been used exclusively for medical treatment, we cannot yet classify it as HE. Should the same technology be applied to healthy individuals for enhance-

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26 "'soldier enhancement' is an enhancement because (and when) it has a statistically relevant likelihood of increasing the probability of accomplishing the stated military objective through biological, medical, or technological change to a soldier's physical, metabolic, mental, emotional, or moral baseline (or current capability)."; Davidovic, Jovana/Crowell, Forrest S.: Operationalizing the Ethics of Soldier Enhancement. In: Journal of Military Ethics. Vol. 20/2021, https://doi.org/10.1080/15027570.2021.2018176, p. 181.

27 In this context, Lagos Berríos emphasises in his criticism of Kurzweil (Kurzweil, R.: The Singularity Is Near: When Humans Transcend Biology. London 2005, p. 25) that technologies which counteract ageing should not count as HE because ageing is not a disease that needs to be overcome. See Lagos Berríos, Rodrigo: La disputa por la naturaleza humana. Comentarios sobre el concepto de naturaleza humana en el contexto del transhumanismo y las mejoras biotecnológicas, ETHIKA+ Revista de Filosofía, 2022, pp. 101-117.

ment, it would then fall within the realm of HE. Consequently, no specific technology can be universally labeled as a 'HE-specific technology'; rather, its classification as 'HE technology' depends on the context and intended use. A second example illustrates the fluid nature of the boundary between therapy and enhancement.[28] Neil Harbisson's case challenges conventional understandings of HE: Harbisson, who was born with achromatopsia – an inability to perceive color – underwent a procedure to implant an antenna in his head, enabling him to perceive colors through auditory signals.[29]

From a conventional health standpoint, this procedure might be seen as a compensatory form of impairment correction (therapeutic), because it affords Harbisson an ability that most people consider ordinary: perceiving color. However, one could also argue that the implanted antenna constitutes a form of HE, as it endows Harbisson with a sensory capacity exceeding what is typically considered normal for humans. Ultimately, whether Harbisson's intervention should be classified as remedying a deficiency or as HE depends on how the term is defined and the context in which it is analysed. In some instances, it may qualify as a remedy for a limitation that simultaneously amounts to a significant sensory and physical enhancement. Harbisson's case thus illustrates that HE can apply not only to healthy individuals striving to augment their capabilities but also to those with illnesses who wish to improve or overcome their existing constraints.

So far, three definitions of HE have been critiqued and philosophically examined. We argued that the concept of HE remains ambiguous upon closer examination, as long as core terms such as HE technology, human nature, disease, and health remain undefined.

28 See Hauskeller, M.: Mythologies of transhumanism. London 2016.

29 See Alcaraz, Aleksandra Łukaszewicz: Cyborgs' Perception, Cognition, Society, Environment, and Ethics: Interview with Neil Harbisson and Moon Ribas, 14 October 2016, Ace Hotel, New York City. Journal of Posthuman Studies 3 July 2019; 3 (1): pp. 60-73. doi: https://doi.org/10.5325/jpoststud.3.1.0060.

4. Ethical barriers in the use of HE for military purposes

With regard to the discussion on whether HE follows moral purposes, researchers such as Bostrom and Hughes offer divergent perspectives. Bostrom emphasizes the individual dimension of HE, arguing that individuals should have the freedom to choose which technologies they wish to apply to themselves.[30] Thus, for Bostrom, HE is primarily a matter of personal choice. Hughes, by contrast, focuses on the social dimension of HE. He asserts that social inequality is largely rooted in biological differences and suggests that HE could play a role in addressing these disparities.[31] In military contexts, HE predominantly aligns with Bostrom's perspective, as it focuses on enhancing individual soldiers to secure strategic advantages over potential adversaries.

If HE is not adopted primarily for moral purposes, the question arises as to how HE should be addressed within military ethics. The table below offers a non-exhaustive overview of selected technologies, whether already in use or potentially deployable for military purposes. HE technologies such as exoskeletons, prosthetics, caffeine, Ritalin, access chips, genetic engineering, and cyborg technologies[32] are categorised according to specific ethical criteria and barriers.[33] This descriptive classification highlights concerns about the ethical implications of using these technologies without clearly defining their intended applications. Moral questions regarding their normative application will be explored in the subsequent chapter.

30 See Bostrom, Nick: In Defense of Posthuman Dignity. In: Bioethics, Vol. 19 (3)/2005, p. 203.

31 See Hughes, James J.: Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future.New York 2004, p. 195.

32 See Coeckelbergh, Mark: Cyborg humanity and the technologies of human enhancement. In: Philosophy: Technology, Macmillan Interdisciplinary Handbooks 2017, pp. 141-160.

33 The moral issues are not listed in an order that reflects their 'severity'.

Ethical barriers and soldier enhancement technologies	Exo-skeleton	Prosthetic limbs	Caffeine	Ritalin	Access chip	Genetic engineering	Cyborg[34]
Area of application	Physical	Physical	Neuro-logical	Neuro-logical	Physical	Physical	Physical
Invasive			x	x	x	x	x*
Non-invasive	x	x					
Permanent				x*[35]	x*	x	x*
Non-permanent	x	x					
Reversible	x	x			x*		
Irreversible						x	x*

Technologies that are or could be employed for soldier enhancement purposes cover a wide range of application areas. Physical applications of HE extend to 'skin-sensor' technologies, including intelligent uniforms equipped with sensors and advanced communication systems; indeed, the United Nations already employs certain versions of these uniforms operationally to aid wounded soldiers.[36] Other examples of physical enhancements involve exoskeletons designed to carry heavy loads, along with non-invasive prosthetics and removable devices that do not remain in the body indefinitely – unlike invasive access chips, which can, for instance, lock or unlock secure facilities. When it comes to neurological areas of application, neuro-enhancers are used to increase individuals' attention span, reaction time, and speed. These applications also include sleep aids and other stimulants aimed at enhancing cognitive functioning: legal stimulants like caffeine as well as so-called 'smart drugs' and substances such as Ritalin, nootropics, and modafinil, which have reportedly been used in the U.S. military. While the long-term effects of these

34 Donna Haraway describes a cyborg as: "a hybrid of machine and organism, a creature of social reality as well as a creature of fiction". Haraway, Donna: A Cyborg Manifesto. In: Bel, David/ Kennedy, Barbara M. (ed.): The Cybercultures Reader, London/New York: 2000, p. 291. First published in: Haraway, Simians: Cyborgs, and Women: The Reinvention of Nature. New York 1991.

35 Consideration is given not only to existing technologies but also to those marked with *, highlighting potential future relevance.

36 See NATO: Making Life Saving wearable tech for soldiers, 10.02.2023, https://shape.nato.int/news-archive/2023/video-making-life-saving-wearable-tech-for-soldiers, accessed 29.04.2024.

substances remain unclear, modafinil in particular has been associated with changes in the user's personality (i.e., lethargy).[37]

The above-mentioned technologies raise ethical concerns. The table classified them based on these features, highlighting invasiveness, permanence, and reversibility as key considerations. For example, invasive technologies such as access chips that are implanted subcutaneously raise distinct medical-ethical principles like dignity and autonomy.[38] Distinguishing between invasive and non-invasive modalities also becomes crucial for questions of justice: certain devices can remain within the body indefinitely – such as implanted access chips – whereas others, like caffeine or other substances, only have temporary effects. Irreversible technologies are those integrated into the body so thoroughly that they cannot be removed. Meanwhile, the distinction between permanent and non-permanent typically refers to the duration over which an individual is altered – short, medium, or long-term. Additionally, there may be future technologies specifically designed to promote moral or cultural enhancement, as Savulescu describes:

> Technology might even be used to improve our moral character (…) It may be possible to alter biology to make people predisposed to be more moral by promoting empathy, imagination, sympathy, fairness, honesty, etc.[39]

Drawing on Savulescu's vision, it is plausible that certain technologies might be developed to make warfare more equitable or humane[40] – for example, a contact lens capable of automatically distinguishing between combatants and civilians, thereby simplifying adherence to the principle of distinction from international humanitarian law. Such innovations would seek to reconcile

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37 Goodley, Héloise: Performance enhancement and the military. Exploring an ethical and legal framework for 'super soldiers', London 2020, p. 21.

38 See Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001.

39 Savulescu, Julian: Genetic Interventions and The Ethics of Enhancement of Human Beings. In: Steinbock, Bonnie (ed.): The Oxford Handbook of Bioethics, Oxford 2009, https://doi.org/10.1093/oxfordhb/9780199562411.003.0023, p. 523.

40 See Wiseman, Harris: Moral Enhancement – "Hard" and "Soft" Forms. In: American Journal of Bioethics, Vol. 14 (4)/2014, pp. 48-49. https://doi.org/10.1080/15265161.2014.889247. Kamiehski, Lukasz: On Weaponizing Cannabis. In: Journal of Military Ethics, Vol. 20/2021, pp. 251-268 also discusses this topic with regard to cannabis.

values with technological artefacts, providing potential solutions to the value alignment problem in technology ethics.[41]

5. Ethical challenges in the application of HE: An overview

Ethical concerns extend beyond the barriers outlined in the previous chapter. We also need to address the use of technologies themselves, e.g. in scenarios where soldiers are *required* to ingest stimulants to maintain cognitive alertness. Even technologies that do not exceed the listed ethical barriers above – those that are non-invasive, non-permanent, and reversible – can still be employed in morally questionable ways. Below, we offer a non-exhaustive overview of ethical concerns such as justice and inequality, bodily integrity, and autonomy.

5.1 Justice and inequality

The bioconservative Fukuyama objects to the use of biomedical technologies on the grounds of preserving human dignity and preventing threats to human rights. He fears that bio-technological interventions aimed at enhancing human capabilities may lead to the emergence of a wealthy elite, granting enhanced individuals significant social and economic advantages, particularly in the job market.[42] Annas likewise warns that HE could split society into a classification of first-class people – who are genetically modified and have enhanced capabilities – and second-class people – who are not genetically modified and maintain standard capabilities.[43] Sandel adds to the normative justice critique that these disparities might continue to affect future generations.[44]

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41 Moral values are dynamic and not only differ across cultures, histories, and legal contexts but also evolve over time.

42 See Fukuyama, Francis: Our Posthuman Future: Consequences of the Biotechnology Revolution, London 2002, p. 145.

43 See Annas, George J./ Andrews, Lori B/ Isasi, Rosario M.: Protecting the endangered human: toward an international treaty prohibiting cloning and inheritable alterations. In: American Journal of Law & Medicine, Vol. 28(2-3)/2002, p. 162.

44 See Sandel, Michael J.: The Case against Perfection. Ethics in the Age of Genetic Engineering. Cambridge 2007. https://doi-org.uaccess.univie.ac.at/10.4159/9780674043060, p. 15.

A similar problem of inequality arises with regard to knowledge. Fricker stresses that epistemic injustice can lead to the classification of people: those who have access to relevant knowledge and those who are excluded from this knowledge due to structural barriers or discrimination.[45] Particularly concerning access to education and professional opportunities, practical questions of justice and fair access to knowledge arise for the implementation of technologies for HE purposes: Will non-enhanced individuals be disadvantaged in the future due to epistemic injustice and restricted job accessibility?

Comparable concerns also arise within military contexts, regarding soldier enhancement as perpetuating existing inequalities. For example, would a super soldier possessing an exceptionally keen sense of smell receive priority in future job placements? Proponents of HE, such as Harris, dismiss such scenarios as problematic. Drawing on a consequentialist cost-benefit analysis,[46] Harris argues that equal opportunities need not be a prerequisite for fair competition between enhanced and non-enhanced individuals.[47] While enhanced persons may indeed potentially get better employment chances, they could simultaneously experience disadvantages in other areas, like social integration. In the long run, Harris contends that HE represents the inevitable progression in a medically enlightened age, even if they do ultimately form an enhanced elite.[48]

5.2 Bodily integrity and paternalism

Depending on the values and structures within particular military forces, soldiers may exhibit varying degrees of compliance with superior's orders. According to positivist interpretations, hierarchy is often viewed as fulfilling

45 See Fricker, Miranda: Evolving Concepts of Epistemic Injustice. In: Kidd, Ian James, José Medina and Gaile Pohlhaus (ed.): The Routledge Handbook of Epistemic Injustice. London & New York 2017, pp. 53-59.

46 See Harris, John: Enhancing Evolution: The Ethical Case for Making Better People. Princeton 2011, p. 38.

47 See Harris, John: Enhancing Evolution: The Ethical Case for Making Better People. Princeton 2011, p. 47.

48 See Harris, John: Enhancing Evolution: The Ethical Case for Making Better People. Princeton 2011, p. 45.

effectiveness in security policy issues.[49] As argued elsewhere, certain circumstances – especially emergencies – can justify violence in order to act collectively as quickly and as effectively as possible. Yet does this rationale extend to coercive invasive measures of HE? Can it be morally permissible to order the enhancement of soldiers on the grounds of emergency?[50]

Beauchamp and Childress define paternalism as:

> the intentional overriding of one person's preferences or actions by another person, where the person who overrides justifies the action by appeal to the goal of benefiting or of preventing or mitigating harm to the person whose preferences or actions are overridden.[51]

Paternalism rests on acting in the best interests of the individual in question and can, in certain situations, momentarily override autonomy. Such approaches may involve banning, prescribing, or regulating behaviors to attain a particular goal. In its milder form, soft paternalism can lead to preferential treatment of an individual and is justified by an assumption of better insight into the circumstances, particularly when the individual lacks awareness of their own self-interest.[52] By contrast, positive paternalism actively interferes with a person's decision-making, whereas negative paternalism withholds information that could otherwise influence the decisions of those involved.[53] A practical example of soft, positive paternalism would be a military leader concluding that HE interventions serve both the soldiers' and (inter)national security's best interests even if the soldiers themselves might not fully grasp

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49 See Walsh, Adrian/Van de Ven, Katinka: Human Enhancement Drugs and Armed Forces: An Overview of Some Key Ethical Considerations of Creating 'Super-Soldiers'. In: Monash Bioethics Review, Vol. 41 (1)/2022, p. 21. https://doi.org/10.1007/s40592-022-00170-8.

50 Pressure does not necessarily come from hierarchical paternalism; it can also arise through peer or group influence.

51 Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001, p. 169.

52 See Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001, p. 171.

53 "As a negative obligation, the principle requires autonomous actions not to be subjected to controlling constraints by others. As a positive obligation, the principle requires both respectful disclosures of information and other actions that foster autonomous decision making." Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001, p. 80.

or acknowledge the risks. Introducing collectivity and hierarchy to this argument, in such cases, soldiers could be mandated to accept interventions designed to optimize the unit's performance and fulfil strategic objectives, potentially at the expense of their personal autonomy and discrediting their bodily integrity.

Advocates of autonomy would rarely agree with this kind of paternalistic rationale. Beauchamp and Childress frame bodily integrity to be a moral boundary in medical ethics, viewing personal autonomy as the fundamental right to make free decisions about one's own body and its external limits.[54] They define an autonomous person based on their capability of making intentional decisions, with fully informed understanding and without external control.[55] In defending the right to non-interference,[56] they posit that a patient's autonomy extends to preserving their bodily integrity, even against potentially beneficial interventions. Under this bioethical principle, nobody should be forced to compromise their bodily integrity.

The emergency argument for invasive interventions for military operations is based on the necessity for rapid action during emergency situations. Prior arguments emphasizing the soldiers' autonomy in combat suggest that military personnel retain ultimate decision-making authority, and, by extension, bodily autonomy, even in emergency scenarios.[57] However, balancing the need for moral actions with the operational speed required in urgent military scenarios is inherently delicate.[58] In such circumstances, paternalistic measures might be justifiable under the principle of necessity. However, while swift action in life-threatening medical emergencies may be justified by

54 See Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001, p. 77.

55 See Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001, pp. 78f.

56 See Beauchamp, Tom L./Childress, James F.: Principles of Biomedical Ethics. New York 2001, p. 290.

57 See Tragbar, Lisa: Die Lehre des gerechten Krieges als Militärethik: Über die Vorbereitung von Militärangehörigen auf kognitive Kriegsführung, The Defence Horizon Journal 2023. https://doi.org/10.5281/zenodo.10154313.

58 See Walsh, Adrian/ Van de Ven, Katinka: Human Enhancement Drugs and Armed Forces: An Overview of Some Key Ethical Considerations of Creating 'Super-Soldiers'. In: Monash Bioethics Review, Vol. 41 (1)/2022, pp. 22-36. https://doi.org/10.1007/s40592-022-00170-8.

paternalistic reasoning, this logic does not seamlessly apply to HE.[59] Unlike immediate life-saving interventions, HE is typically employed as a pre-emptive modification rather than an urgent necessity, thus not falling within the scope of the emergency argument. According to Beauchamp and Childress, individuals have a moral right to full disclosure. Accepting autonomy as the foundation of bioethical decision-making implies that voluntary consent must remain a baseline requirement for employing invasive HE technologies, regardless of the urgency of the situation.

5.3 Changes in 'human nature'

Is there a fundamental human boundary that HE must not breach? If we assume the existence of 'human nature', does it become impermissible to alter it? Certain bioconservatives maintain that there are enduring personality characteristics that should remain inviolate. For instance, Habermas argues that interventions aimed at modifying 'human nature' could transform our ethical self-understanding of our species:

> From this perspective, the question arises as to whether the instrumentalization ("Technisierung") of human nature changes species-ethical self-understanding ("gattungsethische Selbstverständnis") in such a way that we can no longer understand ourselves as ethically free and morally equal beings who are oriented to norms and reasons.[60]

He argues that the instrumentalization of human nature, if it alters our fundamental capabilities or characteristics, could undermine our self-understanding as ethically autonomous and morally equal beings, guided by universal norms and reasons. Habermas opposes embryo selection and genetic manipulation unless justified by a clear medical purpose, such as the treatment of diseases: "the line between therapy for an illness and improving a

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[59] For instance, if HE is used preventively, its absence does not necessarily result in death but may lead to a strategic disadvantage compared to opponents. In contrast, a patient requiring urgent treatment to prevent life-threatening complications may provide a stronger justification for paternalistic measures, as their life is at immediate risk.

[60] Habermas, Jürgen: Die Zukunft der menschlichen Natur: Auf dem Weg zu einer liberalen Eugenik? Frankfurt/Main 2005, p. 74.

disposition"[61] cannot always be clearly drawn. In the discussion of genetic interventions, he does not refer to enhancement but instead refers to 'eugenics'.[62] According to him, the selection or enhancement of genes violates the liberal principles of autonomy and equality:

> "If a genetically modified person feels limited in the use of their ethical self-determination (ethische Gestaltungsfreiheit) by the foreign designer, they suffer from the awareness that they have to share the authorship of their own life destiny with another author."[63]

According to Habermas, genetically modified individuals cannot be regarded as fully responsible authors of their own life stories if their genetic makeup has been determined by their parents' personal preferences. Moreover, such genetic interventions would undermine equality by disrupting the fundamental symmetry between free and equal persons across generations.[64] He criticises interventions in the human genome for bluffing the intuitive distinction between "subjective" and "objective", as well as "grown" and "made".[65] In his view, they could be seen as a form of instrumentalization, which disregards nature's inherent self-regulation. Habermas posits that genetic interventions in humans could transform the control of nature into an act of self-empowerment, therefore changing our "ethical self-understanding of the species" and affecting a universalistic understanding of morality.[66]

6. Conclusion

While soldier enhancement has considerable potential for military security strategies, the risk of misusing HE for combat purposes is no less plausible than the dangers of crossing moral barriers. To illustrate both the advantages and ethical concerns associated with its use in military contexts, we initially employed the thought experiment of a "super soldier" featuring enhance-

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61 Habermas, Jürgen: Vorwort. In: Michael Sandel (Ed.): Plädoyer gegen die Perfektion. Im Zeitalter der genetischen Technik, Berlin 2008, p. 9.

62 See Habermas, Jürgen: Vorwort. In: Michael Sandel (Ed.): Plädoyer gegen die Perfektion. Im Zeitalter der genetischen Technik, Berlin 2008, pp. 7-16.

63 Habermas, Jürgen: Die Zukunft der menschlichen Natur: Auf dem Weg zu einer liberalen Eugenik? Frankfurt/Main 2005, p. 137.

64 See ibid., p. 30.

65 See ibid., p. 85.

66 See ibid.

ments based on NBIC technologies. However, subsequently, we conducted a critical examination of the term HE to clarify its ambiguities and to delineate which technologies fall outside its scope. After categorizing various technologies and their ethical barriers according to the criteria of invasiveness, permanence, and reversibility, we concluded with an overview of the ethical issues surrounding HE. Drawing on Fukuyama and Annas, we highlighted potential consequences for justice matters. We then applied Beauchamp and Childress's framework of biomedical ethics to examine the limits of paternalism in the discussion of bodily integrity and soldier enhancement. Finally, we showed Habermas's perspective to explore the challenges of preserving human autonomy in the context of genetic interventions. Nevertheless, several unresolved issues remain, which we could only briefly touch upon in this ethical overview of HE for military purposes.

What still requires attention? Ethical conclusions depend on empirical data regarding the precise effects of HE-related technologies.[67] While further research on potential side effects is urgently needed, such studies remain scarce – largely due to the broad scope of the topic, as shown in Chapter 2. Before establishing normative guidelines for implementing HE in the military, it is crucial to address foundational ethical questions and standardize key terminology.[68] Additionally, several pragmatic bioethical issues relating to responsibility and liability remain unresolved. For instance, who is accountable if a subdermal chip malfunctions? Is there a right to compensation if complications arise from removing a prosthetic limb?[69] Should the emphasis of HE for military purposes lay on achieving optimal performance, enhancing sol-

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67 See Walsh, Adrian/Katinka Van de Ven: Human Enhancement Drugs and Armed Forces: An Overview of Some Key Ethical Considerations of Creating 'Super-Soldiers'. In: Monash Bioethics Review, Vol. 41 (1)/2022, p. 33. https://doi.org/10.1007/s40592-022-00170-8.

68 Walsh et al and Allenby suggest that the Just War Theory could be useful in the development of normative standards. See Walsh, Adrian/Katinka Van de Ven: Human Enhancement Drugs and Armed Forces: An Overview of Some Key Ethical Considerations of Creating 'Super-Soldiers'. In: Monash Bioethics Review, Vol. 41 (1)/2022, pp. 22-36. https://doi.org/10.1007/s40592-022-00170-8. See Allenby, Braden R.: The Implications of Emerging Technologies for Just War Theory. In: The Applied Ethics of Emerging Military and Security Technologies, 2015, pp. 3-21.

69 See Coeckelbergh, Mark: Cyborg humanity and the technologies of human enhancement. In: Philosophy: Technology, Macmillan Interdisciplinary Handbooks 2017, p. 141.

diers' competency profiles, or fostering virtues?[70] Ultimately, the use of HE for military purposes is an area that requires further ethical consideration, particularly regarding the criteria that are essential to protect a soldier's autonomy: providing adequate information, ensuring voluntary participation, and maintaining transparency about both potential consequences and military applications.[71] These unresolved issues extend to core philosophical and ethical concerns, including autonomy, human nature, and conflicting values in machine design.

70 See Pfaff, Anthony C: Virtue and Applied Military Ethics: Understanding Character-Based Approaches to Professional Military Ethics. In: Journal of Military Ethics Vol. 22 (3-4)/2023: p. 168-84. https://doi.org/10.1080/15027570.2023.2200064.

71 See Goodley, Héloise: Performance enhancement and the military. Exploring an ethical and legal framework for 'super soldiers', London 2020, p. 24f. Goodley explains what to consider when giving consent and what types of consent there are, e.g. explicit, tacit, informed consent and an opt-out option.

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Chapter IV – Society

Mizkit/Adobe Stock

Society. Chapter Summary

The following three papers highlight the tension between the rapid development of human enhancement (HE)and artificial intelligence (AI) technologies, the changes in civil society affected by them and the delayed development of international law.

The great expectations of society with regard to the positive improvements in everyday life through the use of trustworthy instruments of HE and AI are countered by equally relevant fears about possible encroachments on privacy and fundamental individual rights. Such negative expectations of certain social groups are fuelled by the barely comprehensible further developments in all areas of HE and AI technology, especially in the military sector.

However, the combination of an increased use of HE and autonomous weapon systems would also offer the potential of humanising the use of these weapon systems and thus safeguarding the principle of ultimate human responsibility.

Although international law has responded to these social and technological dynamics with countless attempts at regulation, the consensus among states does not include legally binding restrictions or prohibitions, perpetuating the dilemma between social progress and legal stagnation.

European AI ethics – between categorical imperative and placebo rhetoric

Gernot Stimmer

1. The unlimited scope of AI

For many observers, the "uncanny" expansion of the use of AI in all areas of life is an undisputed fact that has been viewed positively from the outset, both from a scientific-technical and economic-political perspective, but has been the subject of increasingly critical debate in recent years. The mainstream of heated debate is currently moving between the extreme positions of unconditional apology (Larry Page: AI as a "digital God") and hysterical apocalyptic sentiment (Dan Hendryck's "Against the End of the World"), with only one thing in common: the call for a global or at least regional AI order. This article is primarily dedicated to recording and comparing the various regulations that have been agreed on a global-international, transnational and nation-state level, without the multitude of additional regulations that have been and are being established by civil society actors. The exclusivity with which the media publicly uses the keyword "artificial intelligence", usually abbreviated to the magic cipher "AI", should not obscure the fact that this is only the most effective digital form of a general technical-scientific boom to improve the human way of living and working. The new magic formula "human enhancement" (HE) can be used to summarise the wealth of instruments, methods and inventions in the field of Human Enhancement.[1]

In the following, we will therefore limit ourselves to global, transnational or regional regulations (conventions, resolutions, standards, recommendations) of international actors with varying degrees of binding force that relate exclusively or at least in part to the application or restriction of new AI technologies and their respective ethical legitimation.

[1] The definition of HE: Wikipedia: Human Enhancement, last modified 24 November 2024 at 11.32 PM (UTC). https://en.wikipedia.org/wiki/Human_enhancement.

1. *The OECD AI Principles*

The declaration of principles adopted by the 36 member states at the Ministerial Council Meeting on 22 May 2019 was also adopted by six other countries, especially Latin American countries, and includes five principles and five recommendations to governments. The Davos World Economic Forum's efforts to regulate AI at global level are also closely related in terms of programme and ideology. The AI Governance Alliance (40 (predominantly) OECD countries, academia and global companies) was founded in June 2023 in an initial step. However, the hoped-for agreement at the 54th Annual Meeting of the World Economic Forum in Davos did not materialise, which is not surprising given the current 700 national or private AI regulations.[2] The international AI agreements adopted by the G7 (6 OECD countries & Japan) in February 2024, which build on the G7 Hiroshima Summit of May 2023 and include the "Hiroshima Process International Guiding Principles for All AI Actors" and the "Hiroshima Process International Code of Conduct for Organizations Developing Advanced AI Systems", are also strongly oriented towards economic policy.[3]

2. *The UNESCO Recommendation on the Ethics of Artificial Intelligence of 23 November 2021*

The Recommendation, adopted by the 193 members of UNESCO in 2021, is based on the results of multi-stakeholder workshops in 25 countries and provides for evaluation based on national reports on the implementation of the Recommendation, to be submitted every four years. A Global AI Ethics and Governance Observatory has been established to improve the sharing of experiences, to assess the capacity of member states to implement the Recommendation and to develop an ethical impact assessment tool for AI systems. In order

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2 OECD: Recommendation of the Council on Artificial Intelligence. OECD/LEGAL/0449; OECD: Artificial Intelligence in Society. OECD Publishing, Paris 2019. https://doi.org/10.1787/eedfee77-en, accessed 20 April 2024.

3 KIZUNA: The Hiroshima AI Process: Leading the Global Challenge to Shape Inclusive Governance for Generative AI. 9 February 2024. https://www.japan.go.jp/kizuna/2024/02/hiroshima_ai_process.html.

to improve the interoperability of the different AI regulations in Europe, the UNESCO National Commissions of Austria, Germany and Switzerland hosted an online event in the form of a UNESCO Talk: "Ethical AI in Europe", presenting the translation of the UNESCO Recommendation on the Ethics of Artificial Intelligence agreed between the countries.[4]

3. *The "AI Ethics" (Rome Call) of January 2023*

This was agreed at the conference in Rome between the Vatican, representatives of the Muslim and Jewish religious communities and global companies (Microsoft, IBM, etc.).[5]

4. *The NATO AI Strategy adopted on 21 October 2021*

In contrast to the other civilian organisations compared and their AI policies, NATO is a purely military-security alliance of states whose understanding of AI goes far beyond the purely military sphere and includes all issues and aspects of "dual-use technologies" such as

4 Austrian Commission for UNESCO: Ethik in Wissenschaft und Technologie. Gesellschaftliche Folgen antizipieren. https://www.unesco.at/wissenschaft/wissenschafts-und-bioethik/ethik-kuenstliche-intelligenz, accessed 20 April 2024; UNESCO: Regierungen müssen generative KI in Schulen schnell regeln. 7 September 2023. https://www.unesco.de/wissen/ethik/kuenstliche-intelligenz/regierungen-generative-ki-schulen-altersgrenze-13-jahre, accessed 20 April 2024; Güell Paule, Laia: UNESCO launches Global AI Ethics and Governance Observatory at the 2024 Global Forum on the Ethics of Artificial Intelligence. 6 February 2024. https://digital-skills-jobs.europa.eu/en/latest/news/unesco-launches-global-ai-ethics-and-governance-observatory-2024-global-forum-ethics.

5 Vatican News: Pope Francis to participate in G7 session on AI. 26 April 2024. https://www.vaticannews.va/en/pope/news/2024-04/pope-francis-g7-summit-italy-artificial-intelligence.html; Ring-Eifel, Ludwig: Digitale Ethik Vatikan will beim Thema Künstliche Intelligenz mitreden. 23 January 2023. https://www.herder.de/hk/aktuell/vatikan-will-beim-thema-kuenstliche-intelligenz-mitreden.

quantum and biotechnology, data protection, cyberspace, etc.[6] In February 2023, the NATO Data and Artificial Intelligence Review Board created a certification standard for the user-friendly and responsible use of AI for both the military and industrial sectors in order to implement this AI regulation.

5. *The UN Resolution on the promotion of "safe, secure and trustworthy" artificial intelligence (AI) systems of 21 March 2024*

Based on a resolution from November 2021 on the creation of global standards for AI ethics, the proposal submitted by the US was adopted as a non-binding resolution on 21 March 2024 by 193 states following negotiations with 120 member states. The main objective was formulated as the creation of international standards for the global use of AI. An AI committee convened by the UN Secretary-General drew up seven proposals for the "Global Digital Compact" to be adopted at the UN Summit of the Future at the end of September 2024, including the establishment of a scientific advisory board, a global fund financed by private and public money to remedy the asymmetric development of AI technology, a global database for AI training data, permanent dialogue between states and private stakeholders and a dedicated UN AI office. The Summit of the Future, held during the UN General Assembly on 22-23 September 2024, adopted a Pact for the Future and a Declaration on Future Generations, as well as the "Global Digital Compact", which only pro-

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[6] Frank, Dorothea: NATO-Zertifizierungsstandard für Künstliche Intelligenz in Behörden. In: Spiegel. 15 February 2023. https://www.behoerden-spiegel.de/2023/02/15/nato-zertifizierungsstandard-fuer-kuenstliche-intelligenz/; Cheung, Sunny; Wettrennen um KI: Chinas Volksbefreiungsarmee und die NATO. In: Friedrich Naumann Stiftung Analyse. November 2023. https://www.freiheit.org/de/taiwan/wettrennen-um-ki-chinas-volksbefreiungsarmee-und-die-nato; North Atlantic Treaty Organization: Summary of the NATO Artificial Intelligence Strategy. 22 October 2021. https://www.nato.int/cps/en/natohq/official_texts_187617.htm; Hauser, Gunter: Die NATO. Die Grundlage des europäisch-atlantischen Sicherheitsverbundes. In: Hochleitner, Erich P. (ed.): Das Europäische Sicherheitssystem zu Beginn des 21. Jahrhunderts. Böhlau Verlag 2000, pp. 267-336; Kleinwächter, Wolfgang: Entwicklungen im Internet Governance-Umfeld April bis Juli 2024. In: DENIC Internet Governance. 14 August 2024. https://blog.denic.de/entwicklungen-im-internet-governance-umfeld-januar-bis-marz-2024/.

claimed very general principles for an "open, free and secure digital future" for all people. After three failed drafts, the power struggle between governments (multilateralism) and large digital companies (stakeholderism) was reflected in the anticipated "soft" proposals. For institutionalisation, a special scientific advisory board and permanent dialogue between governments and relevant civil stakeholders should be established.[7]

6. *The Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law of March 2024*

On 15 March 2024, the Council of Europe's Committee on Artificial Intelligence (CAI) presented a framework convention on fundamental principles and standards for the compatibility of the development of AI-based systems with the principles of human rights, democracy and the rule of law. This document, which is binding upon its 46 members, was negotiated with the participation of the US and the EU. Following adoption of the draft by the Council of Europe's

[7] Research Institute AG Wien: Vereinte Nationen und Europarat beschließen Regelwerke zu künstlicher Intelligenz. 28 March 2024. https://researchinstitute.at/vereinte-nationen-und-europarat-beschliessen-regelwerke-zu-kuenstlicher-intelligenz/; Fokuhl, Josefine: UN-Gremium legt sieben Vorschläge zur Steuerung von KI vor. In: Handelsblatt. 19 September 2024; UNRIC-Regionales Informationszentrum der Vereinten Nationen: UN-Zukunftsgipfel. https://unric.org/de/un-system/un-zukunftsgipfel-summitofthefuture/, accessed 30 October 2024; Europäische Kommission: Gestaltung der digitalen Zukunft Europas. NEWS ARTICLE, 23 September 2024. https://digital-strategy.ec.europa.eu/de/node/13020; Oswald, Fiene: Erste UN-Resolution zu Künstlicher Intelligenz. 2 April 2024, pp. 1-6. https://www.basecamp.digital/ki-verstehen-erste-un-resolution-zu-kuenstlicher-intelligenz/; Österreichische UNESCO-Kommission: UNESCO Talk: Ethische KI in Europa. 23 June 2023. https://www.unesco.at/wissenschaft/artikel/article/unesco-talk-ethische-ki-in-europa; United Nations, Office for Digital and Emerging Technologies: Global Digital Compact. 15 October 2024. https://www.un.org/global-digital-compact/sites/default/files/2024-09/Global%20Digital%20Compact%20-%20English_0.pdf.

Committee of Ministers in the summer of 2024 and ratification by member states, the treaty will be open for accession by other states.[8]

7. *The EU Artificial Intelligence Act of 13 March 2024 (AI Act)*

The proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence, submitted by the European Commission in April 2021, was finally adopted by the European Parliament on 13 March 2024 and by the Council of the European Union in May 2024 after three days of trilogue negotiations, following the opinions of the Council of the European Union and the European Parliament, and thus entered into force on 21 May 2024. Implementation will be staggered until May 2027 (6 months for banned AI systems, 24 months for generative AI, 36 months for high-risk AI systems).[9] The European Commission-

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[8] Council of Europe, Secretary General Marija Pejčinović Burić: Artificial Intelligence, Human Rights, Democracy and the Rule of Law Framework Convention. 15 March 2024. https://www.coe.int/en/web/portal/-/artificial-intelligence-human-rights-democracy-and-the-rule-of-law-framework-convention; Council of Europe: European Convention on Human Rights. As amended by Protocols Nos. 11 and 14 Supplemented by Protocols Nos. 1, 4, 6, 7, 12, 13 and 16. September 2019. https://edoc.coe.int/en/european-convention-on-human-rights/8363-european-convention-on-human-rights-as-amended-by-protocols-nos-11-and-14-supplemented-by-protocols-nos-1-4-6-7-12-13-and-16.html; Köver, Chris: KI-Konvention des Europarats. Viel Abkommen um Nichts. In: Netzpolitik Org. 20 March 2024. https://netzpolitik.org/2024/ki-konvention-des-europarats-viel-abkommen-um-nichts/16.

[9] European Commission: Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules On Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts. 21 April 2021. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0206; European Parliament: EU AI Act: first regulation on artificial intelligence. The use of artificial intelligence in the EU will be regulated by the AI Act, the world's first comprehensive AI law. Find out how it will protect you. 8 June 2023 (Last updated: 18 June 2024). https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence; European Commission: Artificial Intelligence – Questions and Answers. In: Questions and Answers, 1 August 2024. https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_1683; KPMG International: Das bedeutet das EU-Gesetz zur KI. 10 May 2024. https://kpmg.com/de/de/home/themen/2024/03/das-bedeutet-das-eu-gesetz-zur-ki.html; Council of the EU: Artificial Intelligence Act: Council calls for promoting safe AI that respects fundamental rights. 6 December 2022. https://www.co

funded SIENNA project, which collects AI regulations and codes of conduct, lists 18 AI regulations and recommendations for behaviour based on ethical values for 2024, ranging from the SHERPA project 2019 to the ACM Code of Ethics and Professional Conduct of the Association for Computing Machinery, and from the Barcelona Declaration for the Proper Development and Use of Artificial Intelligence in Europe to the Montréal Declaration for a Responsible Development of Artificial Intelligence 2023. This civil society engagement is not discussed separately below.[10]

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nsilium.europa.eu/en/press/press-releases/2022/12/06/artificial-intelligence-act-council-calls-for-promoting-safe-ai-that-respects-fundamental-rights/; Hilbricht, Benjamin: EU Trilog zur KI-Verordnung endet mit Kompromiss. In: *Behörden Spiegel.* 22 December 2023. https://www.behoerden-spiegel.de/2023/12/22/eu-trilog-zu-ki-verordnung-endet-mit-kompromiss/; Milicic, Milka/Zimmermann-Gassner, Carla: WEKA Business Solutions GmbH. Die neue KI-Verordnung in der EU. 7 March 2024. (Updated 01.08.2024). https://www.weka.at/news/Datenschutz-IT/Die-neue-KI-Verordnung-ist-seit-01.08.2024-in-Kraft?searchtext=1164787; Meltzer, Josh/Tielemans, Aaron: *The European Union AI Act. Next steps and issues for building international cooperation, in Global Economy and Development at Brookings.* Policy Brief, May 2022. https://www.brookings.edu/wp-content/uploads/2022/05/FCAI-Policy-Brief_Final_060122.pdf. Meltzer, Josh/Tielemans, Aaron: Comment: The EU AI Act: its international implications for AI policy development and cooperation, in Encompass. September 2022. https://encompass-europe.com/comment/the-eu-ai-act-its-international-implications-for-ai-policy-development-and-cooperation; Noerr: KI-Verordnung (AI-Act) final verabschiedet. In: *News.* 21 May 2024. https://www.noerr.com/de/insights/ki-verordnung-ai-act-final-verabschiedet; European Commission: European AI Office. Accessed 30 October 2024. https://digital-strategy.ec.europa.eu/de/policies/ai-office.

10 SIENNA: AI & Robotics: Codes and guidelines. Last updated 19 April 2024. https://www.sienna-project.eu/w/si/robotics/; The SIENNA Project: AI & Robotics: Codes and guidelines. Accessed 15 July 2024. https://www.sienna-project.eu/w/si/robotics/codes-and-guidelines/; ACM Code of Ethics and Professional Conduct. Accessed 15 July 2024. https://www.acm.org/code-of-ethics; Université de Montréal: The Montréal Declaration for a Responsible Development of Artificial Intelligence. Accessed 15 July 2024. https://montrealdeclaration-responsibleai.com/the-declaration/.

1.2 Comparison of AI regulations

(For a comprehensive overview of Artificial Intelligence policies depicted in this contribution, refer to the ***paper insert*** *titled* ***"AI Regulations in Comparison"*** *which is enclosed with this publication.)*

Comparing global (UN, UNESCO, Rome Call), transnational (OECD, NATO) and regional (EU, Council of Europe) AI regulations according to criteria

1. Definition and impact assessment (positive vs negative) of AI
2. Scope of social and political areas
3. Ethical support
4. Restrictions, prohibitions
5. Control, instruments

These show a number of similarities, but also significant differences:[11]

1.3 Definition and assessment of the impact

An internationally applicable definition of AI is yet to be developed, despite the UN calling for global standards for AI ethics in November 2021 and UNESCO producing a guide to AI ethics. In the course of the EU's AI legislation, this call has also been echoed by the European Parliament (a single "technology-neutral" definition of AI) and the Council of the European Union. In its opinion of November 2021, the latter still assumed a technocratic understanding of AI, limited to "machine learning systems and concepts and logical-scientific concepts". Article 3 of the final EU AI Act, on the other hand, introduced a very broad definition in order to be compatible with other AI regulations:

> "software that is developed with one or more techniques and approaches listed in Annex I and can for a given set of human defined objectives, generate outputs such as content, prediction, recommendations of decisions influencing the environments they interact with"[12]

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[11] All data and facts cited (except for sources specifically cited in the text) are from the literature cited above.

[12] Meltzer, Josh/Tielemans, Aaron: Comment: The European Union AI Act. Next steps and issues for building international cooperation. In: B/Global Economy and Development at Brookings. Policy Brief May 2022, https://www.brookings.edu/wp-content/uploads/2022/05/FCAI-Policy-Brief_Final_060122.pdf.

Behind this battle for sovereignty of definition lies the EU's clear interest in dominating the global AI market through joint AI regulations with other countries, especially those outside Europe. For example, the EU is working with the UN on the creation of common AI rules, as well as with the Council of Europe via its members and with the largest countries in Latin America, which are strongly orientated towards the EU in their AI policy.[13] The cooperation negotiations within the framework of the joint EU-US Trade and Technology Council (TCC) on a more risk-based development of safe AI technology on the basis of the "AI for Public Good EU-U.S. Research Alliance in AI for the Public Good" are much closer, but also more controversial. Since November 2023, cooperation between the USA and the UK has become even closer and more specialised, leading to a memorandum of understanding on the development of joint AI safety tests in April 2024.[14]

In contrast, the fundamentally positive assessment of AI systems appears to be more consistent. UNESCO highlights the benefits in education, science and research, while UN Resolution 2024 sees AI technology as a lever for non-discrimination against countries and societies in the "global south" and for achieving the sustainability goals of the "Agenda 2030". The OECD's more economic assessment of AI is mainly based on economic growth, thereby securing jobs and generally increasing prosperity. This view of the organisation as a whole is reinforced by the almost euphoric assessment of individual member countries. A case in point is the OECD's report on artificial intelligence in Germany, which is based on the claim that Germany could win the international race to implement trustworthy AI with its "hu-

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13 Li, Cathy: Fourth Industrial Revolution. UN and EU both agree new AI rules, and other digital technology stories you need to know. *World Economic Forum.* 8 April 2024 (Updated 10 September 2024). https://www.weforum.org/agenda/2024/04/artificial-intelligence-technology-news-april-2024/.

14 Bundesministerium für Bildung und Forschung: Kooperation international. *Berichterstattung weltweit.* 8 April 2024. https://www.kooperation-international.de/aktuelles/nachrichten/detail/info/usa-und-vereinigtes-koenigreich-vereinbaren-zusammenarbeit-zu-sicherer-kuenstlicher-intelligenz; World Economic Forum. Accessed 10 May 2024. https://www.weforum.org/agenda/2024/04/artficial-inteligence; EGA: Artificial Intelligence: Latin America's Regulatory and Policy Environment. 4 March 2024. Accessed 15 July 2024. https://www.edelmanglobaladvisory.com/insights/artificial-intelligence-latin-americas-regulatory-and-policy-environment.

man-centred focus" and the involvement of civil society, using the EU as a lever.[15]

NATO's AI Strategy is based on four objectives:

(1) to develop AI responsibly for defence;
(2) to improve interoperability between member nations;
(3) to protect its own AI technology from hostile attack (disinformation campaigns); and
(4) to maintain the West's technological edge.

To this end, NATO relies on a network of sites and extensive cooperation with the private sector and academia, coordinated by a "Defence Innovation Accelerator for the North Atlantic" (DIANA) and a dedicated Science and Technology Facility supported by the NATO Innovation Fund.[16] The Council of Europe, on the contrary, sees the compatibility of AI technology with the principles of democracy, the rule of law and human rights as the goal of the Framework Agreement.

2. Sociopolitical areas

With regard to the scope of AI technology, all AI organisations assume that AI will become a fact of life that will change all areas of life and thus politics in the future, which can hardly be avoided and must therefore be countered with the most comprehensive normative regulation possible. With its rather general AI principles, the OECD specifically targets the protection of privacy and trust in corporate governance in the use of personal data, which is obviously in the interests of the big-data corporations in the US. UNESCO lists eleven policy areas to be covered by the AI regulation, in particular, development cooperation, education, culture, communication, health, work and gender equality. The UN Resolution also emphasises the general accessibility of AI technology through the creation of global structures. NATO also sees the area of application of AI technology beyond the military sector, specifically in the private sector (dual-use technologies). The EU AI Act foresees positive effects for a single AI market, but emphasises the risk-based protection of fundamental rights threatened by AI in different areas of life, from data protection to health and the environment. The AI Act thus becomes a

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15 OECD Berlin Centre: *OECD-Bericht zu Künstlicher Intelligenz in Deutschland*. 6 June 2024. (Online edition, OECD-Publishing, Paris). https://doi.org/10.1787/8fd1bd9d-de.

16 Cheung: Wettrennen um KI. Online ibidem.

cross-cutting regulatory instrument relevant to all areas of competence. The restriction of the areas affected by AI in the Council of Europe appears to be significant. The definition of the affected areas of life and policy led to a dispute with the US, which participated in the negotiations and succeeded in completely excluding the military and security sector and de facto excluding the private sector (i.e. including private companies) from the regulation with a mere opt-in clause for signatory states. The "ground-breaking text", hailed as a success by the Secretary General of the Council of Europe, authorising signatory states to regulate the "private sector" at national level, was strongly criticised by NGOs as a "free pass for corporations and security agencies". This tendency towards "soft" formulation also characterises the other parts of the Convention.[17]

2.1 Ethical justification

All of the AI regulations compared refer to ethical principles that can be derived from the various codifications of fundamental and human rights. However, it is not possible to conclude from this that AI ethics are already being applied globally. The global AI concepts of the UN and UNESCO refer to the principles of the 1948 UN Declaration of Human Rights (including the eight additional conventions), but do not constitute a legally binding and therefore enforceable legal basis. Furthermore, the quoted UNESCO principles have a particularly flexible and dynamic interpretation within the meaning of the definition of "ethics" of the AI 2019: The formulation in the German language allows for constant relativisation and changeability of the ethical standards.[18] This soft ethical formulation also explains why UNESCO's 2019 AI Recommendation was signed by all 193 member states, and although the March 2024 resolution emphasises the protection of fundamental and human rights, including online, the AI panel's proposals for the Global Digital Compact (GDC) see the danger of AI use, mainly in potential electoral manipulation and disinformation. The GDC, which was adopted by the UN General Assembly, echoes the call for the UN Declaration of Human Rights to be applied online and sees acute violations, partic-

[17] Köver: KI-Konvention des Europarates. ibidem.

[18] Ethics of AI: "…eine systematische normative Reflexion, basierend auf einem holistischen, umfassenden, multikulturellen und sich weiter entwickelnden Gerüst wechselseitig voneinander abhängiger Werte, Prinzipien und Handlungen…", in UNESCO: Ethik in Wissenschaft und Technologie, Gesellschaftliche Folgen antizipieren. ibidem.

ularly in the exclusion of one third of the world's population from internet access. The GDC also criticises the use of AI in security and military settings (in particular, autonomous weapons systems) as violating human rights without ensuring human accountability.[19]

The ethical concepts of the (Western) industrialised countries in the OECD, the Council of Europe and the EU are based on regionally applicable codifications of fundamental rights, such as the European Convention on Human Rights of 1950, including the additional protocols of the Council of Europe, and the EU Charter of Fundamental Rights, enshrined in primary law in 2009 (Art. 2, Art. 6 TEU). The AI ethics of the non-European members of the OECD are based on UNESCO Recommendation 2019 and UN Resolution 2024. The position of the Vatican is interesting: at the G7 Summit in Italy in June 2024, the Pope called for an interdenominational and interdisciplinary "ethics of algorithms" in the sense of "digital anthropology", based on Pope Francis' encyclical "Fratelli Tutti" on digitality and the "Rome Call for AI Ethics" drawn up by the Pontifical Academy, other religious communities and IT companies in February 2020. NATO has also established principles for the responsible use of AI technology, based on generally accepted ethical, legal and political commitments, as well as six specific principles for the use of AI in defence, of which the fifth is particularly worthy of a mention here: controllability of operationally necessary human-machine interaction, an aspect that will be addressed in more detail below in the context of the development of unmanned autonomous weapon systems.[20]

2.2 Restrictions/Prohibitions

The negative impact of AI technologies, in particular, the threat to fundamental rights and democracy, is addressed in all AI policies, but the countermeasures mostly amount to general recommendations (notably the OECD's

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[19] Reiland, Patrick: United Nations. Unpacking the Global Digital Compact. The Intersection of Human Rights and Digital Governance. *Friedrich Naumann Foundation for Freedom*. 19 September 2024. https://www.freiheit.org/human-rights-hub-geneva/unpacking-global-digital-compact.

[20] Communication of the European Union: Consolidated version of the Treaty on the Functioning of the European Union Official Journal 115. 9 May 2008. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12008E/TXT, 17, 19; Ring-Eifel, Ludwig: KANN. 23.1.2023. Digitale Ethik. Vatikan will beim Thema Künstliche Intelligenz mitreden. Online ibidem; Vatican News: Papst Franziskus nimmt an G7-Sitzung zu KI teil. Online ibidem; NATO: Summary. Online ibidem.

"Should..." principles) to ban or not allow risky AI technologies, with proposals that are sometimes unrealistic (UNESCO: age limit of 13 for AI applications). The UN's Global Digital Compact calls on AI producers to develop appropriate technologies that protect human rights. This basic attitude towards "trustworthy" AI technology is only qualified by the EU's AI Act, which, despite a positive assessment of a future internal AI market, adopts an emphatically risk-based position. The comprehensive understanding of risk is divided into four risk levels according to the degree of risk:[21] (see Figure 1, next page):

(1) **Minimal risk**: "trusted" AI systems that are not subject to the obligations of the AI regulation, but can voluntarily adopt the requirements and codes of conduct. This includes "open source" AI systems.

(2) **Low risk**. AI systems with a risk of manipulation are subject to a transparency obligation (e.g. chatbots).

(3) **High risk**: AI systems with the potential to jeopardise fundamental rights (Art. 1, 8, 11, 12, 21, 29, 47, 48) are listed in two updated annexes (product use cases).
These are divided into two categories:
   a. systems covered by EU manufacturing legislation (toys, aeronautics, medical devices, etc.)
   b. AI systems in specific sectors: infrastructure, education, employment, public and private services, law enforcement, migration, asylum policy, etc.

   These high-risk AI systems are subject to a number of compliance obligations, including risk and compliance assessments, data governance, basic human oversight and cybersecurity. These requirements also apply to general-purpose AI systems.
   In the event of a violation of fundamental rights, there is a right of appeal to national market surveillance authorities.

(4) **Inacceptable risk** with seven exhaustively listed prohibited applications of AI (ranging from the manipulation of cognitive behaviour and Social Scoring to biometric real-time remote identification and also "subliminal influence").

[21] News: KI-Verordnung final. Online ibidem.

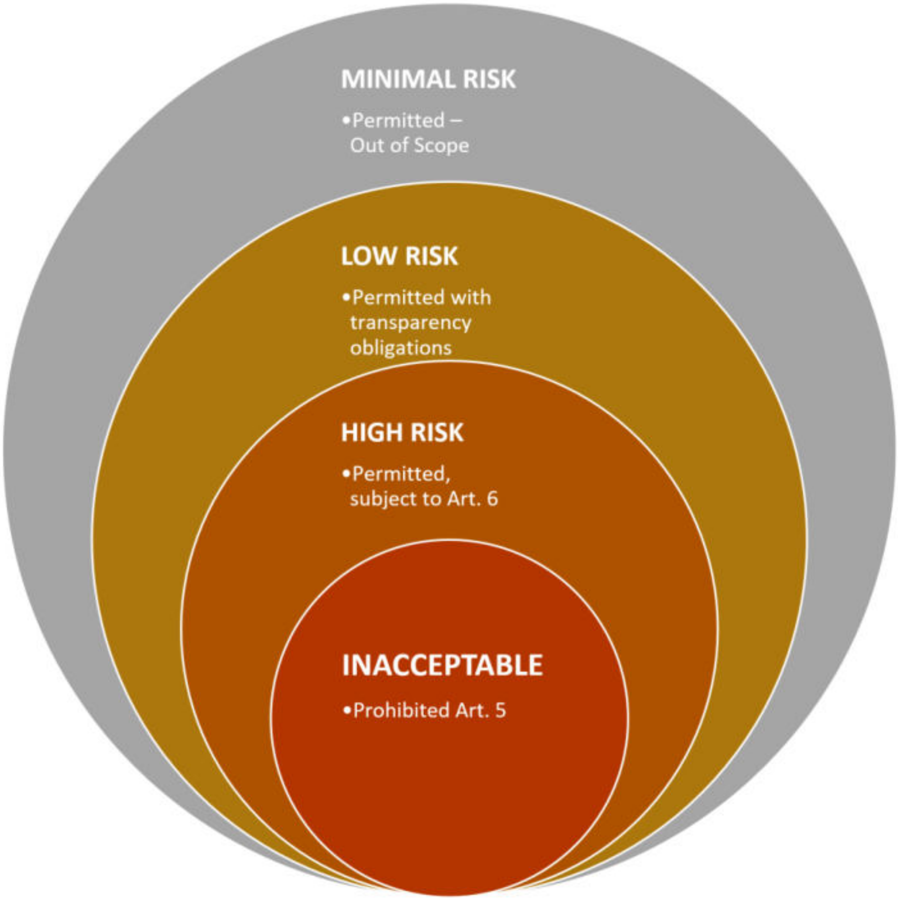

Figure 1: Authors compilation. Source: Eylaw-Ar: AI Act Der EU: Was Start-Ups Rechtlich Wissen Müssen! *EY Law* (blog). 29 July 2024. https://www.eylaw.at/ai-act-der-eu-was-start-ups-rechtlich-wissen-muessen.

However, the EU's highly ethical principle is qualified by the range of exemptions for law enforcement, migration and border control (following judicial approval), research and development of AI, medical and security surveillance and the entire military security sector.[22] The most significant differ-

[22] European Parliament topics: AI Law. First regulation of artificial intelligence. 13 March 2024. Online ibidem; WEKA Business Solutions: The new AI regulation in the EU. 2024. Online ibidem; European Commission: Artificial intelligence Q&A. 12 December 2023. Online ibidem. News: AI regulation final. Online ibidem.

ences to the OECD countries and, in particular, to the US can be seen in the core issue of the risk assessment of AI. The "Guidance for Regulation of Artificial Intelligence Applications" published by the US Office of Management and Budget includes risk assessment and management among the ten basic principles for using AI technology, while the National Institute of Standards and Technology's (NIST) Artificial Intelligence Risk Management Framework explicitly rejects the categorisation of four risk types, arguing that this would only add to the cost of implementing AI regulations and make the path to international AI regulation more difficult. The EU is therefore caught in a dilemma between (too) high ethical standards and the demands of a rapidly growing AI market, which calls for a "Global Partnership on Artificial Intelligence" as defined by the OECD.[23]

2.3 Control and monitoring instruments

The institutionalisation of controls and instruments is analogous to the degree of risk assessment in the use of AI technology. The OECD and UNESCO primarily focus on education, information and training of educators, each coordinated by a Global AI Observatory or Global AI Ethics and Governance Observatory, supported by national institutions of the member states (Austria: Advisory Council on Ethics in AI), while the Council of Europe relies on strengthened legal instruments (guidelines for users on risk mitigation, minimum requirements for impact assessments) to be implemented by national authorities. The UN Resolution also considered its recommendation to be only a prelude to the Summit of the Future held in New York on 22-23 September 2024 as part of the UN General Assembly, where the above-mentioned "digital pact" between the "Global South" and the "Global North" on the fair use of AI technology was concluded. In the end, the only monitoring tools provided were a Scientific Advisory Board and ongoing dialogue between states and private stakeholders. The proposed Digital Human Rights Advisory Service of the UN Office of the High Commissioner was reduced to a monitoring function "upon request".[24] The control measures and instruments of the NATO AI Strategy also do not go beyond general principles such as legality, accountability, transparency, func-

23 Meltzer/Tielemans: The European Union AI Act. Online ibidem.

24 Reiland: United Nations. ibidem.

tional reliability and certification following stress tests.[25] The EU AI Act is implemented centrally by a dedicated AI Office and the European Data Protection Supervisor, based on a database for independent high-risk systems, in cooperation with the mandatory national AI authorities (supervisors) of the member states. The extension of the supervisory powers of the AI Office and its sanctioning powers (fines of up to €35 million or 7% of global annual turnover) prevented the softer control proposals (self-assessment by producers, appointment of independent third-party boards) put forward by global data companies during the negotiations on the AI Act. The AI Act is closely linked to other legislation as part of the EU's digital strategy, in particular, the Data Governance Act of April 2022 and the GAIA-X project.[26]

2.4 Conclusion

Apart from the EU's risk-based AI strategy, all current international AI regulations are characterised by consistent optimism surrounding the positive applications of AI in everyday civil society. Protection against the potential dangers of AI and HE technology already in practice, which have long been pointed out by an alarmed international scientific community, is generally found in verbal assurances such as "trustworthy technology", "human-centred control", "transparency of the accountability loop", "ethics of logarithms", etc., whose placebo rhetoric is all too easily overlooked. This is clearly expressed in the proclamations and declarations of the "Global Digital Compact", agreed as part of the UN's "Summit of the Future", which took place on 22-23 September 2024. Although it claims to be a new digital governance order, it does not go beyond general phrases such as "inclusive digital economy" and "inclusive, open, safe and secure digital space".[27]

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25 NATO: Summary. Online ibidem.

26 Meltzer/Tielemans: The European Union AI Act. Online ibidem. European Commission, European Data Protection Supervisor: Artificial Intelligence. accessed 29 June 2024. https://www.edps.europa.eu/data-protection/our-work/subjects/artificial-intelligence_en, News: AI regulation final. Online ibidem. European Commission: European AI Office. 6 June 2024. https://digital-strategy.ec.europa.eu/en/policies/ai-office.

27 United Nations: Summit of the Future. Accessed 30 September 2024. https://www.un.org/en/summit-of-the-future; United Nation: Dag Hammarskjöld Library, UN documentation: Development. Introduction, 2000-2015. Accessed 10 November 2024. https://research.un.org/en/docs/dev/2000-2015.

3. AI rules in military, defence and security policy

3.1 Special law vs. legal vacuum?

In all of the AI regulations that were compared at the beginning, the area of military security or security policy was either not addressed at all or was deliberately excluded (with the exception of the NATO AI Strategy). This applies both to UN Resolution 2021 (introduced by the US), in which the entire military use of AI was excluded (due to a lack of consensus), and explicitly to the EU AI Act of March 2020, according to which AI systems used exclusively for defence and national security are exempted from the otherwise applicable obligations and prohibitions in the event of unacceptable risks. Against the background of a dense set of AI norms at global and regional European level – which, however, do not cover the entire area of military security and defence policy – there is a need for a specific normative order for this sector, where the massive use of AI technology and the resulting risk potential are currently most evident. The debate at military and civilian level oscillates between the positions of special regulation for the military versus subordination of the military sector to general AI regulations.[28] The UN Convention on Certain Conventional Weapons (CCW), which entered into force in 1983, represented an initial approach to international regulation of AI in the military sector, which subsequently led to years of negotiations by a Group of Governmental Experts (GGE) on the inclusion of "lethal automatic weapons systems" (LAWS). The initial result is the 11 (non-binding) guidelines drawn up in 2019, in which the validity of classical international humanitarian law and the principle of human responsibility and decision-

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[28] Ethics and Armed Forces: Controversies in Military Ethics & Security Policy: 2024/1 - AI and Autonomy in Weapons: War and Conflict out of Control? Autonomous Weapons Systems – Current International Discussions. https://www.ethikundmilitaer.de/en/2024/1-ai-and-autonomy-in-weapons-war-and-conflict-out-of-control/autonomous-weapons-systems-current-international-discussions; Ethics and Armed Forces: Controversies in Military Ethics & Security Policy: 2024/1 - AI and Autonomy in Weapons: War and Conflict out of Control? AI for the armed Forces does not need a special morality! A brief argument concerning the regulation of autonomous weapons systems. Accessed 29 June 2024. https://www.ethikundmilitaer.de/en/2024/1-ai-and-autonomy-in-weapons-war-and-conflict-out-of-control/ai-for-the-armed-forces-does-not-need-a-special-morality-a-brief-argument-concerning-the-regulation-of-autonomous-weapons-systems; IFFF: Wiener Konferenz zu autonomen Waffensystemen. 13 May 2024. https://www.wilpf.de/publikationen/.

making authority were established for all automatic (i.e. also AI-based) weapon systems.[29] This consensual mode of negotiation also forms the basis of the mandate of the group of experts appointed by the governments concerned, which was extended in November 2023, but whose results would continue to be considered completely non-binding due to the opposition of certain highly armed states.[30] In contrast to this familiar diplomatic practice, the growing concern of the global community about the potentially lethal effects of the new AI technology led to a joint appeal by the UN Secretary-General and the President of the ICRC in October 2023 to reach a binding agreement on the prohibition of LAWS by 2026. The result of these efforts was UN Resolution 78/241 (introduced by Austria) on autonomous weapons systems, adopted by 164 states at the General Assembly in December 2023. Regional conferences on LAWS have since been held in Latin America, Africa and Europe. The most recent of these was the international conference convened by Austria on 23-24 April 2024 entitled "Humanity at the Crossroads: Autonomous Weapons and the Challenge of Regulation" in Vienna. The aim of the conference, which brought together 130 countries and representatives from business, academia and civil society, was to develop an international regulatory framework to ban or at least restrict autonomous weapons systems (known in the media as "killer robots"). However, the adoption of a common protocol has so far failed to materialise due to the principle of consensus.[31]

29 Wikipedia: Ethics of artificial intelligence. Wikimedia Foundation. 4 December 2024, at 5.29 p.m. (UTC). https://en.wikipedia.org/wiki/Ethics_of_artificial_intelligence.

30 Wikipedia: Ethics of artificial intelligence, online ibidem; Connolly, Catherine: How are efforts to reach a legally binding agreement on autonomous weapons systems progressing? In: Ethics and Armed Forces: Controversies in Military Ethics & Security Policy. AI and Autonomy in Weapons: War and Conflict out of Control? Accessed 15 July 2024. https://www.ethikundmilitaer.de/en/magazine-datenbank/detail/01-2024/article/autonomous-weapons-systems-current-international-discussions.

31 Connolly, Catherine: How are efforts to reach a legally binding agreement on autonomous weapons systems progressing? Online ibidem; Bilgeri, Andreas: Autonomous weapons systems - the state of the international debate. In: AI and Autonomy in Weapons: War and Conflict out of Control? ed. Zentrum für ethische Bildung in den Streitkräften (ZEBIS) Ethik und Militär. Kontroversen in Militärethik und Sicherheit. Accessed 15 July 2024. https://www.ethikundmilitaer.de/en/magazine-datenbank/detail/01-2024/article/autonomous-weapons-systems-current-international-discussions; ORF. *News Wien* on 28 April 2024: Konferenz will Regeln für Killerroboter. https://orf.at/stories/3355502/.

3.2 Unity in non-uniformity

In the context of the currently still open debate, the following positions of individual states and alliances of states can be identified at international level, some of which contradictory, some of which cross-cutting:[32]

a) Although a minority of highly armed states participate in the CCW, they reject any prohibition of LAWS through multilateral agreements. In addition to the US, Israel, Australia and India, this includes the Russian Federation, which has been working on the development of LAWS since 2012. The majority of the international community is in favour of a two-tier multilateral regulatory framework that seeks to ban AI and to regulate the controlled use of AI in the military sector. Under international law, this is based on multilateral, non-binding consensus agreements based on the GGE Guiding Principles, which do not in-

[32] Dahlmann, Anja/Hoffberger-Pippan, Elisabeth/Wachs, Lydia: Autonome Waffensysteme und menschliche Kontrolle Konsens über das Konzept. Unklarheit über die Operationalisierung. In SWP-Aktuell 2021/A 31, 14 April 2021. doi:10.18449/2021A31. https://www.swp-berlin.org/10.18449/2021A31/. Bilgeri, S: Autonome Waffensysteme. Online ibidem; Gillen, Erny: Das Militär braucht keine Sondermoral! Ein Zwischenruf zur Regulierung autonomer Waffensysteme. *Ethic and Armed Forces. Controversies in Military Ethics & Security Policy*. 30 October 2024. https://www.ethikundmilitaer.de/en/magazine-datenbank/detail/01-2024/article/ai-for-the-armed-forces-does-not-need-a-special-morality-a-brief-argument-concerning-the-regulation-of-autonomous-weapons-systems; Reitmeier, Gabriele: *Lizenz zum Töten Künstliche Intelligenz in den Waffensystemen und neue Herausforderungen für die Rüstungskontrolle*. ed. Friedrich-Naumann-Stiftung für die Freiheit. October 2020, file:///C:/Users/aborowska/Downloads/Policy%20Paper%20LAWS-final.pdf; Government of the Netherlands. REAIM 2023. Accessed 15 July 2024. https://www.government.nl/ministries/ministry-of-foreign-affairs/activiteiten/reaim; U.S. Department of State, Bureau of Arms Control, Deterrence, and Stability: Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy. 1 November 2023. https://www.state.gov/political-declaration-on-responsible-military-use-of-artificial-intelligence-and-autonomy/; U.S. Department of State (gov): Political Declaration on Responsible Use of Artificial Intelligence and Autonomy. PDF. Accessed 15 July 2024. https://www.state.gov/wp-content/uploads/2023/10/Latest-Version-Political-Declaration-on-Responsible-Military-Use-of-AI-and-Autonomy.pdf, 1-2; EPO, Entwicklungspolitik online Weltpolitik: Autonome Waffensysteme Russland, Indien, Israel und USA blockieren Verbotsverhandlungen. 20 December 2021. https://www.epo.de/index.php?option=com_content&view=article&id=16398:autonome-waffensysteme-russland-indien-israel-und-usa-blockieren-verbotsverhandlungen&catid=50&Itemid=84.

terfere with independent national regulations. These include, for example, the UK and the Netherlands, which together with South Korea organised the REAIM 2023 conference on “Responsible Artificial Intelligence in the Military Domain” in The Hague in February 2023 with the participation of 100 states and representatives from science, research, industry and civil society, and which will be continued in Seoul in September 2024. The “Call for the use of military AI based on national guidelines” agreed by 61 participating states was seen as a setback by civil society NGOs and undermined by the US, with its own “Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy”. The programmatic summary of the declaration published by the Department of State is based, on the one hand, on the right of states to develop autonomous weapons systems in order to improve their military capabilities, which ultimately also carry out operations that are no longer controlled by humans. On the other hand, this development should be consistent with ethical standards based on international conventions and traditional international humanitarian law, which should be ensured through training, transparency and oversight of the “senior officer corps”. Of the 54 states that signed the declaration by 29 May 2024, 39 already had LAWS.

b) Multilateral agreements at the UN CCW Conference on Disarmament in Geneva, based on the 11 Guiding Principles developed by the Group of Governmental Experts (GGE) in 2019.
    - For most states’ parties, these are seen only as non-binding declarations and proposals that do not exclude national regulations, such as France (national AI strategy 2019), Switzerland and Germany, whose government adopted a national AI strategy in 2018, limited to non-military areas, and at the same time decided to ban LAWS, but called on the Bundestag to establish principles for armed drone missions in 2023.[33]
    - A minority (non-aligned states, Austria, Brazil, Japan), on the other hand, calls for the binding effect of the GGE Guiding Principles and the prohibition of LAWS.

[33] Sauer, Frank: Drei Thesen zur nationalen Regulierung von Autonomie in Waffensystemen [Three theses on national regulation for autonomy in weapons systems], in: Lammert, Norbert/Koch, Wolfgang (Eds.): Bundeswehr der Zukunft – Verantwortung und Künstlichen Intelligenz, Konrad-Adenauer-Stiftung, 58-69, 2023.

- Special positions:
  The People's Republic of China occupies a special position. As part of its global power policy, China focuses on unlimited expansion of its armed forces with the development of all AI technologies in order to overcome the existing digital supremacy of the West. In May 2019, China published the "Beijing AI Principles". On the other hand, it is also taking part in the GGE negotiations and, as recently as 2016, was in favour of a ban on LAWS in war operations.[34]
- Japan's current AI policy also appears ambivalent. On the one hand, the G7 member is calling for international regulation of the trustworthy development and use of AI in the civilian sector as part of the Hiroshima AI Process, has established its own AI Safety Institute and is planning a Tokyo Centre for the Global Partnership on AI (GPAI). The Ministry of Defence is also pushing for the widespread use of AI technology in seven core areas of national security as part of a directive issued in July 2024. At the same time, the government issued a directive against the development of LAWS, a position that was also officially submitted to the UN.[35]
- The heterogeneous positions of NATO's 32 member states on the issue of LAWS (ranging from the rejection of any ban to modification of the principle of human-centred control, to government declarations in favour of a ban on autonomous weapons systems) explain why, despite a comprehensive yet very pragmatic catalogue of principles, the Alliance has so far failed to reach a unified position on the regulation of LAWS.

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[34] Pramudia, Putu Shangrina: China's Strategic Ambiguity on the Issue of Autonomous Weapons Systems. In *Global: Jurnal Politik Internasional*. Vol. 24: No. 1/2000, DOI: 10.7454/global.v24i1.706. https://scholarhub.ui.ac.id/global/vol24/iss1/1/; Schwan, Ben: China stellt Richtlinien für Künstliche Intelligenz auf. Die 'Beijing AI Principles' sollen eine Art Erklärung der Menschenrechte für KI-Anwendungen sein. In: *Heise online, 16 June 2019*. https://www.heise.de/news/China-stellt-Richtlinien-fuer-Kuenstliche-Intelligenz-auf-4442404.html.

[35] Nova, Agenzia: Japan has a policy against the development of lethal fully autonomous weapons: "A human-centric principle should be kept at the center of technological development". 15 July 2024. https://www.agenzianova.com/en/news/il-giappone-adotta-una-politica-contro-lo-sviluppo-di-armi-letali-completamente-autonome/.

- The EU also occupies a special position with its strictly risk-based AI regulation of May 2024, which, however, only applies to the civilian use of AI technologies (and thus also to their commercial use), while the military and security sector is excluded and requires its own regulation. However, there is also resistance within the EU to this "special right" for the military sector.
- The strict separation between civilian and military AI does not exclude its intensive and long-term use as a political and legal agenda of the EU. Any regulation of the production and use of AI technology in the military sector is subject to a permanent conflict of interests within the three decision-making bodies, namely the EU.
    - On the one hand, the need to protect European society from the potentially harmful effects of the use of AI weapon systems.
    - On the other hand, the legitimate security interests of EU member states and the Union itself to protect themselves against attacks and threats from third countries or terrorist groups using all modern weapon systems, including LAWS.
    - In their proposals and concepts, all three decision-makers - the European Commission, the Council (of Foreign Ministers) and the European Parliament - oscillate between an ethically justified strategy of restriction and prohibition and a technology policy that enhances the EU's legitimate defence capabilities.

This applies, in particular, to the position of the European Parliament, which, based on hundreds of submissions and petitions from civil society, had already adopted a resolution in September 2018 calling for a fundamental ban on LAWS. Behind this moral demand, however, there are other security interests of the parliamentarians, who are in favour of the safe development and use of autonomous weapons systems, but in compliance with a clear human-centred legal chain of responsibility or an international governance control body to be established at UN level.[36] This "soft law" strategy characterises the position of the European Parliament.

This "soft law strategy" also characterises, to a much greater extent, the position of the Foreign Affairs Council (FAC) and the Commission, which avoids all issues and focuses much more on geopolitical and economic aspects, combined with the realisation that the member states are currently not prepared to surrender their sovereignty in these matters in favour of majority decisions. The EU is fully in line with the trend of international AI regulation agreed to date, which is fundamentally characterised by optimistic expectations about the many improvements to everyday life that the new AI technology will bring. This technological "faith" is also widely shared by global civil society, as sociological evidence shows.[37]

3.3 "Human in the loop" vs "Human out of loop"

The decisive criterion for the use or prohibition of LAWS is expressed in two magical keywords: "human in the loop" vs "human out of the loop", i.e. the assured human control of autonomous weapon systems in use - as opposed to operational decisions determined autonomously by the weapon system.[38] However, this apparently ethically and logically clear distinction between applicable and prohibited LAWS loses its selectivity in practice, as the human-centred control principle can also be interpreted pragmatically as "sufficient human control", in which the controlling person exercises overall supervision, but can ultimately be replaced by the autonomous weapon system for operational command.[39]

Transferring the criterion of human-centred control competence to our left-right scheme leads to the following weighting (see Figure 2, next page):

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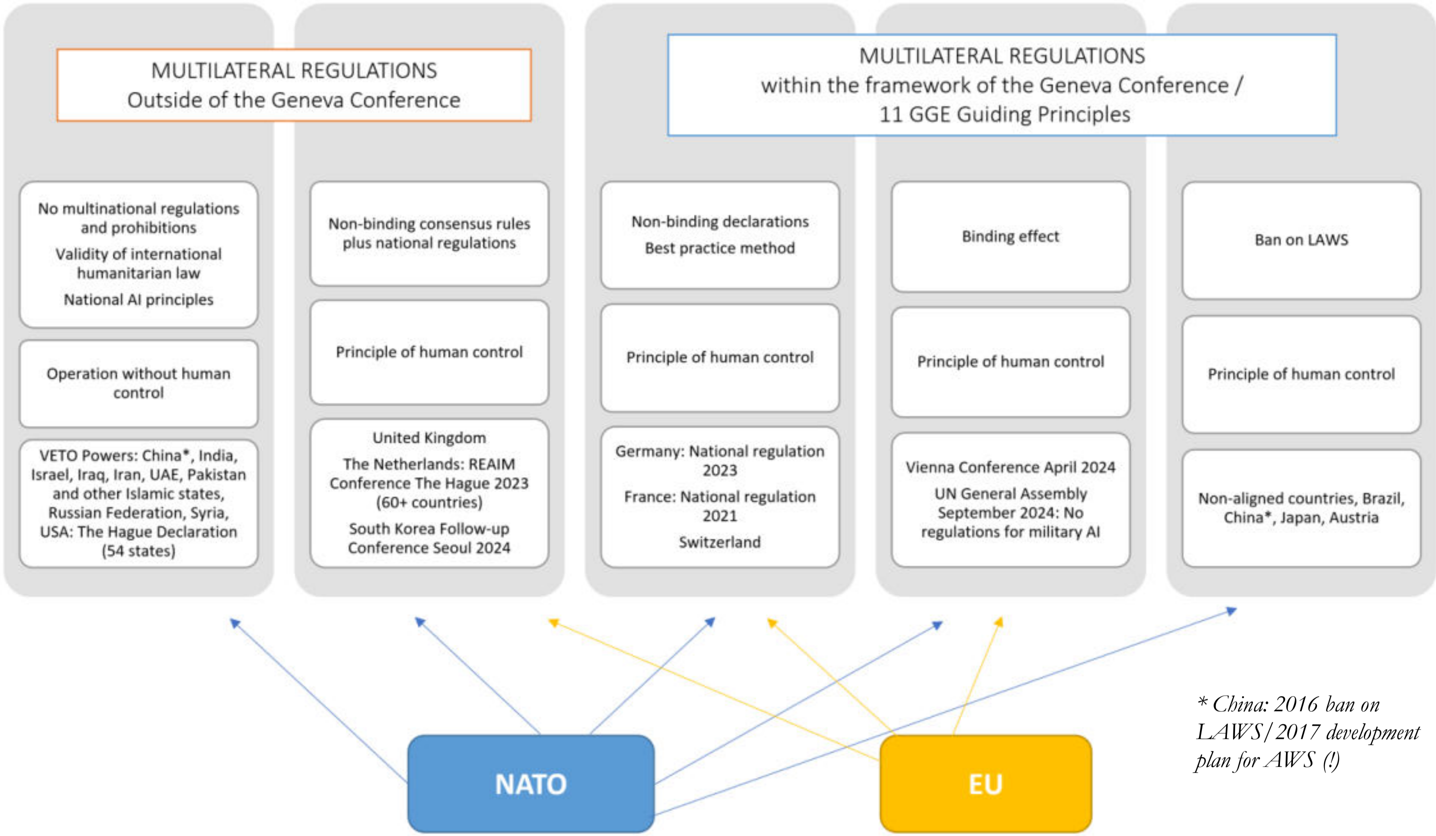
36 Conn, Ariel: European Parliament Passes Resolution Supporting a Ban on Killer Robots. *Future of Life Institute.* 14 September 2018. https://futureoflife.org/ai/european-parliament-passes-resolution-supporting-a-ban-on-killer-robots/; Santopinto, Federico: *N O T E - The EU, Artificial Military Intelligence and Autonomous Lethal Weapons*. Institut des Relations Internationales et Strategiques. France, 2024. https://coilink.org/20.500.12592/6hdrf4d.

37 Hofer, Bernhard: Impact. ibidem, Tab. 2 Scenarios.

38 Wikipedia: Ethics of artificial intelligence. Online ibidem.

39 Santopinto: The EU. Online ibidem.

Figure 2: Positions of states and alliances of states on LAWS



** China: 2016 ban on LAWS/2017 development plan for AWS (!)*

Authors illustration based on Figure 1. Sources: Dahlmann, Anja/Hoffberger-Pippan, Elisabeth/Wachs, Lydia: Autonomous Weapon Systems and Human Control. Consensus on the concept, uncertainty about operationalisation, SWP-Aktuell 2021/A 31, 14.04.2021, Stiftung Wissenschaft und Politik (SWP) 2021 URL: https://www.swp-berlin.org/10.18449/2021A31/, accessed 15

The minority group against bans and multilateral regulations adopts the interpretation of the U.S. Department of Defense policy that autonomous weapons systems must ultimately be able to select and engage targets without further intervention by a human operator.[40] The International Committee of the Red Cross uses a more drastic definition: "Autonomous weapon systems select targets and apply force without human intervention."[41] In contrast, in 2017, Russia, otherwise a classic veto power, was still in favour of the principle of human-centred control, albeit without an international commitment. For the majority of states that accept multilateral regimes in various forms, the principle of human-centred ultimate control remains, albeit with increasingly different interpretations. The maxim of "meaningful human control" demanded by NGOs and civil society, i.e. the obvious human-control competence as a principle that applies to all phases of decision-making, planning and operational implementation, is replaced by a multitude of semantic modifications from "sufficient human control" to "sufficient human supervision" to "appropriate human judgement". This softening of ethical positions is most evident in the EU institutions: the ban on LAWS adopted by the EP in 2019 was transformed in the resolution of 15 December 2021 into a distinction between pure "killer robots" and normal LAWS, the use of which can only be ordered by authorised persons in specific cases. The Foreign Affairs Council (FAC), which is fundamentally more pragmatic in its approach, is even clearer when it uses the term "sufficient human supervision". With the further differentiation between autonomous air defence systems and LAWS, the promotion of LAWS would, at least in theory, also be possible within the framework of the European Defence Fund.[42]

4. The "Gretchenfrage" (key question) – What do you think about ethics?

The deliberate semantic ambiguities and attempts to interpret key legal and international legal terms have alarmed representatives of ethically and morally oriented groups and civil society bodies to defend principles that were previously beyond dispute. The disputes focus not only on the particularly sensitive area of the application of LAWS, but also on the fundamental prob-

40 Santopinto: The EU. ibidem.

41 Wikipedia: Ethics of artificial intelligence. Online ibidem.

42 Santopinto: The EU. ibidem.

lem of ethically justifiable restrictions on the use of AI and HE technologies, which are ostensibly intended to serve the general progress of humanity or the overall optimisation of human capabilities. In this struggle for "immovable basic principles" and "red lines" that cannot be crossed, we refer to only a few manifestations in the context of the comments in ZEBIS (2024/1) and their main arguments:[43]

- In March 2023, the German Ethics Council spoke out against the ability of machines to act and take responsibility "within the framework of the philosophical theory of action" and insisted on the fundamental human ability to control.
- The interdisciplinary network "Meaningful Human Control – Autonomous Weapon Systems between Regulation and Reflection" calls for "human-centred" interaction between the weapon system and the ultimately responsible human being. This "meaningful human control" would also make it possible to assign responsibility and impose criminal sanctions for misconduct. This is because national and international criminal law, as well as international humanitarian law, are fundamentally human-centred and therefore cannot be applied to the actions of autonomous machines that cause harm.
- From the perspective of Catholic moral theology, "digitalised killing" per se undermines the formal and material dignity of human beings, upon which all modern ethical convictions are ultimately based.
- Beyond religious theology, secular social philosophy also derives its rejection of autonomous AI technology from the principle of inviolable human dignity. Jürgen Habermas and Francis Fukuyama, for example, generally see the physical-psychological "improvement of the species" of humans (illustrated by the figure of the "cyborg") as a loss of their ethical freedom and ultimately a violation of the principle of equality by differentiating between those who have AI and those who do not. The criterion of individual free will for the use of

[43] ZEBIS ed.: Connolly, "Wie geht es mit den Bemühungen [...]"; Gillen: AI for the military ibidem; Beck, Susanne: Humanity in war? The significance of 'Meaningful Human Control' for the regulation of autonomous weapons systems; Koch, Bernhard: Human dignity and 'autonomous' robotics: What is the problem? June 2024. https://www.ethikundmilitaer.de/fileadmin/ethics_and_armed_forces/Ethics-and-Armed_Forces-2024-1.pdf.

(medical, psychological, technical, etc.) HE measures or other AI technologies, which Habermas and others call for as a turning point, extends the debate to the fundamental question of the ethical and legal limits of HE and AI technologies.[44]

Against this phalanx of principle-oriented (deontological) ethicists, to which Bernhard Hofer and Rita Phillips, for example, refer in their contributions, the proponents of "post-humanism" are forming, whose understanding of ethics is measured purely in terms of the success and consequences of the use of weapons, under the maxims of increasing efficiency, global competition and military superiority. According to the maxims of increased efficiency, global competition and military superiority, states (and alliances of states) are entitled not to abandon these potential military advantages without clear evidence of the danger posed by autonomous weapons systems. Civil society, whose acceptance of civil and military AI and HE technology should be demanded, is increasingly being left out of this very "academic" dispute.[45]

This debate is intensified by new innovations and advances in the development of AI capabilities, according to which the problem of the ethical legitimacy of the operation of autonomous AI systems could be solved by the implementation of ethical decision-making capabilities. This would also relativise the chain of human ultimate responsibility in the sense of "machine ethics" (ethics for machines as subjects). If we follow the proponents of this "moral Turing Test", three types of "moral agents" relevant to our debate can be distinguished (James Moor):

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44 Hofer, Bernhard: Effects of human enhancement technologies (HET) on society. In chapter SOCIETY in this publication; Tragbar, Lisa/Lagos, Rodrigo: Human Enhancement for military purposes: Ethical considerations. In chapter ETHICS in this publication.

45 Zajac, Maciek: Burden of Proof in the Autonomous Weapons Debate – Why Ban Advocates Have Not Met It (Yet). Ethics and Armed Forces 01/2024, pp. 34-42 Masuhr, Niklas: KI als militärische Befähigungstechnologie. *CSS Analysen zur Sicherheitspolitik*, nr. 251/October 2019, ed. Merz, Fabien, pp. 1-4. https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/CSSAnalyse251-DE.pdf; Hofer, Bernhard: Effects of human enhancement technologies (HET) on society. In chapter SOCIETY in this publication. Phillips, Rita: Ethical discourses on autonomous weapon systems. In chapter SOCIETY in this publication.

(1) the implicitly ethical agent, with an ethical dimension traceable to the operator;
(2) the explicitly ethical agent, making ethical decisions based on acknowledged moral information; and
(3) the fully ethical agent, explicitly capable of judgement and reasoning.[46]

However, this would be a clear violation of the principle of responsibility (human in the loop), which has so far been undisputed in international law, and is likely to provoke strong protests and interventions at scientific and social level. On the other hand, it seems appropriate to draw attention to the technological development of military autonomous weapons systems, which is already underway and against which the international community currently imposes no legal restrictions. Joachim Klerx's article "The Future of Human Enhancement in the Military Domain" is a milestone in this respect. In it, the author points to profound changes in warfare between 2025 and 2045, in which a new form of "Artificial Super Intelligence (ASI)" will make the political and strategic decision-making processes of warfare more efficient. This process of "disempowerment" of the individual in the military sector has its counterpart in civilian AI technology: here, the largest global digital platforms (Microsoft, Google, Amazon) are competing to develop and mass-produce a new AI Copilot. This digital agent would be the "intimate" companion of its client, both as a talking advisor and as an independent "legal entity" (signing contracts, managing passwords, etc.). The potential dangers posed by the arbitrary autonomy of AI technology would have to be pre-emptively averted by internal corporate "ethics committees".[47]

As Rita Phillips explains in detail, certain HE inventions, in particular, augmented reality (AR) and brain-computer interface (BCI), could enable the

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[46] Wikipedia: Ethik der künstlichen Intelligenz. https://de.wikipedia.org/wiki/Ethik_der_k%C3%BCnstlichen_Intelligenz. Based i.a. on Rath, Matthias/Krotz, Friedrich/ Karmasin, Matthias (eds.): Maschinenethik. Normative Grenzen autonomer Systeme. Springe VS, Wiesbaden 2018; Müller, Vincent C.: Ethics of Artificial Intelligence and Robotics. In: Edward N. Zalta (ed.): The Stanford Encyclopedia of Philosophy (Summer 2021 Edition). https://plato.stanford.edu/archives/sum2021/entries/ethics-ai/.

[47] Klerx, Joachim: The future of human enhancement in the military domain. In chapter TECHNOLOGY in this publication; Jürgens, Johanna: Die Agenten kommen. In: *Die Zeit.* nr. 46. 30 October 2024, 19.

human operator to incorporate more ethical components into the use of AWS. The integration of HE findings into the development of new AWS would strengthen the cognitive and affective capabilities of the human controller in their position "in the loop" (such as the ability to distinguish between civilians and enemies) and thus create greater distance from the killing and destruction of the enemy.[48] However, this new "Icarus" version of a future HE "*Übermensch*" (superhuman) can be countered by the argument of the loss of individual responsibility caused by HE and thus the criminal liability of the actions of "enhanced" persons. The permanent use of biochemical, cybernetic prostheses, etc. HE can lead to the reduction or elimination of the individual's ability to recognise the wrongfulness of the action taken and thus their responsibility and culpability. However, the reduction or loss of the cognitive element of "mens rea" consequently leads to the perpetrator's "enhanced" lack of guilt and impunity. The legal position of the International Criminal Court (ICC), which has been active since 2002, seems to be helpful here. Article 30 of its "Rome Statute", for example, addresses the partial or total lack of responsibility of a perpetrator acting while intoxicated, but not the voluntary use of these means. However, this insight, which is reminiscent of Habermas's postulate of free will, finds its logical limit specifically in the area of military obedience to orders or the ability to act in an emergency. In principle, however, the ultimate responsibility of the state - acting through its executive branch - remains, which, through the use of such means, aims at or tolerates the reduction or elimination of the ethical capabilities of the offending individual.[49]

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48 Phillips, Rita: Ethical discourses on autonomous weapon systems. In chapter SOCIETY in this publication.

49 Harrison Dinniss, Heather A./Kleffner, Jann K.: Soldier 2.0: Military Human Enhancement and International Law. In: International law studies 92/2016, 432-482, here 474-482. https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1695&context=ils; More general on voluntariness and obligation of obedience, see e.g.: Daniel, Giffhorn/Gerndt, Reinhard: "Meaningful Human Control" von autonomen Systemen. In: KI und Autonomie in Waffen: Kriege und Konflikte außer Kontrolle? Ethik und Militär, 01/2024, pp. 68-75. https://www.ethikundmilitaer.de/fileadmin/ethik_und_militaer/Ethik-und-Milit%C3%A4r-2024-1.pdf.

4.1 Military AI ethics perspectives

Two international legal developments are currently decisive for an Austrian HE and AI regulation within the framework of military security policy: The results of the negotiations at the UN Convention on Certain Conventional Weapons (CWW) in Geneva. Despite all verbal commitments to the principles of international law and international humanitarian law, these have a pragmatic-technological orientation (strongly influenced by the USA). This approach of comprehensive international AI regulation is being promoted, in particular, by the Federal Ministry for European and International Affairs, which, following the Vienna Conference on limiting AI in April 2024-2026, anticipates a regulatory proposal from the UN Secretary-General, including the establishment of a regulatory authority. However, the escalation of the current wars means that such a regulation cannot be expected in the foreseeable future.[50]

The EU's AI policy, with its separation of civil and military AI technologies. Although this separation is problematic due to the reality of "dual-use" technologies, it allows the EU to establish a heavily risk-based, binding regulation for the civilian AI sector with a graduated scale of restrictions and prohibitions, while at the same time steering a pragmatic course for the military AI sector that does not abandon the high European ethical standards, but takes into account the security policy sovereignty of the member states and the EU. The fundamental question posed at the beginning of this paper regarding an ethical approach to the use of AI and HE technologies, in AWS in particular, therefore remains unanswered. A European or even international "guideline" is certainly not to be expected. As a result, two technical concepts continue to face each other, with high expectations:

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50 W24: Konferenz in Wien 2024: Regeln für Autonome Waffen. 29 April 2024. https://www.w24.at/News/2024/4/Konferenz-in-Wien-Regeln-fuer-Autonome-Waffen; UN, Regionales Informationszentrum der Vereinen Nationen UNRIC: Summit of the Future. Zukunftsgipfel. https://unric.org/de/un-system/un-zukunftsgipfel-summitofthefuture/; European Commission: The United Nations members adopted a Global Digital Compact shaping a safe and sustainable digital future for all. 23 September 2024, https://digital-strategy.ec.europa.eu/de/node/13020.

- The technocratic perspective, which believes that human responsibility in the operational phase of the mission can be replaced by the further development of fully autonomous weapon systems with the integration of appropriate ethical competences.
- The human-centred counter-position, which believes that the responsibility of the human operator can be preserved even in the final phase of the mission by enhancing human capabilities through the massive use of HE resources.

However, such technologically modified "principled military ethics" based on the European tradition of values can only find their concrete application in conjunction with "situational ethics", which specifically leave room for individual decisions depending on the situation.[51] However, this must not result in the arbitrary generalisation of the predetermined European canon of values, nor must it provide carte blanche for a purely pragmatic and arbitrary interpretation of ethical principles. It should instead be regarded as a guideline for the specific decision-maker on the basis of the proportionality of the infliction of harm and the weighing up of interests. In considering the ethical implications of a machine with "Artificial Super Intelligence", it is essential to recall Clausewitz's enduring insights on "moralische Größen". For Clausewitz, moral values encompass the development of a soldier's character, based on emotional and rational judgement, courage in the face of danger, accountability to external authority and inner conscience. In the context of modern warfare, where machines are increasingly capable of performing tasks traditionally associated with humans, it is crucial to uphold these values to ensure the ethical conduct of operations.[52]

[51] Wikipedia: Ethik der künstlichen Intelligenz. https://de.wikipedia.org/wiki/Ethik_der_k%C3%BCnstlichen_Intelligenz.

[52] Sob, Brigitte: 225 Jahre Clausewitz. Teil 3: Friktion und moralische Größen im Krieg. In: Der Soldat. nr. 22/2005, p. 10.

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Cheung, Sunny; Wettrennen um KI: Chinas Volksbefreiungsarmee und die NATO. In: Friedrich Naumann Stiftung Analyse. November 2023. https://www.freiheit.org/de/taiwan/wettrennen-um-ki-chinas-volksbefreiungsarmee-und-die-nato.

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Effects of human enhancement technologies (HET) on society

Bernhard Hofer

1. Introduction

Human enhancement technologies (HET) have already become a part of our daily lives. Almost every day, we are confronted with new developments in human research and innovation, which increasingly demand societal (re)orientation. What initially seemed like a linear increase in human knowledge has turned into an exponential curve, growing ever steeper, making us aware of the complexity of societal relationships through the multitude of elements, structures, processes and interactions.

This contribution, starting with the historical development of HET (Chapter 1.1), aims to outline the current state of research (Chapter 2). Chapter 3 is dedicated to the societal significance of HET, presenting three selected sociological theories as potential analytical tools, addressing the "social drivers", sketching the key developments since the Industrial Revolution, highlighting HE as an economic factor and exploring the societal benefits of these new technologies along with public expectations and attitudes.

The most extensive part of this discussion is dedicated to the societal challenges (Chapter 4). Alongside selected critical voices from science, reference is made to the possible influence of social groups, and the question is raised as to the extent to which the very concept of humanity itself could change. Chapter 4.4 deals with the potential effects of human enhancement on state security forces and emergency organisations today and in the near future, rounding out the discussion with any associated safety concerns.

Chapter 5 concludes the paper with a brief summary of the previous discussions and the derived conclusions. Embedded tables and graphics serve to broadly categorise specific subject areas and aid in orientation.

1.1 Historical development of human enhancement

The historical development of HET and their application in military contexts goes back a long way and reflects the efforts to enhance the performance of soldiers and achieve military objectives more effectively.

In ancient times and in the Middle Ages, various methods were already being used to improve the physical and mental abilities of warriors. These included techniques such as the use of stimulants like caffeine or plant extracts before battle, the use of armour and weapons to increase survivability and the application of tactics and strategies to improve combat effectiveness.

For instance, Hanson examines warfare in ancient Greece and describes how disciplinary measures and physical training contributed to the improvement of soldier performance.[1] DeVries analyses military technologies and tactics from the Middle Ages, including methods to enhance soldier performance through armour, weapons and siege techniques.[2] Keegan, in his work, covers the development of warfare from antiquity to modern times, touching on both psychological and physical aspects of troop leadership.[3]

Since antiquity, there have been examples of prosthetics and orthopaedic devices used to replace or support lost limbs.[4] In his autobiography, Götz von Berlichingen describes the loss of his right hand in the Battle of Landshut in 1504, as well as the use of his famous iron hand prosthesis.[5] These prostheses can still be found today in the Götzenburg in Jagsthausen and the German Historical Museum in Berlin.

Many of these technologies also found their way into civilian life. For example, the Roman road network was originally built to facilitate rapid troop movements and efficient army supply. Beyond this, these roads promoted

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1 Hanson, Victor Davis: The Western Way of War: Infantry Battle in Classical Greece. Berkeley: University of California Press, 1989.

2 DeVries, Kelly: Medieval Military Technology. Ontario: Broadview Press, 2012.

3 Keegan, John: A History of Warfare. New York: Alfred A. Knopf, 1993.

4 Gerste, Ronald: Die Geschichte der Prothesen. https://www.nzz.ch/wissenschaft/cybathlon-die-geschichte-der-prothesen-ld.119480, accessed 10 September 2024.

5 Von Berlichingen, Götz: Lebensbeschreibung: Götz von Berlichingen's Ritterliche Thaten. Daun (D): Aurel Verlag, 2008.

trade, communication and governance throughout the Roman Empire. Aqueducts ensured the water supply for Roman garrisons and fortified cities, while also providing fresh water to urban populations, improving public health and hygiene and supporting the growth of cities. At the Battle of Agincourt in 1415, the English gained a decisive advantage through the use of longbows. The longbows, with their greater range, allowed them to fire a large number of arrows and their penetrating power could even pierce the armour of French knights.[6]

With the advent of science and technology in the early modern period, new possibilities for improving military performance were explored. This included the development of better weapons and armour, medical techniques for treating injuries and diseases and the introduction of training programmes to improve the physical fitness and combat skills of soldiers.

One milestone, significant even for the civilian sector, was the development of glasses, which likely appeared around the year 1285 in the region of Pisa or Florence. These early glasses, made from convex lenses, were primarily used to correct farsightedness. Initially, these valuable tools were used in scriptoria, where monks and scholars copied and studied manuscripts. In the 14th and 15th centuries, the use of glasses spread among educated and wealthy individuals, and the first workshops in Italy, Germany and the Netherlands began producing and selling glasses. In the 16th century, the utility of glasses expanded with the development of concave lenses to correct shortsightedness.[7]

During the Industrial Revolution and up until the 20th century, increasingly advanced technologies and methods were developed to improve military performance. This included the introduction of firearms, artillery and other modern weapon systems, the application of new camouflage techniques, the development of military medicine and first-aid techniques and the use of propaganda and psychology to boost soldiers' morale and commitment.

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6 Curry, Anne: Agincourt. A New History. Tempus Publishing Ltd. 2006. https://archive.org/details/agincourtnewhist0000curr/page/n5/mode/2up.

7 Wikipedia: Die Erfindung der Brille. https://de.wikipedia.org/wiki/Brille#Erfindung_der_Brille, accessed 10 September 2024.

In the course of World War II and the subsequent Cold War, the possibilities for human enhancement expanded significantly. Radar and microwave technology revolutionised warfare by improving reconnaissance and early warning systems. Penicillin, the first antibiotic produced in large quantities, significantly reduced mortality rates and increased the survival chances of the wounded. To achieve higher speeds and altitudes, jet engines were developed for military aircraft, which later laid the foundation for modern commercial airplanes.

Research on drugs and stimulants to increase soldiers' endurance and performance also advanced. Both the German Wehrmacht and the Allied forces used amphetamine-based stimulants to keep soldiers awake, increase endurance and improve cognitive performance. For instance, the Wehrmacht used the drug "Pervitin" (a form of methamphetamine) to keep soldiers alert and focused during combat.[8] During the Iraq War in the 2000s, some military units used Modafinil, a medication for treating narcolepsy and sleep disorders, known as an "attention enhancer" to mitigate the effects of sleep deprivation (allowing soldiers to stay on active duty for up to 40 hours) and improve cognitive performance.[9]

The development of implantable medical devices such as pacemakers, cochlear implants (hearing prostheses) and neurological stimulation devices has made it possible to enhance or support human body functions, and organ transplants today give people with life-threatening illnesses a second chance.

In recent years, significant technological leaps have been made in areas such as genetics, biotechnology, robotics, neurotechnology and AI. Advanced prosthetics and exoskeletons have been developed to improve physical abilities, drones and robots are used for remote surveillance and control, and pharmacological substances are employed to enhance cognitive abilities. However, the latter has not always been successful. Vrecko examined the limitations of those known as "cognitive enhancers" such as Ritalin and

8 Mdr.: Die Droge, mit der Hitlers Soldaten in den Krieg zogen. https://www.mdr.de/geschichte/ns-zeit/zweiter-weltkrieg/pervitin-soldaten-droge-crystal-hitler-deutsches-reich-100.html, accessed 20 September 2024.

9 Schleim, S./Walter, H.: Hochleistung durch weniger Schlaf. https://lehrerfortbildung-bw.de/u_gewi/ethik/bs/weiteres/fb1/5cog/2art/3schlaf/, accessed 10 September 2024.

Modafinil, which are also used in military contexts, and found that the effects of these substances are not universal and are often influenced by emotional and contextual factors.[10]

2. State of research

Presenting the state of research on the diverse challenges surrounding the topic of human enhancement places one in an interdisciplinary field that brings together scientists from areas such as medicine, biotechnology, neuroscience, ethics, law, sociology and philosophy. From a sociological perspective, the social implications of human enhancement and its effects on society take centre stage.

In this context, two related but distinct philosophical and cultural movements come into play, both of which deal with the future of humanity and the role of technology in this future: transhumanism[11] and posthumanism. While transhumanism aims to improve humanity through technology, posthumanism also deals with deconstructing and re-conceptualising what it means to be human, questioning the boundaries between human, animal, machine and environment.

In recent years, there have been numerous publications exploring how transhumanist ideas and technologies impact society and culture, including issues of justice, social inequality, privacy, security and access to enhancement technologies. Transhumanists often strive for a posthuman future, where human existence is so much improved by technology, that it can barely be compared to the current human condition. In this posthuman future, humans could possess a variety of new abilities and traits, allowing them to live longer, be more intelligent and experience the world in new ways. Central themes of posthumanist ideas and visions include "technological immortality", "enhanced intelligence", "physical enhancements" or the "transcendence of space and time".

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[10] Vrecko, Scott: Just How Cognitive Is "Cognitive Enhancement"? On the Significance of Emotions in University Students' Experiences with Study Drugs. AJOB Neuroscience 4(1), pp.4-12, 2013.

[11] See Grinschgl, Sandra: Cognitive enhancement – A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication; Tragbar, Lisa/Lagos, Rodrigo: Human enhancement for military purposes: Ethical considerations. In chapter ETHICS in this publication; Klerx, Joachim: The Future of Human Enhancement in the Military Domain. In chapter TECHNOLOGY in this publication.

One particularly interesting concept is Ray Kurzweil's "technological singularity". He predicts this event for the year 2045. The concept is based on the idea that advances in areas such as artificial intelligence, nanotechnology, biotechnology and robotics will lead to a point where technological development advances so quickly that human existence will be elevated to an entirely new level. According to Kurzweil, technological developments do not progress linearly but exponentially. From 2045 onward, he predicts that human knowledge and technical capabilities will increase explosively. A key element of the technological singularity is the development of artificial intelligence, which will be more intelligent than the human mind and thus able to improve itself. Through the digitisation of human consciousness, the connection of the brain with digital systems or other technologies, the technological singularity will allow humans to overcome death and continue their existence independently of the limitations of the biological body.[12]

Similarly, the philosopher Nick Bostrom speaks of a "superintelligence" and speculates on various ways it could be achieved. However, he also warns of the potential risks of superintelligence, including the risk of insufficient control. A superintelligence could threaten human intelligence, either through unfriendly behaviour, unintended side effects or misunderstandings in goal setting. Moreover, it could resist any attempts from the outside to shut it down. To counter such a development, Bostrom argues that it is necessary to instil goals in the superintelligence that are vital for human survival and well-being.[13]

The robotics and AI researcher Hans Moravec also discusses the possibility of transferring human brains into digital formats, thereby extending human existence beyond death.[14]

These ideas and visions mentioned above are not mere utopian fantasies of certain authors but outline actual stages of human research and development in some areas.

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12 Kurzweil, Ray: Menschheit 2.0: Die Singularität naht. 2nd ed. Berlin: Lola Books, 2014.

13 Bostrom, Nick: Superintelligence: Paths, Dangers, Strategies. Oxford: Oxford University Press, 2014.

14 Morawek, Hans: Mind Children: The Future of Robot and Human Intelligence. Cambridge, MA: Harvard University Press, 1988.

In 2016, Elon Musk founded the company Neuralink,[15] which aimed to create a direct connection between the human brain and computers. The ultimate goal of Neuralink is to expand brain capacity and treat neurological diseases. Neuralink developed a technology that allows tiny electrodes to be implanted in the brain to record and interpret neural signals. These electrodes may be capable of sending and receiving signals, theoretically making it possible to directly connect the brain to computers or other external devices. The potential applications of Neuralink are vast. They include the treatment of neurological diseases such as Parkinson's, epilepsy and depression; the restoration of sensory functions in people with disabilities; the enhancement of cognitive abilities; and the creation of brain-computer interfaces (BCIs) for interacting with digital devices and virtual environments. Despite remarkable progress,[16] however, there are significant challenges and setbacks in this area. While invasive BCIs, which are implanted into the brain, provide the most precise data, they pose significant risks such as infections, scarring and tissue rejection. Additionally, the brain is extremely complex, and understanding the specific patterns responsible for particular thoughts, movements or sensations is still limited.[17]

For the military, the exploration of BCIs offers numerous new possibilities.[18] Jecker and Ko point to research aimed at improving the interaction between soldiers and weapons or other devices through direct brain-computer interfaces.[19] BCIs could also be used in the rehabilitation and treatment of soldiers

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15 Neuralink. https://neuralink.com/, accessed 10 September 2024.

16 Der Standard: Schlaganfalltherapie mit Brain-Computer Interface Technologie - Jetzt neu in Wien. https://www.derstandard.at/story/2000133413828/schlaganfalltherapie-mit-brain-computer-interface-technologie-jetzt-neu-in-wien, accessed 16 February 2022.

17 Akhtar, Altaf et al.: Recent Advances in Implantable and Wearable BCI Systems: A Comprehensive Review. IEEE Transactions on Biomedical Engineering, 2021.

18 See Schulyok, Bernhard/Grangl, Lukas/Gruber, Markus: Human enhancement from a military perspective – WHAT, WHY and HOW? In chapter MILITARY in this publication; Harbich, Harald/Kunze, Michael:Human Enhancement – biological-neurological aspects from a military perspective. In chapter MEDICINE in this publication.

19 Jecker, Nancy S./Ko, Andrew: Brain-computer interfaces could allow soldiers to control weapons with their thoughts and turn off Their fear – but the ethics of neurotechnology lags behind the science. *The Conversation*, 2022. https://theconversation.com/brain-computer-interfaces-could-allow-soldiers-to-control-weapons-with-their-thoughts-and-turn-off-their-fear-but-the-ethics-of-neurotechnology-lags-behind-the-science-194017, accessed 10 September 2024.

who have suffered injuries affecting their central nervous system, such as controlling prosthetics or exoskeletons to assist soldiers with amputations or other neurological impairments.

Advances in neurotechnology made a significant leap forward with the demonstration of the first brain-to-brain interface (BBI).[20] [21] BBIs enable direct communication between two brains via a brain-computer interface (BCI), bypassing the peripheral nervous system. This discovery promises new possibilities for future battlefield technology. As battlefield technology continues to evolve, it is likely to place greater demands on future soldiers.

Many of these applications are still in the research and development phase and cannot currently be deployed on a large scale or in operational situations. In the United States, well-known institutions such as DARPA (Defense Advanced Research Projects Agency)[22] – which developed the ARPANET (the precursor to the internet), stealth technology and GPS – are investing considerable resources in developing BCIs, particularly for military applications like neurological rehabilitation, improved communication for soldiers and pilots and controlling drones and other devices. Through the "Continuous Assisted Performance" programme, DARPA attempted to enable soldiers to remain awake for up to seven days without losing their cognitive functions by using implants, metabolic manipulation and other techniques.[23]

In Europe, Germany's "BrainLinks-BrainTools project"[24] and Switzerland's "Wyss Center for Bio and Neuroengineering"[25] are leaders in BCI research. They are working on a variety of applications, ranging from neurological re-

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20 Rao, Rajesh PN: Towards Neural Co-Processors for the Brain: Combining Decoding and Encoding in Brain-Computer Interfaces. *Science Direct,* 2019, pp.142–151. https://www.rajeshpnrao.com/_files/ugd/f0c175_71f09a3aa6514874a427b92357f1e6f1.pdf, accessed 10 September 2024.

21 Linxing, Jiang/Stocco, Andrea/Losey, Darby M./Abernethy, Justin A./Prat, Chantel S./Rao, Rajesh P. N. 2019a: BrainNet: A Multi-Person Brain-to-Brain Interface for Direct Collaboration Between Brains. *Scientific Reports* 9 (1). https://doi.org/10.1038/s41598-019-41895-7.

22 DARPA. https://www.darpa.mil/, accessed 10 September 2024.

23 Netzeitung. http://www.netzeitung.de/wissenschaft/253228.html, accessed 15 July 2024.

24 BrainLinks BrainTools. https://www.brainlinks-braintools.uni-freiburg.de/de/, accessed 10 August 2024.

25 Wyss Center. https://wysscenter.ch/, accessed 10 August 2024.

habilitation to brain-computer interfaces for everyday tasks. In Japan, research institutions such as the "RIKEN Brain Science Institute" and companies like "Panasonic" and "Sony" have also made significant progress in developing BCIs. China has also invested heavily in neuroscience and BCI development in recent years.

Neuroenhancement) is now applied in various areas, including academic performance, professional productivity, athletic performance, creative abilities and even the treatment of neurological or psychiatric disorders.[26]

In the field of biotechnology and bioengineering, certain procedures and techniques have enabled the cultivation and modification of tissues and organs in laboratories, potentially contributing to the treatment of diseases and the enhancement of human functions.

The discovery and development of techniques for genetic manipulation, such as the CRISPR/Cas9 method (clustered regularly interspaced short palindromic repeats), which can precisely cut and alter DNA, have the potential to modify the human genome, treat diseases or adjust genetic traits.

Interesting progress has also been made in the area of camouflage, such as in the fashion industry. For instance, facial recognition technology, commonly used in smartphones, which initially categorises, measures and matches facial features, can be thwarted with clothing developed by the Italian startup "Cap_able." Cap_able uses what are known as adversarial images in its clothing to deceive facial recognition systems. The algorithm recognises individuals wearing Cap_able's clothing not as humans but as dogs, zebras or giraffes.[27]

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[26] Viertbauer, Klaus/Kögerler, Reinhart: Neuroenhancement: Die philosophische Debatte. Suhrkamp Verlag, 2019.; Harbich, Harald/Kunze, Michael: Human Enhancement – biological-neurological aspects from a military perspective. In chapter MEDICINE in this publication.

[27] Diese Kleidung schützt dich vor Gesichtserkennung. In: *20 Minuten*. https://www.20min.ch/story/diese-kleidung-schuetzt-dich-vor-gesichtserkennung-767520860973, accessed 19 August 2024; See also Ö1 Radiokolleg: Die Kunst der Camouflage (4). https://sound.orf.at/podcast/oe1/oe1-radiokolleg/die-kunst-der-camouflage-4, accessed 19 August 2024.

Another notable project is the STILE initiative –a European Defence Agency (EDA) project aimed at developing a European multifunctional smart textile for defence purposes. Experimental prototypes are currently being tested to determine the extent to which the textile can improve camouflage, environmental monitoring (temperature, humidity, radiation, etc.), the wearer's vital signs and protection from chemical, biological, radiological (CBR) threats.[28] At the Hagenberg campus of the University of Applied Sciences Upper Austria, researchers in the Embedded Systems Lab are also working on smart textiles. The researchers have developed and patented a new process that enables software to recognise hardware attached to textiles more quickly. This should significantly accelerate the production and activation of smart clothing.[29]

3. The significance of human enhancement to society

3.1 HET in light of sociological theories

3.1.1 The AGIL scheme as a static analytical tool

One initially useful theoretical structure that can help generate a broader understanding of the complex dynamics and requirements associated with the development and implementation of HET is Talcott Parsons' AGIL scheme. The AGIL scheme describes four fundamental functional requirements that every system must fulfil in order to survive and develop. These four functions are: Adaptation (A), Goal Attainment (G), Integration (I) and Latency (L).

Adaptation refers to the system's ability to respond to external environmental demands and mobilise resources to meet those demands. Goal Attainment refers to the system's ability to set and achieve specific objectives. Integration refers to the coordination and maintenance of cohesion between the various parts of a system. Latency refers to the maintenance of core values and cultural patterns that ensure the long-term stability of a system.

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28 European Defence Agency. https://eda.europa.eu/docs/default-source/eda-factsheets/deliverable_d1-18_factsheet-(final)-(stile)-(30-04-2020)-(v-5-0)#Fact%20sheet, accessed 19 August 2024.

29 Embedded Lab. https://www.csi.minesparis.psl.eu/en/people/honorary-members/michel-callon/, accessed 19 August 2024.

Within this overall system, specialised interconnected components, known as subsystems, operate with their own specific functions, tasks and processes that contribute to achieving the overarching goals. By applying this scheme to the development of HET, we can conduct a systematic analysis of societal responses and developments in this area.

- **Adaptation** refers to the ability to utilise technological developments and innovations to enhance human capabilities. This can include access to resources such as research funding, scientific data and technological infrastructures. Subsystems might include research and development institutions, universities and technology companies, which continuously develop new technologies and solutions to enhance human capabilities.
- **Goal Attainment** involves setting specific objectives and visions for improving human capabilities and consistently pursuing them. This includes both short-term goals (e.g. developing new medical devices) and long-term visions (e.g. improving quality of life or life expectancy). Subsystems such as regulatory bodies, ethics committees and political institutions play a key role in setting goals and guidelines for the development and application of HET.
- **Integration** stands for ensuring that various technologies and systems work together harmoniously and that there is a coordinated effort to optimise their implementation and use. This could also include establishing standards and protocols to ensure compatibility and collaboration. Standardisation organisations, professional associations and international bodies could act as subsystems that ensure the integration and coordination of various actors and technologies within the HET sector.
- **Latency** refers to the ethical, cultural and social values that need to be preserved and promoted to support the acceptance and sustainable development of these technologies. This also includes public education and awareness of the implications of HET. Educational institutions, media outlets, religious organisations and cultural institutions could act as subsystems that contribute to preserving and promoting societal values and norms necessary for the acceptance and integration of HET.

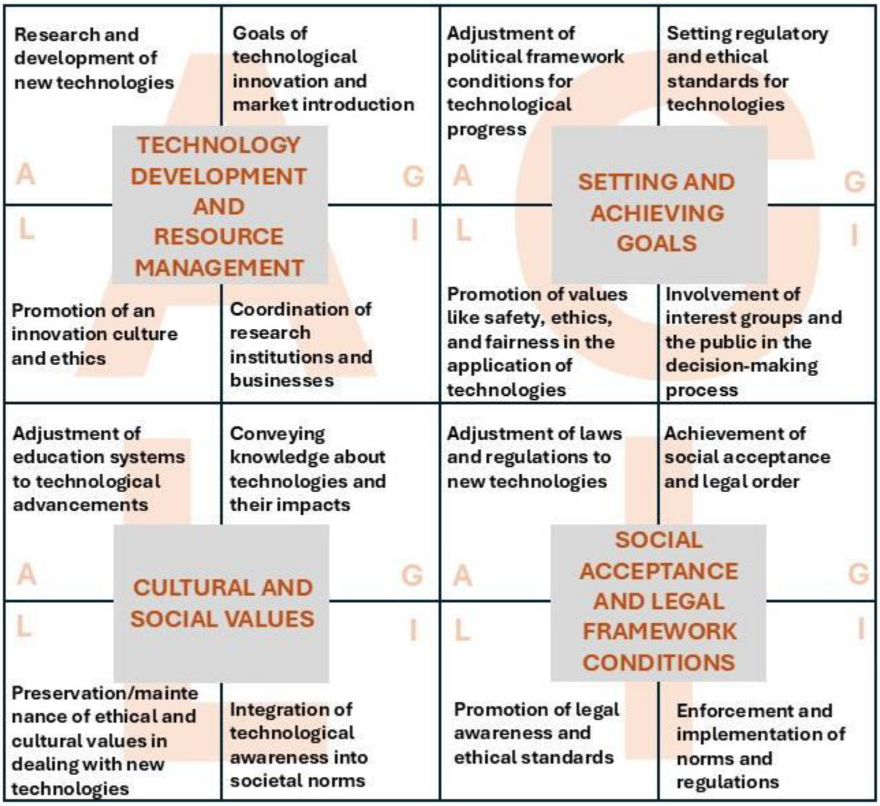

Figure 1: Application of the AGIL scheme to the development of human enhancement technologies. Source: Author's illustration.

This structure demonstrates how each subsystem (A, G, I, L) can be divided into the four functional imperatives, allowing for a comprehensive analysis of social systems.

However, the AGIL scheme, with its structured perspective, has some weaknesses. The development of HET is often characterised by rapid technological advances, diverse ethical considerations and global interdependencies, which cannot be fully captured in a static scheme like that of AGIL. The scheme might also imply that there are certain "correct" ways in which HET should be developed and integrated, potentially excluding alternative approaches or critical perspectives. Moreover, there is a tendency to adopt a Western-centric perspective, without sufficiently considering global differences in the development and acceptance of HET.

3.1.2 Actor-Network Theory (ANT)

To better address the critiques of applying the AGIL scheme to the development of HET, one might turn to a sociological theory that is more dynamic, conflict-oriented and less normative. One suitable alternative is the Actor-Network Theory (ANT) by Bruno Latour,[30] Michel Callon[31] and John Law.[32]ANT is a sociological approach that views social, technical and natural elements as equal actors within a network. It emphasises that both human and non-human actors (e.g. machines, objects, concepts) operate and interact within a network to shape socio-technical systems. ANT analyses how these actors form complex networks through their interactions and relationships, where power and agency[33] are not restricted solely to humans.

For the analysis of HET, this theory offers several advantages:

- It considers both human actors (e.g. scientists, politicians, users) and non-human actors (e.g. technologies, machines, documents) as equally important in the analysis. This helps to better understand the role of technologies and their interactions with human actors.
- It emphasises the significance of networks that arise from the interactions between actors. These networks are dynamic and constantly evolving, enabling a detailed examination of the development and dissemination of HET.
- It investigates how scientific facts and technological artefacts are constructed and stabilised through social processes. This helps analyse the complex and often conflict-laden processes of technology development and implementation.

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30 Latour, Bruno: Wir sind nie modern gewesen: Versuch einer symmetrischen Anthropologie. Frankfurt am Main: Suhrkamp, 2008.

31 Callon, Michel. n.d. https://www.csi.minesparis.psl.eu/en/people/honorary-members/michel-callon/.

32 Law, John/ Hassard, John: Actor Network Theory and After. The Sociological Review, Special Issue, 47(S1). eds. 1999.

33 "Agency" refers to the ability of an actor ("agent") to perform actions and exert influence over events or other actors. In Actor-Network Theory (ANT), this concept is expanded to include not only humans but also non-human actors such as objects, technologies and concepts. These non-human actors also possess agency, as their characteristics and interactions within the network influence actions and can co-determine specific outcomes. ANT thus emphasises that agency is not exclusively human but is distributed across a network of diverse actors.

By analysing negotiations, power struggles and conflicts of interest between the various actors involved in the development and implementation of HET, the often contentious processes can be captured more realistically. ANT is not limited to a specific cultural or social context, allowing it to better account for global differences in the development and acceptance of HET. It also allows for a detailed and complex analysis of interactions between different actors and technologies without oversimplifying social processes.

Application of ANT to HET

1. **Identification of actors**: identify all relevant human and non-human actors in the field of HET, including scientists, engineers, politicians, users, technologies, research instruments, regulatory documents, etc.
2. **Network analysis**: examine the networks and connections between these actors. How do they interact with each other? What alliances and conflicts arise?
3. **Tracing controversies and stabilisation**: analyse how controversies and conflicts are resolved and how specific technological solutions and standards become established and stabilised.
4. **Examination of power relations**: consider power relations and conflicts of interest between different actors and how these influence the development and implementation of HET.

Example application

A research team develops a new brain-computer interface (BCI) technology. Using ANT, one could investigate how the interactions between developers, users, regulatory authorities, ethical committees and the BCI devices themselves shape the design, implementation and acceptance of this technology. Additionally, one could analyse the power struggles around the definition of standards, the negotiation of ethical guidelines and the influences of global markets.

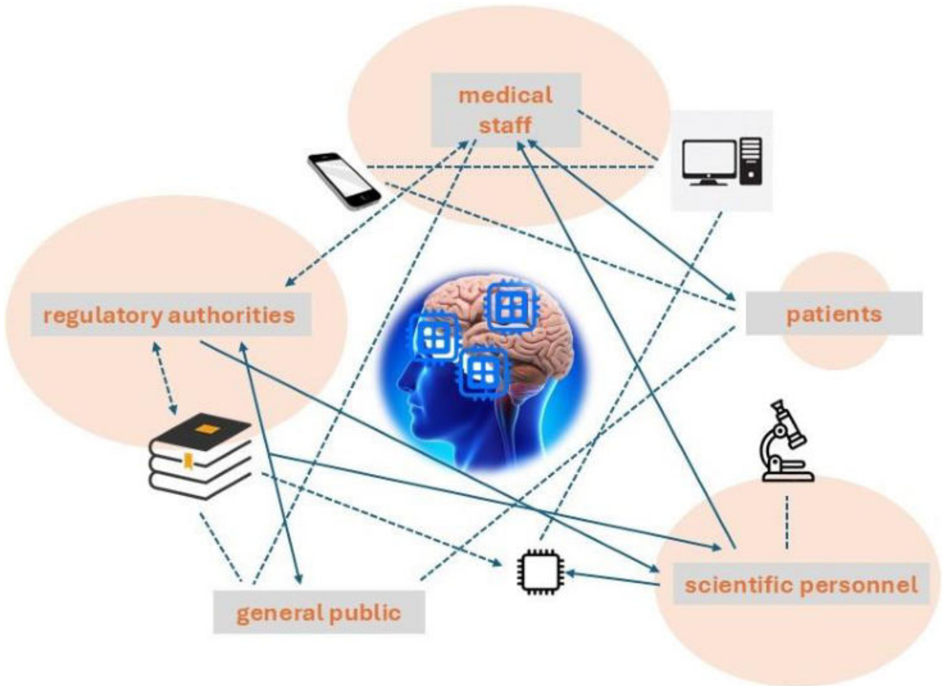

Figure 2: Example application of Actor-Network Theory to the development of HET. Source: Author's illustration.

Legend

Lines: interactions and relationships

- Solid line: direct cooperation
- Dotted line: indirect influence
- Arrow direction: direction of influence

Circles/Shading: areas of influence and agency

- Large circle: strong influence
- Small circle: weak influence

This structure allows for the visualisation of complex interactions and dependencies within the development and use of human enhancement technologies, as seen through the lens of Actor-Network Theory.

3.1.3 The systems theory of Niklas Luhmann

Niklas Luhmann's systems theory[34] offers an extremely useful framework for analysing and assessing the impact of human enhancement technologies (HET) on society. This theory helps to understand the complex interactions between such technologies and social systems. It views society as a network of differentiated, self-referential social systems, each operating according to its own logic and communication codes. These systems (e.g. politics, economy, science, law, health) serve specific functions (e.g. money, power, law, knowledge), interact with each other, but are largely autonomous and operate according to their own rules, meaning that they can only change internally. Social developments are therefore open-ended and not predetermined; they depend on the decisions and reactions of the systems. Communication is the driving force that determines how various social systems respond to human enhancement technologies and how these technologies are evaluated, regulated and disseminated within society.

[34] Luhmann, Niklas: Soziale Systeme. Grundriss einer allgemeinen Theorie. Frankfurt am Main: Suhrkamp, 1984.

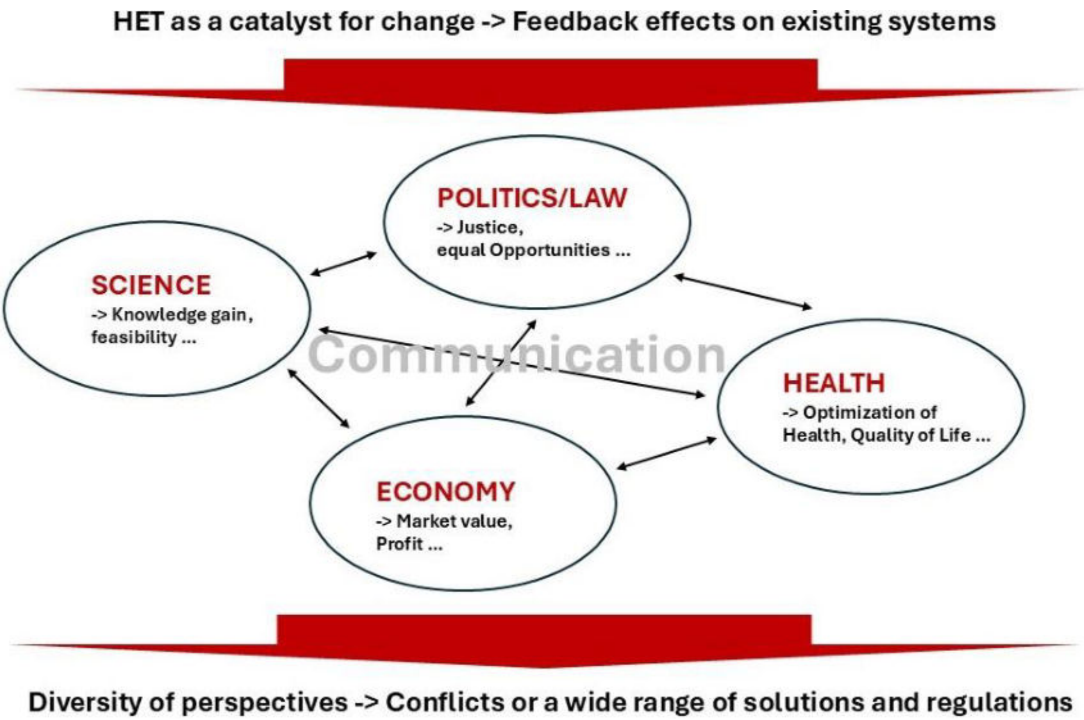

Figure 3: HET considering Luhmann's systems theory. Source: Author's illustration.

Human enhancement technologies can act as catalysts for changes in society, which in turn have feedback effects on existing systems. Since each social system processes the introduction of HET according to its own logic, we are dealing with a diversity of perspectives. This diversity of perspectives can lead to conflicts but also to a wide range of solutions and regulations.

3.2 Human enhancement in the context of social drivers

The term "social driver" refers to social, cultural, political and economic factors that influence the behaviour, attitudes and decisions of individuals and groups in a society. These "drivers" can drive a variety of social phenomena and trends and have a significant impact on the functioning and development of societies. In the context of technology and innovation, social drivers can help identify the demand for certain technologies, promote the adoption of new technologies and influence the direction of technological developments.

Typical examples of social drivers include cultural norms and values, societal trends and needs, political decisions and regulations, economic conditions and issues of social justice and ethics. Cultural norms and values shape the attitudes and behaviours of a society, although one must distinguish between norms and values. Drawing on the American philosopher John Dewey, who differentiated between "desired" and "desirable",[35] sociologist Hans Joas emphasises: "A value is not a factual wish but a notion of what is worth wishing for".[36] While norms regulate sociocultural, social, economic and political relationships between actors, expressing the rightness of social action, values determine what is considered good. Values, according to Joas, are "highly emotionally charged"[37] and do not always align with norms, which creates potential for conflict.

Societal trends and needs, such as demographic changes, social inequality or environmental issues, can increase the demand for certain technologies and solutions, thus steering the direction of technological developments. Closely associated with this are political decisions and regulations, which are reflected in laws, regulations and political programmes and thus initiate a process of steering development. The "economic framework" is a particularly significant social driver. Economic factors such as supply and demand, investments, labour market conditions and financial incentives have a direct impact on the development and dissemination of technologies. They can influence the success or failure of innovations and drive the development of new markets and industries.

35 Kostrova, Elizaveta: The "Ought"-Dimension in Value Theory: The Concept of the Desirable in John Dewey's Definition of Value and Its Significance for the Social Sciences. In: Philosophy of Science: Between the Natural Sciences, the Social Sciences, and the Humanities, edited by Alexander Christian, David Hommen, Nina Retzlaff, and Gerhard Schurz. Springer International Publishing AG. 2018.

36 Joas, Hans: Wie entstehen Werte? Wertebildung und Wertevermittlung in pluralistischen Gesellschaften. tv-Impuls-Veranstaltung, 15 September 2006. https://mediendiskurs.online/data/hefte/pdf/Veranstaltungen/tv_impuls/2006_Ethik/Vortrag_Joas_authorisiert_061017.pdf.

37 Ibid.

3.3 Social and economic factors

Once new technologies have become established, they have various effects on society, depending on their degree of penetration. They play a central role in how we perceive and understand nature, culture and society. A glance at history may illustrate this.

The Industrial Revolution, which began in the 18th century, led to a rapid acceleration in developments in technology, productivity and science. As the Industrial Revolution increasingly affected and transformed various aspects of economic life, people's living conditions also changed. Industrial factories, mostly located in cities, initially saw a large influx of labour from rural areas, leading to a general depression of wage levels. The companies competing in the market were focused on profitability and profit generation; as a result, technological developments replaced jobs where possible, and the remaining necessary workforce was given subsistence wages for cost reasons. This preordained social misery led to protests, strikes, the formation of trade unions and only gradually, over time, to an improvement in people's living standards.

With increased mechanisation, mass production of goods and the widespread use of electricity, the early 20th century saw another upheaval, which sociologist Georges Friedman referred to as the second industrial revolution.[38]

In his book *The Coming of Post-Industrial Society*, Daniel Bell pointed out in the early 1970s that there was a shift from an industrial society to a knowledge- and service-based society, which was accompanied by a significant reduction in the number of industrial jobs.[39] At the same time, the service sector boomed, partly due to outsourcing activities that were not part of companies' core competencies and partly due to changing leisure habits as a result of shorter working hours. Leisure industries began to attract consumers with promises of pleasure, entertainment and relaxation.[40]

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38 Friedmann, Georges: La crise du progrés: Esquisse d'histoire des idées 1895-1935. Paris. 1936.

39 Bell, Daniel: The Coming of Post-industrial Society. 1973. https://katalog.ub.uni-heidelberg.de/titel/65729022.

40 Bell, Daniel: Die kulturellen Widersprüche des Kapitalismus. Frankfurt am Main: Campus. 1991.

By the late 1960s and early 1970s, society was increasingly reliant on information and communication technologies in more areas of life. Bell was also one of the first to use the term "information society".

Towards the end of the 20th century, a further shift occurred due to digital technology and computers, a shift Bell referred to as the "digital revolution" or the "third industrial revolution".[41] The term digital revolution refers to the transformation triggered by digital technology and computers, which (since the end of the 20th century) has impacted almost all areas of life in many countries, leading to a digitally connected lifestyle (digital lifestyle) – similar to how the Industrial Revolution 200 years earlier led to an industrial society.

Authors such as Klaus Schwab,[42] Nikolas Davis[43] or Luciano Floridi[44] already refer to a "fourth industrial revolution" and emphasise that HET, such as genetic modifications, brain-computer interfaces and biotechnological enhancements, are a crucial component of this revolution. These technologies are transforming not only the world of work but also human self-conception and the way individuals are integrated into society at unprecedented speed and on an unprecedented scale.

Our relationship with nature has also been transformed by technology, which has enabled new ways of exploring, utilising and manipulating the natural environment. Advances in science and technology have helped us better understand and utilise natural resources, yet they have also raised new ethical and environmental concerns.[45] Technologies also shape our individual and collective identities as well as our self-image.

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41 Bell, Daniel: The Third Technological Revolution and Its Possible Socio-Economic Consequences. Salford: University of Salford. 1988.

42 Schwab, Klaus: The Fourth Industrial Revolution. London: Penguin Books Ltd. 2016.

43 Schwab, Klaus/Davis, Nicholas: Shaping the Fourth Industrial Revolution. Crown Publishing Group, Random House. 2018.

44 Floridi, Luciano: The 4th Revolution: How the Infosphere is Reshaping Human Reality. Oxford: Oxford University Press. 2014.

45 See also Stimmer, Gernot: European AI ethics – between categorical imperative and placebo rhetoric. In chapter SOCIETY in this publication.

3.4 Human enhancement as an economic factor

The economic impact of HET is evident both in direct growth opportunities for new markets and in enhancing the competitiveness and innovative capacity of existing industries. In particular, entirely new possibilities are emerging in key areas such as healthcare, the labour market and the innovation economy. In recent years, the global market for human enhancement has shown impressive growth. In 2022, it reached a market size of $97.9 billion. Forecasts are promising: by 2028, the market is expected to grow to $215.9 billion, representing an annual growth rate of 14.09%.[46] The global human enhancement market valuation includes products from the categories of exoskeletons, smart devices (technologies that improve cognitive functions), medical devices (equipment supporting health) and implants (implanted devices that enhance performance). According to the IMARC report of 2023, the world's leading companies in the human enhancement field include Vuzix Corporation (specialising in Augmented Reality (AR) glasses and smart glasses), Ekso Bionics Holdings Inc. (developers of exoskeletons and bionic prosthetics that enhance mobility), Google LLC (known for its research and development in artificial intelligence, robotics and wearables), B-Temia Inc. (focused on wearable robotics and exoskeletons) and Samsung Electronics Co. Ltd. (a technology giant active in areas including wearables and health technology).[47]

3.5 Human enhancement technologies and their potential societal benefits

Smart technologies that extend and enhance human abilities can encourage new behaviours in various ways and help workers become better versions of themselves. The relationship between technology and workers has evolved over time: in the past, technology was used to replace workers in repetitive, dangerous or isolated tasks. Back then, technology was used as a supplement to workers, providing additional skills and insights. Today, we see technologies that can help workers improve and become better versions of themselves.

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[46] International Market Analysis Research and Consulting Group: Global Human Enhancement Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028. IMARC Group. 2023.

[47] Ibid.

New possibilities for self-measurement and self-optimisation that can change our understanding of ourselves and our bodies are emerging. In simpler terms, people can now monitor, analyse and optimise their bodies and abilities in more detailed and precise ways. For example, with technologies such as fitness trackers, wearables and apps, people can closely monitor their physical activity, sleep, nutrition and other health parameters. They receive real-time data on their physical performance and health, allowing them to adjust their behaviour and optimise their health and performance. Although this seems positive, there are also potential downsides. Excessive use of self-optimisation technologies could lead to people increasingly defining themselves by their performance and outward appearance, rather than by their personality and inner values. Additionally, a certain dependency on technology is created, which could lead to a decline in natural abilities and a reduction in self-reliance.

Another example, beyond the technologies already integrated into everyday life, are brain-computer interfaces (BCIs), which could allow people to monitor and control their brain functions. With BCIs, people could, for example, enhance their concentration, control their thoughts or even treat neurological disorders. According to Don Ihde, such human enhancement technologies (HET) would expand our traditional understanding of the body by adding new components or functions that are not natural. For instance, implanted devices or prosthetics could be considered an integral part of the body, leading to a new definition of embodiment. It would also be possible to develop various identities and self-images shaped by the technologies individuals choose.[48] This could lead to a variety of identities, distinguished by different technological preferences, physical traits and abilities.

Moreover, the way people perceive themselves and their environment could change by enabling new sensory or cognitive capabilities.

The use of brain-computer interfaces (BCIs) could also influence social behaviour in society. One positive outcome could be that people who are unable to communicate verbally or physically due to injuries or neurological disorders might gain a voice through BCIs and communicate with others. Ad-

48 Ihde, Don: Postphenomenology and Technoscience: The Peking University Lectures. Albany: SUNY Press. 2009.

ditionally, BCIs could help break down barriers for people with disabilities and improve their participation in social life. Individuals with paralysis could move wheelchairs or even create artworks with the help of BCIs, giving them greater autonomy and independence.

Extending this thought further, individuals could also become conditioned in their thought patterns through the use of BCIs. Direct interaction between the brain and computers could lead to new forms of thinking and problem-solving, initially influenced by the functions and limitations of the technology. In the long run, however, people using BCIs might be able to communicate telepathically or solve complex problems together by synchronising their brain activity.

In general, HET could benefit not only individual users but also various groups and institutions by improving health, performance and quality of life, and by creating new opportunities for innovation and economic growth. Among the beneficiaries could be healthcare systems, which would gain more efficient medical treatments, shorter recovery times and potentially reduced long-term costs. Employers could also benefit from the increased productivity and performance of their employees. Workers who are healthier, more motivated and more focused could work more effectively and achieve better results. Additionally, enhancing workers' cognitive and physical abilities would transform how work is organised and carried out. New work forms with greater productivity and efficiency would emerge, although this could also raise questions surrounding job security, equal opportunities and labour rights.

Educational institutions would also be beneficiaries, with improved learning capabilities and concentration among students leading to better learning outcomes and more efficient teaching. Naturally, this would require appropriate guidelines for integration into the curriculum, ensuring that teachers and students have access to the necessary resources and training. Additionally, attention would need to be paid to the privacy and security of students.

3.6 Expectations and attitudes of society

Currently, in Austria and Europe, there are no specific social science surveys exclusively focused on the public's expectations and concerns regarding human enhancement technologies. Most studies addressing such technologies tend to deal more generally with digitisation, medical technologies and their societal impacts.

However, there are two interesting studies on the subject so far: a Pew survey[49] from the USA conducted in 2020 and a survey from the EU-funded SIENNA project[50] from 2019.

In the Pew survey, the majority supports the use of facial recognition technologies to identify individuals who may have committed a crime or to monitor crowds. On the other hand, driverless, autonomous passenger vehicles are mostly rejected, as are brain-embedded computer chips that would allow people to process information much faster and more accurately. Interestingly, when examining respondents' levels of religious commitment, there are significant differences. Individuals with a strong sense of religious affiliation are more likely to express concerns, particularly that certain physical and cognitive enhancements could be seen as interfering with nature. This is particularly true for gene editing for babies or brain-embedded computer chips.

The SIENNA study provides an initial insight into the perspectives of selected EU countries. In general, a positive attitude towards human enhancement technologies is observed. This is particularly true for technologies that enhance human intelligence or help improve people's moral values. However, when it comes to extending human life through technology to up to 120 years, the majority are opposed to it, with opposition being even more pronounced in EU countries.

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49 Rainie, Lee/Funk, Cary/Anderson, Monica/Tyson, Alec: AI and Human Enhancement: Americans' Openness is Tempered by a Range of Concerns. Pew Research Center. 2022.

50 Prudhomme, Marie: Public views of human enhancement technologies in 11 EU and non-EU countries. University of Twente. 2019.

4. Challenges

Public perception of human enhancement varies depending on culture, education level and other factors.[51] Petersen analyses the role of trust and scepticism in public perception of biotechnologies, including human enhancement, and highlights the political implications.[52]

While some people welcome the possibilities of human enhancement, concerns about the potential risks and side effects of these technologies also exist. Given the potential societal impacts of human enhancement, organisations and governments are considering creating ethical and legal frameworks for the development and use of these technologies. There is growing debate about issues such as privacy, equality and fair access to human enhancement technologies. The development of HET also raises complex ethical and moral questions. For example: should parents be allowed to enhance the genetic traits of their children? Is there a moral obligation to promote technologies that could improve physical or mental abilities?

The development of HET could also challenge our notions of what it means to be human. If people can enhance their physical or mental abilities, how will this affect our understanding of human identity?

Particularly concerning is the fact that, through the individual's habituation to technology and the associated perception of it as an integral part of daily life, a relatively heavy dependency is created – essentially, a kind of reliance on the hope for functional technology.

What applies to the individual can also be transferred to society as a whole. For example, the widespread use of BCIs could lead to changes in social norms as society adapts to new forms of human interaction and communication, leading to a general acceptance of new behaviours and social practices. However, if this technology is used by governments, corporations or other groups to monitor and control citizens' behaviour and thoughts, it would represent a restriction on individual freedom and privacy. In this con-

51 Nakazawa, Eisuke/Mori, Katsumi/Udagawa, Makoto/Akabayashi, Akira: A Cross-Sectional Study of Attitudes Toward Willingness to Use Enhancement Technologies: Implications for Technology Regulation and Ethics. BioTech (Basel) 11(3): 21. 2022.

52 Petersen, Alan: The Politics of Bioethics. New York: Routledge. 2011.

text, comparisons with the dystopian society described by George Orwell, controlled by "Big Brother",[53] or Michel Foucault's work, *Discipline and Punish: The Birth of the Prison,*[54] are almost inevitable.

In general, the use of human enhancement raises a number of ethical, legal and security-related questions.

Ethics provide a framework within which individuals can make moral decisions. They help in understanding what is right and wrong and offers guidelines for moral behaviour. Ethics allow us to critically reflect on, analyse and develop a deeper understanding of moral issues. For our purposes, the area of applied ethics, which deals with applying ethical principles to concrete situations or areas of human life, is particularly important.

Ethical and moral questions may arise, with particular regard to the use of violence and responsibility for decisions made by autonomous systems. These questions could lead to debates about the role of technology in warfare and the ethical limits of military use. The alteration of human nature also brings about numerous questions. In the use of neuroenhancement technologies, in particular, questions of autonomy, self-determination and integrity are at the centre of debate.

The SIENNA initiative (Stakeholder-informed ethics for new technologies with high socio-economic and human rights impact) examined the ethical, legal and social aspects of human enhancement and developed proposals for ethical frameworks, which were presented at the final conference in 2021.

Among other things, it was found that the societal values most at risk from human enhancement technologies (HETs) are autonomy, dignity, equality, fairness, health and safety, peace, privacy, respect for human life and solidarity. The most vulnerable communities are patients, people with disabilities, the elderly and children (e.g. due to their lack of choice and decision-making power when using HETs, combined with an incomplete understanding of the full implications). The SIENNA initiative suggests that the impacts of HET on these groups should be carefully monitored (and, if necessary, reg-

53 Orwell, George: Nineteen Eighty-Four. London: Secker & Warburg. 1949.

54 Foucault, Michel: Überwachen und Strafen: Die Geburt des Gefängnisses. Frankfurt am Main: Suhrkamp. 1977.

ulated). One of the identified impacts relates to the changing nature of what is considered "human" or what was previously recognised and acknowledged as "human". However, the study also emphasises the potential benefits for individuals and society, provided they are fairly distributed.

The authors also mention the possible costs of HET's impacts. Some of these costs may be direct (attributable to the technology itself) or indirect (not directly caused by the technology but associated with its broader effects on society). Finally, the study points to measures that can be taken to mitigate the negative impacts of HET. These include political and regulatory measures (responsibility: politicians, regulatory authorities, national ethics commissions), technological/industry-specific measures (responsibility: companies, industry associations, HET designers and innovators), societal measures (responsibility: academia, civil society, media) and individual measures (responsibility: individuals who use HET, consider using them or are affected by such HET).[55]

Although there are no specific international standards or treaties governing the use of HET, some instruments and norms may still be relevant. For example, the Geneva Conventions and their Additional Protocols[56] contain provisions for the protection of war victims, including the wounded, sick, prisoners and civilians. The use of human enhancement technologies in a military context would have to comply with these provisions to ensure that the rights and dignity of those affected are protected.

Two other conventions – the Biological Weapons Convention[57] and the Chemical Weapons Convention[58] – could also be relevant. While HET does not directly fall under these conventions, certain applications or technologies related to biological alterations or manipulations, or certain pharmacological

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55 Publications - SIENNA. 2024. 15 February 2024. https://www.sienna-project.eu/w/si/publications/.

56 Genfer Abkommen Und Kommentare. Internationales Komitee vom Roten Kreuz. 21 June 2024. https://www.icrc.org/de/recht-und-politik/genfer-abkommen-und-kommentare.

57 Biological Weapons. United Nations Office for Disarmament Affairs. https://disarmament.unoda.org/biological-weapons/, accessed 19 August 2024.

58 Organisation for the Prohibition of Chemical Weapons. n.d. OPCW. https://www.opcw.org/, accessed 19 August 2024.

substances or chemical compounds used to enhance physical or cognitive performance, could raise ethical and legal questions.

Moreover, the use of HET would have to be consistent with the Universal Declaration of Human Rights[59] and international humanitarian law.[60] The former establishes fundamental rights and freedoms that apply to all people, while the latter provides rules and principles to protect civilians and war victims in armed conflicts.

4.1 Critical voices from science

The human and social sciences, which deal with humans as research subjects and study the phenomena of social life, have a significant influence on future behaviour, attitudes and decisions regarding human enhancement.

For example, philosopher Jürgen Habermas has critically addressed the ethical and societal implications of HET. Habermas argues that the manipulation of human nature through biotechnologies and neuroscience could lead to a loss of human dignity by treating human nature as a manipulable object. The use of HET could thus compromise human dignity by reducing people to a set of traits that can be modified through technology. He also warns of the risk of social exclusion and the creation of a new class division between those who have access to HET and those who do not. This would exacerbate existing social inequalities and lead to a division between the "enhanced" and the "non-enhanced" members of society. Individual autonomy and self-determination could also be jeopardised by the manipulation of human nature, as increasing reliance on technology could impair our ability to make free

59 Allgemeine Erklärung der Menschenrechte. 2019. Vereinte Nationen - Regionales Informationszentrum für Westeuropa. Vereinte Nationen. https://unric.org/de/allgemeine-erklaerung-menschenrechte/, accessed 13 December 2019.

60 IHL Treaties - Treaties and States Parties. n.d. https://ihl-databases.icrc.org/en/ihl-treaties/treaties-and-states-parties.

decisions and exercise self-determination, making us dependent on external control mechanisms.[61] [62]

Nikolas Rose, in his work *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century*, examines the political and social consequences of biomedical research and practice, including the development and application of HET. Rose highlights the importance of state regulation and control in the development and application of HET. For him, these technologies are potentially powerful tools that can influence political and social structures. At the same time, like Habermas, he warns that such technologies could deepen the divide between those with access to them and those without, thus reinforcing social injustice. Regarding the impact on individual self-formation and self-optimisation, Rose also sees the danger of new forms of social pressure and coercion to conform to such norms.[63]

Similarly, Sherry Turkle, an American sociologist at the Massachusetts Institute of Technology (MIT), has studied the impact of technology on human relationships and social interactions. In her book *Alone Together: Why We Expect More from Technology and Less from Each Other*, Turkle shows how people are increasingly developing emotional bonds with robots and how these relationships could influence our understanding of intimacy and empathy. She examines how technologies such as Facebook, Twitter and text messaging affect our ability to maintain real connections with other people and how they change our perceptions of closeness, privacy and identity. She warns that we are increasingly expecting more from technology and less from each other, which could have negative effects on our mental well-being and social relationships.[64]

Francis Fukuyama goes even further, discussing the possibility that advances in genetic engineering could allow people to manipulate the genetic traits of

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61 Habermas, Jürgen: Die Zukunft der menschlichen Natur: Auf dem Weg zu einer liberalen Eugenik? Frankfurt am Main: Suhrkamp. 2001.

62 See also Stimmer, Gernot: European AI ethics – between categorical imperative and placebo rhetoric. In chapter SOCIETY in this publication.

63 Rose, Nikolas: The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century. Princeton, NJ: Princeton University Press. 2007.

64 Turkle, Sherry: Alone Together: Why We Expect More from Technology and Less from Each Other. New York: Basic Books. 2011.

their children to make them smarter, stronger or more attractive. He warns of the potential risks of these technologies, including the creation of a genetic elite and the emergence of new forms of discrimination. Like Habermas and Rose, Fukuyama points out that the introduction of HET could deepen social inequality, as wealthy individuals are more likely to afford expensive enhancement technologies. This could further widen the gap between those who can enhance themselves and those who cannot afford to do so. Fukuyama also warns that biotechnology has the potential to fundamentally alter human nature and identity by blurring the boundaries between human and machine, nature and technology, leading to a loss of humanity and alienation from our natural environment.[65]

In summary, the following concerns and critiques can be noted:

- The potential loss of human dignity due to the manipulation of human nature.
- The risk of reducing humans to certain traits that can be modified by technology.
- The risk of social exclusion and the creation of a new class divide.
- The exacerbation of existing social inequalities and injustices.
- The threat to individual autonomy and self-determination due to social pressure and coercion.
- The impairment of the ability to make free decisions and exercise self-determination.
- The influence of technology on political and social structures.
- The impact on intimacy and empathy, as well as on mental well-being and social relationships due to increasing reliance on technology.
- Potential existential threats due to inadequate control and misunderstandings in the use of technology.

[65] Fukuyama, Francis: Our Posthuman Future: Consequences of the Biotechnology Revolution. New York: Farrar, Straus and Giroux. 2002.

4.2 The influence of social groups

Social groups have always had a significant impact on society as a whole by shaping politics, culture, the economy, social norms and values, education, health and many other areas. They can exert political pressure and drive political change by engaging in lobbying, organising petitions or holding demonstrations. Social groups can also influence political parties and participate in shaping laws and policies. They impact culture, for example, by organising events, preserving cultural traditions or influencing the economy through consumer decisions, promoting economic activities or advocating for specific interests. By promoting and supporting particular behaviours and lifestyles, social groups also contribute to defining and spreading social norms and values.[66]

Social groups might oppose the use of HET for various reasons. Some groups, focusing on ethical principles and moral values, raise concerns about the potential impact of human enhancement on human identity, autonomy and justice. They argue that certain forms of enhancement technologies might endanger human dignity and integrity and should therefore be rejected. Today, there are already global civil rights groups that oppose the use of surveillance technologies by governments and corporations. These groups express concerns about privacy, individual freedoms and the abuse of power, and advocate for the protection of citizens' rights and limitation of state surveillance.

Religious organisations could also oppose HET. In the past, religious groups have spoken out against the genetic manipulation of plants and animals, as they believe it is morally wrong to interfere with the genetic code of living

[66] Gemeinsames Positionspapier von 139 Verbänden und Organisationen. *Keine Deregulierung neuer Gentechnik-Verfahren.* 2023. https://www.greenpeace.de/publikationen/Positionspapier_Gentechnik.pdf, accessed 12 July 2024.; Amnesty International: Österreich: Einsatz von Gesichtserkennung verstößt gegen Menschenrecht. May 2021. https://www.amnesty.at/presse/oesterreich-einsatz-von-gesichtserkennung-verstoesst-gegen-menschenrechte/, accessed 12 July 2024.; Amnesty International. Satzung. https://cdn.amnesty.at/media/10929/amnesty-international-oesterreich-satzung-2023.pdf, accessed 12 July 2024; PETA (People for the Ethical Treatment of Animals). https://www.peta.de/ueberpeta/, accessed 12 July 2024; Disability Rights Advocates. https://dralegal.org/, accessed 12 July 2024.

beings. From their perspective, human enhancement represents an intrusion into the divine creation plan, an intrusion they consider sinful.

Socialist and communist groups may be concerned about the potential impact of human enhancement on existing social inequalities and injustices. They might argue that certain forms of human enhancement could reinforce existing social hierarchies.

Organisations advocating for the rights of people with disabilities may raise concerns about how human enhancement affects the perception and treatment of disabilities. For example, HET could exacerbate the stigmatisation of people with disabilities. Furthermore, these organisations have historically opposed eugenic practices aimed at controlling the genetic composition of the population and eliminating or discriminating against individuals with certain disabilities.

Environmental and sustainability groups might argue that some forms of enhancement technologies could pose a threat to natural ecosystems, particularly if these technologies require unsustainable levels of resources or if they lead to unintended environmental consequences.

And lastly, there are groups to consider that oppose animal testing and advocate for alternative methods of researching and testing medications: anti-globalisation activists who raise objections regarding global standards for "optimised" humans, arguing that these could suppress regional and cultural differences, thereby overwriting traditional views on health, performance and social roles with technologically driven norms and ideals. And – finally – conspiracy theorists and their followers, who warn of surveillance, mass "re-education" or manipulation, genetic "superhumans" and ruling elites, as well as depopulation and population control.

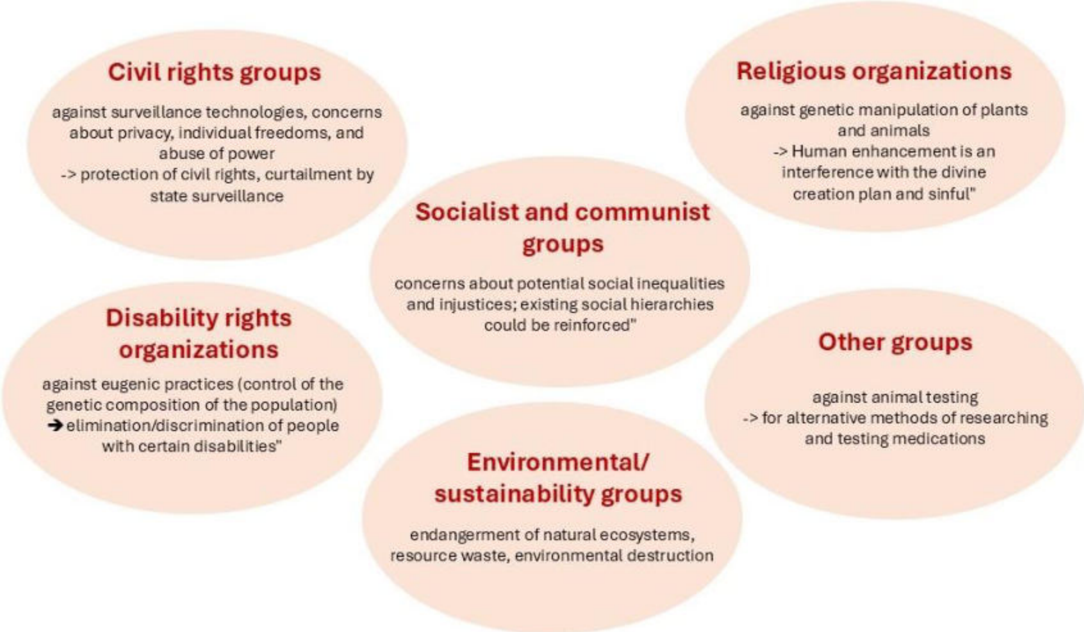

Figure 4: Influence of Social Groups. Source: Author's illustration.

4.3 Does human enhancement technology change the concept of humanity?

Overall, the development of human enhancement technologies (HET) has the potential to fundamentally change our concept of what it means to be human, by pushing the boundaries of what we consider possible and redefining our notions of human identity, human-technology relationships and ethical questions.

With technologies that enhance physical or mental abilities, people could achieve things previously thought impossible, leading to a shift in the boundaries of what it means to be human. Individuals using certain enhancement technologies may no longer consider themselves solely "natural" humans, but rather transhuman or posthuman beings. This raises complex ethical and moral questions. Is there a moral obligation to promote the development of technologies that can improve humans' physical or mental abilities?

The issue posed by the use of HET is evident in the simple question of where the boundary between a "normal" human and a cyborg lies. The term "cyborg" is short for "cybernetic organism" and was first coined by astronaut and scientist Manfred Clynes and neuroscientist Nathan S. Kline in the 1960s. The boundary between human and cyborg is a complex and evolving question, as it is influenced by a variety of factors and can vary depending on perspective and definition. Generally speaking, the transition from human to cyborg begins when technological components are integrated into the human body to support, enhance or replace biological functions. According to Chris Hables Gray,[67] a cyborg is an organism composed of technological extensions and biological organs. Based on this definition, someone wearing a pacemaker could be considered a cyborg. However, a single dental implant or medical prosthesis does not necessarily make someone a cyborg. It is the presence of multiple technological components that affects essential biological functions – the more comprehensive the integration of technology into the human body, the more likely one is to be considered a cyborg. Traditionally, the term "cyborg" is used for individuals with more extensive technological enhancements that go beyond medical prosthetics. This includes implants to improve the senses, artificial limbs with enhanced functions, brain-computer interfaces or other complex technological integrations. Through these technological enhancements, cyborgs can achieve abilities beyond what is possible for a normal human. This could include the ability to control electronic devices with the brain or gain superhuman strength through prosthetics. Thus, the transition to being a cyborg should be seen as gradual. If the respective changes significantly influence a person's identity or self-concept, this could be interpreted as a sign that they are moving towards a cyborg state. Furthermore, the perception and acceptance of technology in the human body vary depending on cultural context and individual attitudes. In some societies, technological enhancements are seen as normal and widely accepted, while in others they may be viewed as unusual or even frightening. Therefore, it can be said that the definition of what makes a cyborg may change over time, as advances in technology also evolve our understanding of humanity and identity.

[67] Gray, Chris Hables: The Cyborg Handbook. New York: Routledge. ed. 1995.

4.4 Impact of human enhancement on state security forces and rescue organisations

HET plays an increasingly important role in public safety. Currently, access to performance-enhancing technologies for security forces and rescue organisations is limited; with a few exceptions, traditional methods and equipment are mainly used. However, future possibilities of HET are diverse, ranging from enhancing performance and efficiency to raising ethical and legal concerns.

4.4.1 Use of HET today

Security forces increasingly use AI to analyse large data sets; AI systems help evaluate information from various sources and assist military leaders in planning operations.

While civilian companies already use exoskeletons to support their work in logistics and warehousing,[68] the US Army is still testing various exoskeleton systems.[69] A well-known project is Lockheed Martin's "ONYX" exoskeleton, which aims to reduce the physical strain on soldiers during heavy physical activities.[70] Russia, at the University of Science and Technology in Moscow, produces a next-generation combat suit with a "motorised exoskeleton" called Ratnik 3. The innovative Ratnik 3 combat suit includes a variety of armour and protective components from head to toe. A titanium frame for the lower body is intended to give soldiers more strength and endurance. Medical, reconnaissance, target identification and other information are displayed on screens in the helmet.[71] The Japanese company CYBERDYNE,

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68 About Us - Eksobionics. n.d. https://eksobionics.com/de/about-us, accessed 15 August 2024.

69 See Klerx, Joachim: The Future of Human Enhancement in the Military Domain. In chapter TECHNOLOGY in this publication. See Schulyok, Bernhard/Grangl, Lukas/Gruber, Markus: Human Enhancement from a Military Perspective – WHAT, WHY and HOW? In chapter MILITARY in this publication.

70 Military Exoskeletons: The Next Phase - Global Defence Technology. Issue 98. April 2019. 2024. https://defence.nridigital.com/global_defence_technology_apr19/military_exoskeletons_the_next_phase, accessed 15 August 2024.

71 Ritsick, Colin: Ratnik 3 - Russian Combat Suit. Future Infantry Exoskeleton Combat System. Military Machine. 13 January 2020. https://militarymachine.com/ratnik-3/, access 15 August 2025.

founded in 2004 mainly for medical-therapeutic purposes, produces devices that process bioelectrical signals from the skin's surface, enabling natural movement with motor support and thus reducing strain.[72]

Special clothing with integrated heating and cooling systems keeps the body warm in cold conditions, while cooling garments can regulate body temperature in hot conditions. The intake of specially developed dietary supplements helps to increase the energy, endurance and mental alertness of soldiers and police officers.

By using drones, satellites and other surveillance systems, important data can now be gathered about threats, the extent of damage, the location of victims and the availability of resources, leading to faster information processing and decision-making. Drones and autonomous systems are increasingly being used in military operations, particularly for conducting reconnaissance missions, identifying targets and carrying out surveillance tasks. AI-powered drones can also make more autonomous decisions and conduct targeted attacks.

Real-time data transmission, GPS tracking and remote control of robots are helpful in coordinating emergency organisations, as well as for respiratory protection and protection from chemical substances.

4.4.2 Use of HET tomorrow

In the future, it will be possible to use sleep management improvement methods (technologies to optimise sleep) to ensure that soldiers, police officers and disaster relief workers get enough rest to remain effective in extreme situations. Wearable medical devices could monitor the health of their users and provide rapid medical assistance when needed. Additionally, brain-computer interface (BCI) technologies could improve cognitive abilities by monitoring and controlling brain activity. Sensors and implants can enhance the perception of security and disaster personnel by improving vision, hearing and communication.

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72 Cyberdyne Etabliert Sich Als Marktführer Der Cybernics Technologie. n.d. Cyberdyne Care Robotics GmbH. https://www.cyberdyne.eu/, accessed 15 August 2024.

Gene-editing technologies such as CRISPR (clustered regularly interspaced short palindromic repeats) and Cas9 (CRISPR-associated protein 9) could be used to optimise the genetic makeup of soldiers and police officers, improving their performance and resilience.

Bionic implants that send electrical signals to muscles to enhance their contraction could increase muscle strength and performance.

Nanotechnology could be used to develop implantable devices that enhance soldiers' and police officers' physical abilities, for example, by accelerating the healing of injuries. These could be biodegradable implants coated with growth factors or other bioactive substances, which can be introduced into the body to speed up recovery. Electronic implants could also be used to block or reduce the sensation of pain. Nanotechnology-based implants that release growth factors or medications to promote healing could also be of interest in accelerating wound healing.

Furthermore, advances in robotics and AI will lead to an increase in the use of autonomous robots and drones in military and police operations, improving safety and reducing risks for personnel. The increased use of robotics in military logistics and support tasks will facilitate the transport of goods and materials, improving the efficiency of supply chains. Autonomous vehicles could be used to evacuate the injured and provide medical care.

4.4.3 Other challenges and concerns

The use of HET in security forces raises a number of ethical questions, particularly regarding justice, equality and privacy. Concerns exist about access to these technologies and the potential inequalities that could arise from the deployment of "enhanced" security forces. Over-reliance on HET could also lead to reduced flexibility and adaptability. If these technologies fail or are unavailable, their ability to respond effectively to emergency scenarios would be severely compromised.

In this context, the use of so-called "autonomous systems" must also be questioned.[73] Autonomous systems are those capable of making decisions and taking actions independently and without human intervention. These systems often use artificial intelligence (AI), machine learning and complex algorithms to process data, recognise patterns and act autonomously based on that information.

Vehicles	Self-driving cars, drones and autonomous ships
Industry	Robots working in industrial environments, performing tasks such as assembly, packaging and storage
Weapons systems	Military systems capable of identifying and attacking targets without direct human control
Aerospace	Aircraft, satellites and space probes that fly autonomously and perform manoeuvres
Surveillance	Systems for monitoring and securing areas, operating independently to detect and respond to suspicious activities

Table 1: Examples of the use of autonomous systems.

The use of autonomous systems comes with a number of potential risks. A lack of human control, malfunctions and misinterpretations can lead to unpredictable, inappropriate or even dangerous actions. Ethical considerations might be ignored or inadequately addressed. This also raises questions of responsibility and accountability. Potential security vulnerabilities could make these systems susceptible to cyberattacks and hacking, which could allow malicious actors to take control and use them for harmful purposes. In areas where human labour was previously used, autonomous systems could lead to job displacement or, in a worst-case scenario, job loss.

There is also an increased risk that BCIs (brain-computer interfaces) or other surveillance technologies could be used for espionage or surveillance pur-

73 See Phillips, Rita: Ethical discourses on autonomous weapon systems. Opportunities of Austria's conservative position on autonomous weapon systems in international settings. In chapter SOCIETY in this publication.

poses. This raises numerous new questions about possible countermeasures, including encryption, electronic interference capabilities and defence training.

Despite the rapid development of HET and its integration into everyday life, parts of the population will remain sceptical or even reject these technologies.[74] A lack of acceptance of HE could lead some people to feel uncomfortable or uneasy about being rescued by "enhanced" rescue workers. Furthermore, there could be concerns that the use of enhancement technologies might cause security forces to lose their humanity and become "superhuman" beings who are no longer understood or controlled by ordinary people. This could lead to concerns about a shift in security culture, or even a move towards a militarised or surveillance-driven society.

In general, it seems necessary to subject the types of technologies to be used as well as their practical application and the ethical and social frameworks surrounding them to careful review and ongoing evaluation, ensuring that the use of HET serves the well-being of society as a whole and respects fundamental human principles.

5. Conclusions

The previous considerations show how complex the impact of human enhancement is on society and its various sectors. With each step in development, a new set of challenges arises, with questions that often lag behind the technological advances.

Sociologist Wolfgang Sofsky argues that "we are returning to normal, historically dangerous times"[75] and suggests that we must learn to live with fear, as doing so will reduce the public's demand for state security and its responses. Although "learning to live with fear" is more relevant than ever, a return to "normal, historically dangerous times" seems unlikely from today's perspective. Is it not this very learning from and with fear that drives us to equip people with better traits and abilities to protect themselves against (even per-

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[74] See Grinschgl, Sandra: Cognitive enhancement - A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication.

[75] Sofsky, Wolfgang: Wir kehren zurück in normale historisch, gefährliche Zeiten. Süddeutsche Zeitung, 24 August 2006, No. 194, 11. 2006.

ceived) threats? Is it not this learning that propels HET forward with all its advantages and disadvantages? And do these "new" technologies not also offer hope for a better world?

On closer examination, one finds that many believed, during the golden age after World War II, that the focus was solely on welfare. This attitude has persisted until today. Services have increasingly been outsourced to the state, which guarantees not only security but also prosperity. The individual's sense of entitlement has steadily grown, while the modern administrative and tax state would be unthinkable without constant data collection and surveillance of its citizens. Sofsky remarks, "When did we internalise being watched to the point where we behave as if we are constantly being observed? Then the external gaze has become an internal habit".[76]

It is this habituation effect that makes us careless in our handling of personal data. But it is also the habituation effect that dulls our critical thinking and actions, robbing us of our natural responsibility to advocate for the safety of the community.

The use of enhancement technologies in the military and security sectors on a global scale also raises a number of questions regarding national security, including issues of control, responsibility and stability. The fact that Austria is a neutral state might exacerbate the problem, but a detailed analysis of this issue would exceed the scope of this discussion and is best left to more qualified experts.

The rapid development of human enhancement technologies presents society with fundamental ethical, social and political challenges. These technologies offer the potential to significantly improve human life, but they also carry the risk of exacerbating social inequalities and reinforcing existing power structures. From the perspective of classical sociological theorists such as Max Weber[77] and Émile Durkheim,[78] as well as contemporary ap-

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76 Ibid.

77 Weber, Max: Soziologische Grundbegriffe. 6th ed. Tübingen: Mohr Siebeck. 1984.

78 Durkheim, Emile: Über soziale Arbeitsteilung: Studie über die Organisation höherer Gesellschaften. Frankfurt am Main: Suhrkamp. 1992.

proaches by Anthony Giddens[79] and Ulrich Beck,[80] it becomes clear that a purely technological solution is insufficient to address the complex effects of these innovations. Instead, an integrative approach is required –one that critically reflects on technological developments, establishes ethical guidelines and promotes a broad societal dialogue.

Savulescu and Bostrom[81] insist that it is ultimately not very helpful to debate whether human enhancement is good or bad. In order to derive ethical judgements, it is necessary to pose more specific questions. The focus should be on clarifying which abilities are being enhanced in what ways, who has access, who makes the decisions, what the cost is and within which cultural and socio-political context all of this takes place.

The future of our society depends on whether we are able to shape HET in a way that benefits everyone, not just a select few. The path to a just and inclusive future lies in our shared responsibility and requires deep engagement with the social and cultural implications of these groundbreaking developments.

To successfully navigate this path, we must return to the principles of social justice, solidarity and responsibility. Society must develop mechanisms to ensure that access to human enhancement technologies is fairly and transparently regulated. It is crucial to consider not only economic and technological interests but also the moral and ethical dimensions that are inseparably linked to these technologies.

To successfully compete and remain competitive in the international race for human enhancement,[82] investments in research and development are essential. Collaboration and the exchange of knowledge and resources between governments, universities, research institutions and companies are necessary. Special attention should be given to start-ups specialising in human enhancement. All of this requires the development and implementation of clear legal

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79 Giddens, Anthony: The Consequences of Modernity. Stanford, CA: Stanford University Press. 1990.

80 Beck, Ulrich: Risikogesellschaft: Auf dem Weg in eine andere Moderne. Frankfurt am Main: Suhrkamp. 1986.

81 Savulescu, Julian/Bostrom, Nick: Human Enhancement. Oxford: Oxford University Press. (eds). 2009.

82 See Klerx, Joachim: The future of human enhancement in the military domain. In chapter TECHNOLOGY in this publication.

and ethical frameworks, including standards and guidelines for safety, accountability and transparency in the development and application of enhancement technologies. To ensure that Europe has the necessary expertise and capabilities, educational and training programmes on human enhancement must be promoted, with a particular emphasis on interdisciplinary collaboration between the fields of medicine, technology, ethics, social sciences and law. Naturally, this also requires the provision of funding opportunities, tax incentives and other support measures.

The most challenging task will likely be to involve society and public opinion in the development process of HET (human enhancement technologies) and to ensure access to these technologies for all social groups. It is crucial that political decisions related to enhancement technologies are made through democratic processes in which all segments of society can participate. Legal and ethical regulations can help ensure that "enhanced" individuals do not gain disproportionate advantages in certain areas. For instance, this could involve regulations that limit the use of enhancements in education and the workplace to avoid unfair competition. Such measures also help prevent the emergence of a two-tiered society and foster a sense of fairness. Additionally, to guarantee broad access, it is necessary for the state to finance public programmes or provide subsidies. These initiatives should also acknowledge the value of non-technological forms of human potential and well-being, such as creativity, emotional intelligence and social engagement.

Drawing on the sociological perspectives of classical thinkers who emphasise social cohesion and moral order, as well as the modern discourse on risk societies and reflexive modernity, we must collectively reflect on which forms of enhancement we seek and which societal values should be prioritised. The dialogue between science, politics, civil society and ethics is essential in creating a future where human enhancement technologies do not become another source of division and inequality but serve as a tool to promote the well-being of all people.

Ultimately, it becomes clear that the key to responsibly integrating human enhancement technologies into our society does not lie solely in technological feasibility but in our ability to find just, sustainable and humane solutions as a global community. Only in this way can we align technological possibilities with social values and create a future that is not only technologically advanced but also humanly liveable.

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Ethical discourses on autonomous weapon systems – opportunities of Austria's conservative position on autonomous weapon systems in international settings

Rita Phillips

1. Introduction

Autonomous weapon systems (AWS), once restricted to science fiction's representation of a distant dystopian future, are becoming an increasingly decisive element in modern-day warfare. With the fast-paced development of novel AWS and their ever-increasing role on the battlefield, debates with policymakers and scholars surrounding their use and legal and ethical implications have surged since the early 2000s.[1] While some countries, such as the US, the UK, Russia and China actively endorse the development and use of AWS, Austria takes a more cautious approach. At the United Nations Convention on Certain Conventional Weapons (CCW) in 2018, Austria joined the set of nations, calling for a ban on fully autonomous weapon systems.[2] This represents a consequential shift, as Austria was the first Western democratic nation to do so. While Austria opposes AWS due to "moral, ethical, legal and humanitarian concerns",[3] opportunities for Austria to take on leadership roles in negotiating and debating frameworks for AWS have not yet been cohesively analysed. This paper will address this gap in research by first examining international perspectives and the current understanding of AWS,

1 Arkin, Ronald: *Governing Lethal Behavior in Autonomous Robots*. Chapman and Hall/CRC/. 2009; Sharkey, Noel: Grounds for Discrimination: Autonomous Robot Weapons. In: *RUSI Defence Systems* 11.2/ 2008, pp. 86-89; Sharkey, Noel: The evitability of autonomous robot warfare. In: *International Review of the Red Cross* 94.886/ 2012a, pp. 787-799; Sparrow, Robert: Robots and Respect: Assessing the Case Against Autonomous Weapon Systems. In: *Ethics & International Affairs*, Volume 30/1/ 2016, pp. 93-116.

2 Pax: Positions on Lethal Autonomous Weapon Systems. 2018. https://paxforpeace.nl/wp-content/uploads/sites/2/2020/11/pax-rapport-crunch-time.pdf.

3 Bundesministerium für Europa Integration und Äußeres (BMEIA): Autonomous Weapons Systems. 2024a. https://www.bmeia.gv.at/en/european-foreign-policy/disarmament/conventional-arms/autonomous-weapons-systems.

followed by ethical views on AWS and possibilities for Austria to foster international discussions on AWS.

1.1 Defining autonomous weapon systems

Before assessing ethical questions on AWS, it is important to understand how AWS are defined and understood internationally. Definitions shape the ethical and legal status and thus determine their development and deployment.[4] Although the CCW has hosted annual meetings on AWS since 2013 and established a Group of Governmental Experts (GGE) in 2016, little progress has been made in finding uniform definitions of AWS. As Williams and Scharre[5] outline, "multiple definitions and understandings currently exist about autonomous systems". Inconsistencies in international definitions of AWS may complicate discussions on their ethical and legal implications and can create loopholes for the development and deployment of AWS.

This is exemplified in the United Kingdom's (UK) approach to AWS, suggesting that it "does not possess fully autonomous weapon systems and has no intention of developing or acquiring them."[6] While this statement may appear as a clear policy guideline, there is an important caveat in relation to the UK definition of AWS. The UK government defines AWS as systems that "must be capable of achieving the same level of situational understanding as a human."[7] In essence, the term "autonomous weapon system" is uti-

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4 Roff, Heather M.: An ontology of autonomy for autonomous weapons systems. In: Finkelstein, Claire, MacIntosh, Duncan and Ohlin, Jens David (Eds) *The Ethics of Autonomous Weapons.* Oxford: Oxford University Press/ 2017. Wood, Nathan Gabriel: Autonomous weapon systems and responsibility gaps: a taxonomy. In: *Ethics and Information Technology* 25.1/ 2023, pp. 1-14.

5 Williams, Andrew P./Scharre, Paul D.: Defining Autonomy in Systems: Challenges and Solutions. 2015. p. 27.

6 Ministry of Defence (MOD): Ambitious, safe, responsible: our approach to the delivery of AI-enabled capability in Defence. 2022. https://www.gov.uk/government/publications/ambitious-safe-responsible-our-approach-to-the-delivery-of-ai-enabled-capability-in-defence/ambitious-safe-responsible-our-approach-to-the-delivery-of-ai-enabled-capability-in-defence.

7 Ministry of Defence (MOD): The UK Approach to Unmanned Aircraft Systems (Joint Doctrine Note 2/11), MoD Development, Concepts and Doctrine Centre, paragraph 508. 2017. www.gov.uk/government/uploads/system/uploads/attachment_data/file/33711/20110505JDN_211_UAS_v2U.pdf.

lised in a way that is more analogous to what "general AI"[8] would constitute, shifting the debate on autonomous weapons to a far-off future. Weapon systems that may search, select and engage targets independently and without human supervision – which is how other countries define AWS – would not fall into the UK's classification. This example highlights the detrimental effects the myriads of meanings associated with AWS can have, complicating attempts to foster uniform agreements on conditions of their development and deployment.

An additional issue surrounding definitions is the lack of clarity in descriptions of key characteristics in AWS. A comparative review of international AWS definitions outlines strong international similarities in relation to an absence of complexity in international definitions.[9] Nations commonly utilise general definitions of AWS, merely characterising these systems by their ability to select, engage and fire without the intervention of a human operator. This is exemplified in two of the most influential definitions of AWS. Definitions formulated by the US Department of Defense[10] (USDoD) and the International Committee of the Red Cross (ICRC)[11] emerged from debates and policies surrounding AWS and are often mirrored in those of other countries and organisations. However, both define AWS in undifferentiated ways, simply being a "weapon system that, once activated, can select and engage targets without further intervention by an operator"[12] and a "weapon

8 Fox, John: Towards a Canonical Theory of General Intelligence. In: Journal of Artificial General Intelligence 11.2/2020, pp. 35-40.

9 Wood, Nathan Gabriel: Autonomous weapon systems and responsibility gaps: a taxonomy. In: Ethics and Information Technology 25.1/2023, pp. 1-14.

10 US Department of Defense (USDoD): Autonomy in Weapon Systems. 2012. https://ogc.osd.mil/Portals/99/autonomy_in_weapon_systems_dodd_3000_09.pdf; US Department of Defense (USDoD): Autonomy in Weapon Systems. 2023. https://media.defense.gov/2023/Jan/25/2003149928/-1/-1/0/DOD-DIRECTIVE-3000.09-AUTONOMY-IN-WEAPON-SYSTEMS.PDF.

11 International Committee of the Red Cross (ICRC): ICRC Position on Autonomous Weapon Systems. 2014. https://www.icrc.org/en/document/statement-icrc-lethal-autonomous-weapons-systems.

12 US Department of Defense (USDoD): Autonomy in Weapon Systems. 2012. https://ogc.osd.mil/Portals/99/autonomy_in_weapon_systems_dodd_3000_09.pdf; US Department of Defense (USDoD): Autonomy in Weapon Systems. 2023. https://media.defense.gov/2023/Jan/25/2003149928/-1/-1/0/DOD-DIRECTIVE-3000.09-AUTONOMY-IN-WEAPON-SYSTEMS.PDF.

system that has autonomy in the critical functions of selecting and attacking targets".[13] While the ICRC has recently updated its definition to specify target selection through "information from the environment received through sensors" (ICRC, 2021) and human involvement by "initial activation or launch by a person",[14] these definitions provide only rudimentary information on AWS. This is problematic as general definitions can be interpreted in ways that either legitimise and legalise the development and deployment of fully autonomous systems or prohibit any autonomy in weapon systems.

1.2 Practical examples of issues surrounding general definitions

Problematic implications of general definitions become apparent when unpicking terminology surrounding target selection. If "select" is understood as to "sense" or "detect", then most contemporary weapons would fall into the category of AWS, as considerable attempts by international military have been made to develop precision-guided munition (PGM).[15] In fact, the development of PGM can be traced back to WW2, where different disciplines intended to find ways to improve accuracy. While some ideas, such as Skinner's pigeon-guided missiles,[16] were less successful, Germany introduced the G7e/T4 Falke torpedo in 1943, which used an acoustic homing seeker to account for aiming errors. The G7e/T4 Falke was only used by three submarines and then replaced by the faster G7es/T5 Zaunkönig; however, it marked the advent of a new type of munition.[17] Although PGM can "sense" or "detect" targets by using some kind of signal, it cannot be classified as

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13 International Committee of the Red Cross (ICRC): ICRC Position on Autonomous Weapon Systems. 2014. https://www.icrc.org/en/document/statement-icrc-lethal-autonomous-weapons-systems.

14 International Committee of the Red Cross (ICRC): ICRC Position on Autonomous Weapon Systems. 2021. https://www.icrc.org/en/document/icrc-position-autonomous-weapon-systems.

15 Roff, Heather M.: An ontology of autonomy for autonomous weapons systems. In: Finkelstein, Claire/MacIntosh, Duncan/Ohlin, Jens David (Eds) The Ethics of Autonomous Weapons. Oxford: Oxford University Press/ 2017; Zehfuss, Maja: Targeting: Precision and the production of ethics. In: *European Journal of International Relations* 17.3/ 2011, pp. 543-566.

16 Włodarczyk, Justyna: Beyond Bizarre: Nature, Culture and the Spectacular Failure of BF Skinner's Pigeon-Guided Missiles. In: *Polish Journal for American Studies* 14/ 2020, p.7-140.

17 Watts, Sean: Autonomous weapons: regulation tolerant or regulation resistant? In: Temp. Int'l & Comp. LJ 30/ 2016, pp. 177-187.

AWS as it lacks autonomy.[18] This example outlines how the interpretation of "select" can break down the distinction between "automatic" and "autonomous", suggesting that autonomy is merely a better version of well-designed and highly capable automation.[19]

Additional complexity surrounding "autonomy" is highlighted by the different tasks that can require limited or no human supervision. "Autonomy" resides in a multidimensional continuum, whereby different tasks can be interrelated and independent.[20] AWS may autonomously select a target, calculate the trajectory of a missile and make locational adjustments to engage the target. Autonomy is therefore a task-based collection of capacities and capabilities, whereby planning autonomy (constructing a plan to realise orders) and learning autonomy (learning from previous "experiences" to adapt to novel environments)[21] can be further differentiated. Which types of autonomous tasks can be classified as legal is down to interpretation in general definitions.

Further, general definitions insufficiently characterise the precise level of human control or oversight when considering AWS. For example, Austria takes the "clear position that significant human control over autonomous weapon systems is necessary",[22] leaving the question of what may constitute "signif-

18 Gillespie, Anthony/West, Robin: Requirements for Autonomous Unmanned Air Systems Set by Legal Issues. In: THE INTERNATIONAL C2 JOURNAL. 4(2), 2010.

19 USAF 2016; Roff, Heather M./Danks, David: Trust but Verify: The Difficulty of Trusting Autonomous Weapons Systems. Journal of Military Ethics, 17(1), pp. 2-20. 2018. https://doi.org/10.1080/15027570.2018.1481907; Moray, Neville/Inagaki, Toshiyuki/Itoh, Makoto: Adaptive automation, trust, and self-confidence in fault management of time-critical tasks. *Journal of Experimental Psychology: Applied, 6*(1), 2002. pp. 44-58. https://doi.org/10.1037/1076-898X.6.1.44.

20 Roff, Heather M.: An ontology of autonomy for autonomous weapons systems. In: Finkelstein, Claire/MacIntosh, Duncan/Ohlin, Jens David (Eds) The Ethics of Autonomous Weapons. Oxford: Oxford University Press/ 2017; Wood, Nathan Gabriel: Autonomous weapon systems and responsibility gaps: a taxonomy. In: Ethics and Information Technology 25.1/ 2023. pp.1-14.

21 Wood 2023.

22 Bundesministerium für Europa Integration und Äußeres (BMEIA): Autonomous Weapons Systems. 2024a. https://www.bmeia.gv.at/en/european-foreign-policy/disarmament/conventional-arms/autonomous-weapons-systems.

icant human control" unanswered.[23] Human operators can be in the loop, on the loop and out of the loop.[24] Human-in-the-loop refers to AWS that require human operators to make or confirm decisions. While AWS may provide recommendations or assistance, the human operator must decide which action to take. These systems are often seen as the most ethical systems as they ensure human accountability. Human-on-the-loop systems allow the human operator to monitor actions of AWS and can intervene, if necessary. Human-on-the-loop systems represent a balance between autonomy and oversight. Lastly, human-out-of-the-loop are AWS that operate without real-time human supervision or intervention. These types of AWS are the most controversially discussed systems, as algorithms calculate target engagement.[25] However, even fully autonomous "killer robot" systems can be classified as semi-autonomous systems by integrating a human-in-the-loop mode. For example, while the US definition on AWS prohibits fully autonomous human-out-of-the-loop systems for lethal engagement, these systems have been developed and deployed, just in semi-autonomous, human-in-the-loop mode. In addition, non-lethal intercept missions (e.g. anti-ballistic missiles) are commonly utilised in fully autonomous modes. This is evidenced by systems like the ship-based Phalanx Close-In Weapon System (CIWS), the ground-based air missile defence system Patriot and the experimental unmanned combat aerial vehicle (UCAS) X47B that can be used in fully and semi-autonomous mode. This evidences how ambiguity surrounding the classification of fully autonomous human-out-of-the-loop and semi-autonomous human-in-the-loop AWS can have substantial implications on their legal status.

In conclusion, general definitions of AWS are problematic as different aspects and abilities of sophisticated, complex systems, such as AWS, can be

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23 Galliott, Jai/ Wyatt, Austin: A consideration of how emerging military leaders perceive themes in the autonomous weapon system discourse. In: Defence Studies 22.2/ 2022. pp. 253-276.

24 Schaub Jr, Gary/ Kristoffersen, Jens Wenzel: In, On, or Out of the Loop? 2017. https://cms.polsci.ku.dk/publikationer/in-on-or-out-of-the-loop/In_On_or_Out_of_the_Loop.pdf.

25 Schwarz, Elke: Autonomous Weapons Systems, Artificial Intelligence, and the Problem of Meaningful Human Control. In: Philosophical Journal of Conflict and Violence Vol.1/ 2021, pp 53-72; Amoroso, Daniele/Tamburrini, Guglielmo: The Ethical and Legal Case Against Autonomy in Weapons Systems. In: Global Jurist 18, no. 1/ 2018, 20170012.

interpreted in various ways. The absence of an internationally binding unitary framework that specifies key characteristics of AWS may lead to the asymmetric development and deployment of AWS, affecting global stability and security. Thus, international discussions surrounding the ethical use of AWS would first attempt to unravel and untangle understanding and definitions of AWS.

1. Ethical perspectives on AWS

Ethical questions and implications surrounding the deployment of AWS are guided by normative ethics. Normative ethics determine what is morally right or wrong, good or bad and what moral duties individuals should follow. This allows general principles to be formed that guide moral decision-making processes.[26] Arguments surrounding AWS mainly fall into two strands of normative ethics: Consequentialism and deontology. Consequentialism judges the morality of an action based on its outcome or consequence, whereas deontology emphasises the importance of following moral rules regardless of outcome.

2.1 Consequentialist perspectives on AWS

Consequentialist perspectives on AWS follow the reasoning that AWS could be evaluated positively, if maximising overall happiness and minimising suffering. Amorso and Tamburrini[27] contrast between narrow and broad consequentialist views, with the former being exclusively concerned with culmination outcomes and the latter with the wider consequential evaluation.[28] As Tamburrini[29] highlights, AWS has potential in narrow consequentialist views, as more accurate targeting and a reduction in human frontline exposure may

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[26] Kagan, Shelly: *Normative Ethics*. London: Routledge, 2018.

[27] Amoroso, Daniele/ Tamburrini, Guglielmo: The Ethical and Legal Case Against Autonomy in Weapons Systems. In: Global Jurist 18, no. 1/ 2018. 20170012.

[28] Sen, Amartya: Consequential Evaluation and Practical Reason. In: The Journal of Philosophy 97.9/ 2000, pp. 477-502.

[29] Tamburrini, Guglielmo: On banning autonomous weapons systems: from deontological to wide consequentialist reasons. In: Bhuta, Nehal/Beck, Susanne /Liu, Hin-Yan (Eds): Autonomous Weapons Systems: Law, Ethics, Policy. Cambridge: Cambridge University Press/ 2016. pp. 122-142.

reduce the number of casualties. This perspective can be evidenced by examining the advent of drone and robot mass-scale production during the US campaigns in Iraq and Afghanistan. While spending on drones hovered around $300 million per year in the 1990s, funding rose to $2 billion per year by 2005.[30] Reasons for this substantial increase relate back to urgent front-line demands during the messy counterinsurgency campaigns in Iraq and Afghanistan. Larger drones such as the MQ-1B Predator were able to quietly surveil terrorists and smaller drones like the RQ-11 Raven provided troops with over-the-hill reconnaissance on demand. Similarly, Afghan and Iraqi terrorists' large-scale use of improvised explosive devices (IEDs) created high demand for ground robots that could disable or destroy IEDs without putting human life at risk. While reconnaissance and bomb disposal may not directly equate to AWS, it demonstrates AI's potential to save lives and lower the human cost of war.

Besides removing human soldiers from potentially dangerous situations, computational processes may increase accuracy and precision in targeting and thus contribute to distinguishing between civilians and combatants. Civilians may be less likely to be harmed as algorithms can prohibit civilians from being targeted.[31] Many civilian casualties may be the result of human error.[32] Arkin[33] refers to the "plight of the non-combatant" by suggesting that civilian casualties are not merely caused by being caught up in crossfire but by human failings. Soldiers may make lethal decisions when they are exhausted, angry, afraid or vengeful. In principle, an "ethical governor" could be programmed and integrated into AWS, making sure that the AWS complies with the laws of war.[34] Given the obligation to protect civilians from

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30 Office of the Secretary of Defense: Unmanned Aircraft Systems Roadmap 2005-2030 (2005). https://irp.fas.org/program/collect/uav_roadmap2005.pdf.

31 Arkin, Ronald C./Ulam, Patrick/Duncan, Brittany: An Ethical Governor for Constraining Lethal Action in an Autonomous System. Technical Report GIT-GVU-09-02 / 2009. https://digitalcommons.unl.edu/csetechreports/163/.

32 Arkin, Ronald: The Case for Ethical Autonomy in Unmanned Systems. In: Journal of Military Ethics 9, no. 4/ 2010. pp. 332-341.

33 Arkin, Ronald: Lethal Autonomous Systems and the Plight of the Non-Combatant. In: AISB Quarterly 137, 2013. pp. 1-9.

34 Arkin, Ronald C./Ulam, Patrick/Duncan, Brittany: An Ethical Governor for Constraining Lethal Action in an Autonomous System. Technical Report GIT-GVU-09-02 / 2009. https://digitalcommons.unl.edu/csetechreports/163.

combat, introducing AWS to the battlefield may be desirable or perhaps even a moral requirement if these systems were to reduce harm and eliminate human error.[35]

However, to date there is limited evidence of whether AWS may be more reliable than humans in lethal decision-making. Morally questionable incidents with AWS involvement have not been frequently documented, though this may be due to their limited use on battlefields, or classification and secrecy surrounding AWS incidents. Most popular examples of AWS incidents include fratricides committed with the Patriot missile system during the Iraq war in 2003. The first incident happened on 23 March 2003. The Patriot missile system mistakenly identified a British Royal Air Force Tornado GR4 fighter jet near the Kuwait-Iraqi border as an enemy missile. This likely happened due to the inactive "identification friend or foe" (IFF) signal and the descending trajectory profile of the aircraft. The Patriot's operators did not know about any incoming friendly aircraft and were unable to connect to other radars on the network due to outdated equipment. Deprived of the ability to examine the input of other radars, the orders to engage were given, killing the crew of the Tornado GR4.[36] The second incident occurred only a few weeks later, on 2 April 2003. A US Navy F/A 18C Hornet was mistakenly targeted and destroyed by a Patriot missile system near Karbala, Iraq. Unlike the first incident, the Patriot missile system picked up a "ghost track", identifying a ballistic missile where there was none. This "ghost track" was presumably caused by a non-standard configuration in which radars overlapped and caused interference. After the Patriot's PAC-3 missiles were launched and unable to identify a target, the missiles activated their seekers

35 Sparrow, Robert: Robots and Respect: Assessing the Case Against Autonomous Weapon Systems. In: Ethics & International Affairs, Volume 30/1/ 2016. pp. 93-116; Arkin, Ronald: Governing Lethal Behavior in Autonomous Robots. Chapman and Hall/CRC, 2009.

36 Hawley, John K.: Patriot Wars: Automation and the Patriot Air and Missile Defense System. In: Center for a New American Security. 2017. https://s3.amazonaws.com/files.cnas.org/documents/CNAS-Report-EthicalAutonomy5-PatriotWars-FINAL.pdf; Hawley, John K./Mares, Anna L./Marcon, Jessica L.: On fratricide and the operational reliability of target identification decision aids in combat identification. In: Herz, Robert (Ed.) Human Factors Issues in Combat Identification. Florida: CRC Press, 2017, pp. 299-312.

and locked on to the nearby Hornet fighter jet, killing the pilot.[37] Both fratricides were primarily caused by limitations of the Patriot's autonomous target identification capabilities.[38] While the system was designed to rapidly detect and engage incoming threats, the complexity of high-intensity conflicts highlighted issues in algorithms that differentiate between aircrafts, anti-radiation missiles and ballistic missiles.

While these arguments may not necessarily lead to the conclusion that humans make better decisions than machines, they do weaken the assumption that the use of AWS will necessarily reduce suffering and harm. In fact, to date there is too little evidence on the performance of AWS in saturation scenarios and contested environments to allow for sound judgement on the benefits of AWS (except for some systems like the Aegis Combat System that has been used and continually upgraded since 1983). It is likely that AWS will need to be combat-tested, weaknesses identified and improved.

Additionally, the argument of reducing human warfighters' suffering due to limited frontline exposure can be scrutinised when drawing on historical evidence. The first automatic gun, the Gatling gun, was not invented to accelerate the process of killing, but to save lives by reducing the number of soldiers exposed to the battlefield. The inventor, Richard Gatling, expected that if "a gun – which could by its rapidity of fire, enable one man to do as much battle duty as a hundred, that it would, to a large extent supersede the necessity of large armies, and consequentially, exposure to battle and disease

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37 Hawley, John K.: Looking Back at 20 Years of MANPRINT on Patriot: Observations and Lessons. Army Research Laboratory, 2007. https://apps.dtic.mil/sti/pdfs/ADA472740.pdf, Hawley, John K.: Patriot Wars: Automation and the Patriot Air and Missile Defense System. In: Center for a New American Security, 2017. https://s3.amazonaws.com/files.cnas.org/documents/CNAS-Report-EthicalAutonomy5-PatriotWars-FINAL.pdf; Hew et al. 2010; Hawley, John K./Mares, Anna L./Marcon, Jessica L.: On fratricide and the operational reliability of target identification decision aids in combat identification. In Herz, Robert (Ed.) Human Factors Issues in Combat Identification. Florida: CRC Press/ 2017, pp. 299-312.

38 Hew, Patrick/Lewis, Edward/Radunz, Penelope/Rendell, Sean: Situation awareness for supervisory control: Two fratricide cases revisited. 2010. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=959defb585ed0110be1386259caef17ef53a9c53; Hawley, John K./Mares, Anna L./Marcon, Jessica L.: On fratricide and the operational reliability of target identification decision aids in combat identification. In: Herz, Robert (Ed.) Human Factors Issues in Combat Identification. Florida: CRC Press, 2017, pp. 299-312.

[would] be greatly diminished".[39] Shortly after, the first machine gun, the Maxim gun, was introduced in 1883. From a narrow consequentialist perspective, the use of a superior weapon system in order to reduce casualties may constitute an ethical imperative. However, while the machine gun allowed the British Army to reinforce their colonial requests with reduced casualties on the British side in the late 1800s, the successors of the Maxim gun contributed to mass killings on unprecedented scales during WW1.[40] This example highlights how technological advancement in weapon systems may not have linear outcomes and accentuates the multi-factorial complexity in analysing their potential impact. Wide consequentialist perspectives allow multi-factorial complexity to be taken into account.

Broad consequentialist views extend the scope of consequentialist reasoning by considering a broader array of factors and outcomes. Discussions surrounding the ethical implications of AWS may need to take into account long-term effects on peace stability and incentives to start wars.[41] A reduction in an immediate "body-bag count" may lower the threshold for conflict engagement as a major disincentive for war is removed.[42] This may lead to increased overall long-term suffering as it implies more frequent or prolonged warfare. Additionally, global stability may be threatened as, besides lowering the threshold for war engagement, the deployment of AWS may cause an arms race as nations may feel compelled to develop more sophisticated AWS.[43]

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39 Gatling 1877, as cited in Keller, Julia: Mr. Gatling's Terrible Marvel: The Gun that Changed Everything and the Misunderstood Genius who Invented it. London: Penguin, 2008, p. 27.

40 Keller, Julia: Mr. Gatling's Terrible Marvel: The Gun that Changed Everything and the Misunderstood Genius who Invented it. London: Penguin, 2008.

41 Tamburrini, Guglielmo: On banning autonomous weapons systems: from deontological to wide consequentialist reasons. In: Bhuta, Nehal/Beck, Susanne/Liu, Hin-Yan (Eds): Autonomous Weapons Systems: Law, Ethics, Policy. Cambridge: Cambridge University Press, 2016. pp. 122-142.

42 Sharkey, Noel: Grounds for Discrimination: Autonomous Robot Weapons. In: RUSI Defence Systems 11.2, 2008, pp. 86-89.

43 Sharkey, Noel: The evitability of autonomous robot warfare. In: International Review of the Red Cross 94.886/2012a, pp. 787-799; Tamburrini, Guglielmo: On banning autonomous weapons systems: from deontological to wide consequentialist reasons. In: Bhuta, Nehal/Beck, Susanne/Liu, Hin-Yan (Eds): Autonomous Weapons Systems: Law, Ethics, Policy. Cambridge: Cambridge University Press, 2016. pp. 122-142.

Arms races and their deleterious effect on global stability have numerous references to history. For example, during the pre-WW1 naval arms race (1900–1914) Germany and the UK competed in developing "Dreadnought" battleships, which were the most advanced battleships at that time. The race was driven by Germany's attempt to challenge British naval supremacy and contributed to the rising tensions in Europe, culminating in WW1.[44] During the Cold War Era (1945–1991), the US and the Soviet Union developed weapon capabilities to destroy each other multiple times ("Mutual Assured Destruction", MAD), which paradoxically acted as a deterrent against direct conflict.[45] Unless culminating in war, arms races normally conclude with nations signing treaties to limit developing, stockpiling or deploying specific weapons (e.g. Intermediate-Range Nuclear Forces Treaty, Conventional Armed Forces in Europe Treaty, Anti-Ballistic Missile Treaty, Chemical Weapons Convention). However, treaties on AWS are still in their very early stages and, with evolving international tensions, it is uncertain how attempts to regulate AWS will develop in the future. At the moment, official statements suggest that the aim of AWS development is to remove the human soldier from frontlines, to reduce casualties and increase combat effectiveness.[46] With the US aiming for a long-term transformation of their military

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44 Berghahn, Volker: Naval Armaments and Social Crisis: Germany Before 1914. In: Best, Geoffrey and Andrew Wheatcroft (Eds). War, Economy and the Military Mind. Routledge: London, 2020, pp. 61-88; Maurer, John H.: Arms Control and the Anglo-German Naval Race before World War I: Lessons for Today? In: Political Science Quarterly 112.2, 1997, pp. 285-306.

45 Muedini, Fait: In the United States and the Soviet Union, the Theory of Mutually Assured Destruction Altered International Relations. In: Santos, Rita (Ed): Arms Sales, Treaties, and Violations, 2018, pp. 118-129; Van Munster, Rens/Sylvest, Casper: On history and authority: the Cold War nuclear arms race and its importance for critical security theory. In: Critical Studies on Security 10.3, 2022, pp.157-171.

46 Greenwalt, William C.: DOD's Replicator Program: Challenges and Opportunities. 2023. https://policycommons.net/artifacts/5668878/dods-replicator-program/6434352/; Pfaff, C. Anthony et al.: Trusting AI: Integrating Artificial Intelligence into the Army's Professional Expert Knowledge. Carlisle: USAWC Press/ 2023; Bachmann, Sascha-Dominik Dov/Grant, Richard V.: The Need for An Australian Regulatory Code for the Use of Artificial Intelligence (AI) in Military Application. In: American University National Security Law Brief 13.2, 2023, pp. 1-34.

through AWS and Russia and China targeting the major automation of their militaries by 2028-2030, it is unclear whether or not an arms race may have already begun.[47]

Contrary to the argument that the development and deployment of AWS may cause an arms race,[48] broad historical patterns in warfare indicate that innovations often challenge nations to provide asymmetric responses. This means that the response to the development of an adversary's advantage (e.g. weapons with superior firepower) may involve the development of a different system (e.g. superior surveillance systems) or new strategies (e.g. hit-and-run attacks). For example, when the Japanese encountered superior US skills in naval surface gunfire in WW2, they changed their strategy to attack at night, resulting in devastating nighttime naval surface action at the Battle of Guadalcanal.[49] This example highlights the dynamic in innovation and counter-innovation during warfare. As such, the development and deployment of AWS by one nation does not necessarily lead to increased international development and deployment of AWS.

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47 Sharma, Sanur: Unmanned Ground Vehicles: Global Developments and Future Battlefield. Manohar Parrikar Institute for Defence Studies and Analyses Issue Brief, 2022. https://www.idsa.in/system/files/issuebrief/ib-unmanned-ground-vehicles-ssharma-220422.pdf; Greenwalt, William C.: DOD's Replicator Program: Challenges and Opportunities. 2023. https://policycommons.net/artifacts/5668878/dods-replicator-program/6434352/; Kania, Elsa: "AI weapons" in China's military innovation. 2020. https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_ai_weapons_kania_v2.pdf; Warren, Aiden/ Hillas, Alek: Xi Jinping Thought: Lethal Autonomous Weapons Systems and Military Modernization with Chinese Characteristics. In: The Journal of International Relations, Peace Studies, and Development 7.1, 2022, pp. 6-32.

48 Sharkey, Noel: The evitability of autonomous robot warfare. In: International Review of the Red Cross 94.886/2012a, pp.787-799; Tamburrini, Guglielmo: On banning autonomous weapons systems: from deontological to wide consequentialist reasons. In: Bhuta, Nehal/Beck, Susanne/Liu, Hin-Yan (Eds): Autonomous Weapons Systems: Law, Ethics, Policy. Cambridge: Cambridge University Press, 2016, pp. 122-142.

49 Mahnken, Thomas: Asymmetric Warfare at Sea: The Naval Battles off Guadalcanal, 1942–1943. In: Naval War College Review 64.1, 2011, pp. 95-121.

Besides issues surrounding the potential of an international AWS arms race, scholars are concerned about the effect of AWS on international stability.[50] International stability refers to a stable equilibrium. If disturbed by an outside force, it returns to its original state. An unstable equilibrium, in comparison, is a state in which a small disturbance causes the system to rapidly transition to an alternate state.[51] Introducing AWS may be problematic as they may possibly lead to unintended escalations. During "crisis stability", in particular, characterised by international, multilateral or bilateral tensions, one incident may cause escalation. Due to the pace of AWS decision-making, unsupervised AWS may respond to misidentified targets and thus provoke retaliatory strikes. In the absence of human intuition and reason, this may have grave consequences. For example, on 26 September 1983, the Soviet Union's satellite early warning system Oko misinterpreted a rare alignment of sunlight on high-altitude clouds and the satellite's Molniya orbits as a US nuclear attack. A fully autonomous system would have initiated a retaliatory attack and, in doing so, started WW3. It was only through human intuition that an all-out nuclear war could be prevented.[52] With the speed of AWS outpacing human decision-making, situations could occur where military actions lack sufficient oversight. This increases the likelihood of unintended consequences, making it more difficult to clearly signal national intentions. In a tense situation, this could lead to pre-emptive strikes or escalatory measures based on incorrect assumptions and data interpretation. As Sharkey[53] high-

50 Horowitz, Michael C.: When speed kills: Lethal autonomous weapon systems, deterrence and stability. In Sechser, Todd et al. (Eds.) Emerging Technologies and International Stability. London: Routledge, 2021, pp. 144-168; Leys, Nathan: Autonomous Weapon Systems, International Crises, and Anticipatory Self-Defense. In Yale J. Int'l L. 45, 2020, pp. 377-411; Horowitz, Michael C./Scharre, Paul: AI and International Stability, 2021. https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/AI-and-International-Stability-Risks-and-Confidence-Building-Measures.pdf; Horowitz, Michael C./Scharre, Paul/Velez-Green, Alexander: A Stable Nuclear Future? The Impact of Autonomous Systems and Artificial Intelligence, 2019. https://arxiv.org/pdf/1912.05291.

51 cf. Schelling, Thomas C.: Surprise Attack and Disarmament. In: Bulletin of the Atomic Scientists 15.10, 1959, pp. 413-418.

52 Petrov, Avvakum: The Life Written by Himself. Columbia: Columbia University Press, 2021.

53 Sharkey, Amanda: Autonomous weapons systems, killer robots and human dignity. In: Ethics and Information Technology 21.2, 2019, pp. 75-87; Sharkey, Noel: The evitability of autonomous robot warfare. In: International Review of the Red Cross 94.886/2012a, pp. 787-799.

lights, there remains a certain unpredictability of AWS based on the interaction of different computational algorithms. The deployment of multiple AWS would require testing these systems during war and correcting possible errors, which, to date, has not been done.

Critiques of consequentialist views on AWS argue that consequentialist arguments, particularly wide consequentialist perspectives, are often abstract and imprecise, based on "what-if" scenarios. The use of AWS does introduce high levels of uncertainty and complexity. Predicting consequences based on "what-if" scenarios, including unintended consequences, make precise ethical assessments on AWS challenging. Consequentialist views also do not provide coherent guidance on AWS, as it is not clear how to weigh different consequences. For example, how could a potential reduction in human soldier casualties be balanced against a possible increased risk to global security and stability? These dilemmas can lead to abstract and sometimes vague conclusions based on consequentialist perspectives, which scholars have been grappling with since the early 2000s.[54] An additional layer of complexity surrounding ethical recommendations on AWS is added when integrating deontological perspectives.

2.2 Deontological perspectives on AWS

Deontological views on AWS focus on the inherent morality of actions themselves, rather than the outcomes or consequences. Right and wrong are therefore determined by the rules governing the actions, not by the consequence of the action. One influential deontological argument surrounding

[54] cf. Sparrow, Robert: Robots and Respect: Assessing the Case Against Autonomous Weapon Systems. In: Ethics & International Affairs, Volume 30/1/ 2016, pp. 93-116f; Sparrow, Robert: Killer robots. Journal of applied philosophy, 2007, 24(1), pp. 62-77; Lin, Patrick/Abney, Keith/Bekey, George A.: Robot Ethics: The Ethical and Social Implications of Robotics. Cambridge (MA): MIT Press/ 2014; Sharkey, Noel: The evitability of autonomous robot warfare. In: International Review of the Red Cross 94.886/2012a, pp. 787-799; Lucas Jr, George R.: Automated Warfare. In: Stan. L. & Pol'y Rev. 25, 2014, pp. 317-341.

the prohibition of AWS is based on the concept of human dignity.[55] The utilisation of lethal autonomous weapon systems (LAWS) may be unethical as these systems violate the right to dignity of those targeted.[56] This argument is based on the Kantian account of dignity[57] and on the African Charter on Human and Peoples' Rights which emphasise the interrelated nature of the right to life and the right to dignity.[58] Even if the demands of the international humanitarian law (IHL) could be adhered to by AWS, AWS are incapable of valuing the significance of human life. This may violate the ethical principle of respecting human beings as ends in themselves and dehumanise human actors as just another target to be destroyed.[59] Also, the principles of distinction, proportionality and military necessity require human, not autonomous, judgement as human judgement reflects interpretation and rationalisation processes that are unique to human reasoning.[60]

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55 Heyns, Christoph: Autonomous weapons in armed conflict and the right to a dignified life: an African perspective. South African Journal on Human Rights, 33(1)/2017, pp.46-71; Asaro, Peter: On banning autonomous lethal systems: human rights, automation, and the dehumanization of lethal decision-making, special issue on new technologies and warfare. In: International Review of the Red Cross, 94(886)/2012, pp. 687-709; Docherty, Bonnie: Shaking the Foundations: The Human Rights Implications of Killer Robots. 2014. https://www.hrw.org/report/2014/05/12/shaking-foundations/human-rights-implications-killer-robots; Ulgen, Ozlem: Kantian Ethics in the Age of Artificial Intelligence and Robotics. In: *QIL* 43, 2017, pp.59-83.

56 Heyns, Christoph: Autonomous weapons in armed conflict and the right to a dignified life: an African perspective. South African Journal on Human Rights, 33(1), 2017, pp. 46-71.

57 Heyns, Christoph: Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, A/HRC/23/47. 2013. https://www.refworld.org/reference/themreport/unhrc/2015/en/105196; Heyns, Christoph: Autonomous weapons systems: living a dignified life and dying a dignified death. In Bhuta, Nehal et al. (Eds.), Autonomous Weapons Systems: Law, Ethics, Policy/Cambridge: Cambridge University Press, 2016, pp. 3-20.

58 Heyns, Christoph: Autonomous weapons in armed conflict and the right to a dignified life: an African perspective. South African Journal on Human Rights, 33(1)/2017, pp. 46-71.

59 Ulgen, Ozlem: Human Dignity in an Age of Autonomous Weapons: Are We in Danger of Losing an 'Elementary Consideration of Humanity'? In: Baltic Yearbook of International Law Online 17.1/2020, pp. 167-196.

60 Asaro, Peter: On banning autonomous lethal systems: human rights, automation, and the dehumanization of lethal decision-making, special issue on new technologies and warfare. In: International Review of the Red Cross, 94(886)/2012, pp. 687-709.

However, dignity in death on the battlefield may only be relevant in theoretical debates excluding realistic perspectives of warfare. References to history highlight that there are neither legal, ethical nor historical traditions of combatants allowing their enemies to die a dignified death in war.[61] War without reflection may be mechanical slaughter, as suggested by Heyns.[62] However, the question arises as to whether war with reflection can be seen as fundamentally different. Would the most ethical way to fight and die be in hand-to-hand combat? As such, deontologist perspectives on human dignity in dying remain a matter of debate.

A further deontological perspective that opposes the use of AWS relates to accountability and responsibility. Deontological views emphasise the importance of moral responsibility in lethal decision-making. When AWS make lethal decisions, it raises concern about who is morally accountable for that decision. Deontologists therefore argue that humans should not delegate the responsibility of killing to machines as this diffuses accountability and undermines the moral fabric of decision-making in warfare. This is summarised in the "accountability gap",[63] examining issues surrounding shared responsibility. If an incident results in a war crime, neither manufacturer nor personnel could be held accountable. As long as an AWS is not legally considered a "person", the result would be a gap in accountability. However, the accountability gap is only a concern if the AWS has fired in an unpredictable fashion. If the AWS has simply carried out instructions, then accountability would lie with the operator who has provided these instructions. In decisions surrounding accountability, human intent therefore plays an important role.

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61 Scharre, Paul: Army of None: Autonomous Weapons and the Future of War. New York: Norton & Company, 2018.

62 United Nations: UN human rights expert calls for a moratorium on lethal autonomous robots. Of human rights and robots. 2013. https://www.ohchr.org/en/press-releases/2013/05/un-human-rights-expert-calls-moratorium-lethal-autonomous-robots.

63 Chengeta, Thompson: Accountability gap, autonomous weapon systems and modes of responsibility in international law. In: Denv. J. Int'l L. & Pol'y, 45/2016, pp. 1-50; Drake, Emily: Evaluating autonomous weapons systems: A dichotomic lens of military value and accountability. In: Colum. Hum. Rts. L. Rev., 53/2021, pp. 297-344; Oimann, Ann-Katrien: The Responsibility Gap and LAWS: a Critical Mapping of the Debate. In: Philosophy & Technology 36.1/2023, pp. 1-22.

Scholars argue that keeping the human in the loop may reduce issues surrounding the accountability gap.[64]

However, if operators feel less responsible for lethal action, then this may result in increased killings. Humans are generally reluctant to kill.[65] The army historian Samuel Marshall, for example, found that during WW2 less than 20% of the interviewed US soldiers stated that they shot directly at the enemy.[66] Most soldiers were "posturing", pretending to fight but aiming above the enemy's head or were not firing at all. However, the innate resistance to kill can be overcome by increasing psychological and physical distance and diffusing responsibility.[67] Delegating the decision to kill to AWS may make it easier for the operator to come to terms with the decision to kill, as the operator may offload the moral responsibility for killing. This is problematic, as Grossmann[68] found that soldiers were more willing to kill if the responsibility was diffused. For example, firing rates of US machine gun crews were nearly 100% during WW2, as each member of the crew could justify their actions without taking individual responsibility for killing. The person feeding ammunition did not feel responsible for killing, as they only fed the ammunition, neither did the spotter feel responsible, as they merely pointed out where to shoot, nor the gunner, as they were just following directions provided by the spotter. In essence, this indicates how sharing individual responsibility in the process of killing may normalise lethal actions.[69] AWS

64 Wood, Nathan Gabriel: Autonomous weapon systems and responsibility gaps: a taxonomy. In: Ethics and Information Technology, 25.1/2023, pp. 1-14; Oimann, Ann-Katrien: The Responsibility Gap and LAWS: a Critical Mapping of the Debate. In: Philosophy & Technology, 36.1/2023, pp. 1-22; Drake, Emily: Evaluating autonomous weapons systems: A dichotomic lens of military value and accountability. In: Colum. Hum. Rts. L. Rev., 53/2021, pp. 297-344.

65 Grossman, Dave: On Killing: The Psychological Cost of Learning to Kill in War and Society. In: Tweedy, Rod (Ed.) The Political Self. Routledge: London, 2018, pp. 141-155.

66 Marshall, Samuel/Lyman, Atwood: Men Against Fire: The Problem of Battle Command. University of Oklahoma Press, 2000.

67 MacNair, Rachel M.: The Psychology of Peace: An Introduction. Bloomsbury Publishing USA, 2011; Grossman, Dave: On Killing: The Psychological Cost of Learning to Kill in War and Society. In: Tweedy, Rod (Ed.) The Political Self. Routledge: London, 2018, pp. 141-155.

68 Grossman, Dave: On Killing: The Psychological Cost of Learning to Kill in War and Society. In: Tweedy, Rod (Ed.) The Political Self. Routledge: London, 2018, pp. 141-155.

69 Ibid.

could act as a "moral buffer", reducing individuals' perceptions of moral responsibility for their actions.

This may be the case, in particular, as humans tend to anthropomorphise machines. Humans implicitly oversee the individual system processes of sophisticated systems but identify a "behaviour" of the overall unspecified systems and think of it as the systems' intentions or personality. Suchman[70] specifies this as human "inclination to ascribe actions to the entity rather than its parts", thereby anthropomorphising the machine and ascribing personality to its decision-making capabilities. Sophisticated systems, such as AWS, may be perceived to have independent intentionality that determine decisions. This fallacy would have significant consequences, affecting human ethical thinking and causing human moral agency to atrophy. Deontological perspectives would suggest that lethal action should always remain a troubling and morally challenging act, not a technological option or a choice of technologically asserted recommendations. As Norbert Wiener, the founder of cybernetics as an interdisciplinary science, suggests: "to throw the problem of his responsibility on the machine, whether it can learn or not, is to cast his responsibility to the winds, and to find it coming back seated on the whirlwind."[71]

In conclusion, diffused responsibility in operating with AWS may pose a relevant challenge that needs to be addressed in international discussions surrounding the development and deployment of AWS. Together with issues surrounding the use of autonomous systems in lethal decision-making processes, deontological perspectives on AWS are less ambiguous than consequentialist perspectives and would advise against the use of AWS.

3. The Austrian position on AWS

International debates on AWS were formally introduced under the United Nations Convention on Certain Conventional Weapons (CCW) in 2013. Here, member states started assessing the implications of AWS on international security. However, even before debates on AWS gained traction in

[70] Suchman, Lucy: Human-Machine Reconfigurations: Plans and Situated Actions. Cambridge: Cambridge University Press, 2007, p. 47.

[71] Wiener, Norbert: The Human Use of Human Beings: Cybernetics and Society. Boston: Da Capo Press, 1988, p. 185.

international settings, Austria raised concerns regarding the ethical and legal implications of AWS.[72] While Austria has maintained a critical perspective during the UN CCW meetings, its views became more conservative with the increased use and development of AWS. During the inaugural meeting in 2014, the Austrian delegates emphasised the need for careful consideration of the ethical, legal and humanitarian implications of AWS. An important aspect of the argument was the concern surrounding questions of accountability, focussing on human-in-the-loop approaches in maintaining human decision-making processes over lethal force (UN, 2014). While these arguments were reiterated during the 2015 and 2016 CCW meetings, the Austrian delegates stressed the need for a pre-emptive ban on fully autonomous weapon systems at the 2017 CCW meeting. Main concerns related to the further development and deployment of LAWS and AWS and implications surrounding arms races and indiscriminate killing in the near future.[73]

As progress towards legally binding agreements had been slow, Austria became increasingly frustrated by the lack of consensus and reluctance to com-

72 For example, Meurers, Christian: Der Informationskrieg im 21. Jahrhundert und seine Auswirkungen auf die Militärdoktrinen der USA, 2010. https://www.bmlv.gv.at/pdf_pool/publikationen/diplomarbeit_informationskrieg_publikation_lvak_20100902.pdf; Bundesministerium für Europa: EU-Arbeitsprogramm 2015. 2015. https://www.parlament.gv.at/dokument/XXV/III/148/imfname_383089.pdf.

73 United Nations: Meeting of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (2015a). https://digitallibrary.un.org/record/3856238/files/CCW_MSP_2015_9-EN.pdf; United Nations: Meeting of High Contracting Parties 2015. Austria. 2015b. https://docs-library.unoda.org/Convention_on_Certain_Conventional_Weapons_-_Meeting_of_High_Contracting_Parties_(2015)/austria.pdf; United Nations: Fifth Review Conference of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects. 2016. https://documents.un.org/access.nsf/get?OpenAgent&DS=CCW/CONF.V/2&Lang=E; UN: Convention on Certain Conventional Weapons, 2017. https://meetings.unoda.org/meeting/29460/document.

mit to binding regulations.[74] This disappointment contributed to Austria's decision to take more decisive action, including to support a joint declaration calling for the prohibition of LAWS. The declaration was part of broader efforts within the CCW framework to establish clear international norms applicable to the development and use of fully autonomous weapons.[75] Since then, Austria has started supporting various organisations, such as the campaign "Stop Killer Robots",[76] as well as non-governmental organisations, like Human Rights Watch[77] and drafting statements and resolutions on the implications of AWS.[78]

Since then, international positions in relation to AWS at CCW meetings have become more polarised, particularly with the increasing global tensions in recent years. Nation states can now be split into three main fractions: those advocating for a ban on LAWS and legally binding restrictions on AWS (whereby Austria is among the most vocal states to raise concerns); those with more moderate views on LAWS and AWS, generally supportive of regulations but preferring political declarations and the strengthening of Article 36 weapon reviews (e.g. Germany, Switzerland); and those sceptical of novel regulations, expressing their favour for developing and deploying more au-

74 United Nations: Meeting of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (2015a). https://digitallibrary.un.org/record/3856238/files/CCW_MSP_2015_9-EN.pdf; United Nations: Meeting of High Contracting Parties 2015. Austria. 2015b. https://docs-library.unoda.org/Convention_on_Certain_Conventional_Weapons_-_Meeting_of_High_Contracting_Parties_(2015)/austria.pdf; Bode and Huelss, 2022.

75 Pax: Positions on Lethal Autonomous Weapon Systems, 2018. https://paxforpeace.nl/wp-content/uploads/sites/2/2020/11/pax-rapport-crunch-time.pdf.

76 Stop Killer Robots (SKR): Members, 2024. https://www.stopkillerrobots.org/a-global-push/member-organisations/.

77 Human Rights Watch (HRW): An Agenda for Action. Alternative Processes for Negotiating a Killer Robots Treaty. 2022. https://www.hrw.org/report/2022/11/10/agenda-action/alternative-processes-negotiating-killer-robots-treaty.

78 United Nations Human Rights Council (UNHRC): Joint Statement on Lethal Autonomous Weapon Systems. 2022. https://estatements.unmeetings.org/estatements/11.0010/20221021/A1jJ8bNfWGlL/KLw9WYcSnnAm_en.pdf; Moyes 2022; BMEIA, 2024a.

tonomous weapon systems (e.g. US, UK, Russia).[79] This tripartite division raises relevant questions surrounding expectations on bans and regulations on AWS. While Austria advocates for strong international regulations on AWS, supporting a ban on LAWS,[80] it is questionable to what extent these views may also be realistic. The following will first assess perspectives on the feasibility of bans and regulations on AWS before discussing opportunities that Austria's conservative position may hold.

3.1 (Un)realistic perspectives? The feasibility of banning or restricting AWS and LAWS

Recent conferences and meetings on AWS and LAWS suggest that there is international consensus on AWS and LAWS posing challenges to international humanitarian law and ethical norms. Attempts to formulate legal frameworks or adapt existing policy guidelines to regulate AWS and LAWS effectively are supported internationally.[81] How these frameworks and guidelines may regulate AWS and LAWS is, however, internationally disputed.

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79 cf. Bode, Ingvild/Huelss, Hendrik: Autonomous Weapons Systems and International Norms. McGill-Queen's University Press - MQUP: Montreal Quebec, 2022.

80 Bundesministerium für Europa Integration und Äußeres (BMEIA): Autonomous Weapons Systems. 2024a. https://www.bmeia.gv.at/en/european-foreign-policy/disarmament/conventional-arms/autonomous-weapons-systems.

81 Bundesministerium für Europa Integration und Äußeres (BMEIA): Autonomous Weapons Systems, 2024a. https://www.bmeia.gv.at/en/european-foreign-policy/disarmament/conventional-arms/autonomous-weapons-systems; Bode, Ingvild/Huelss, Hendrik: Autonomous Weapons Systems and International Norms. McGill-Queen's University Press - MQUP: Montreal Quebec, 2022; CCW: Meeting of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, 2022. https://unoda-documents-library.s3.amazonaws.com/Convention_on_Certain_Conventional_Weapons_-_Meeting_of_High_Contracting_Parties_(2022)/CCW_MSP_2022_6_Advance_version.pdf; CCW: Meeting of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, 2024. https://meetings.unoda.org/ccw-mhcp/convention-on-certain-conventional-weapons-meeting-of-high-contracting-parties-2024.

One argument that advocates for a ban on AWS utilises the Martens Clause[82] as a theoretical backdrop. The Martens Clause addresses the protection of individuals in armed conflict, even in situations not covered by specific laws, by invoking the principle of humanity and public conscience. The original formulation states:

> "Until a more complete code of the laws of war is issued, the High Contracting Parties think it right to declare that in cases not included in the Regulations adopted by them, populations and belligerents remain under the protection and empire of the principles of international law, as they result from the usages established between civilized nations, from the laws of humanity and the requirements of the public conscience."[83]

When applying this principle to AWS, it means that AWS may violate the public conscience. However, "there is no accepted interpretation of the Martens Clause."[84] The reference to "public conscience" may imply that public attitudes may justify the use of AWS. However, recent research on US public attitudes towards AWS indicates that under specific circumstances, the majority of the surveyed participants would endorse the use of AWS, particularly to protect US Armed Forces personnel.[85] Some scholars argue that public conscience cannot be equated with public opinion, as conscience has an explicitly moral inflection that opinion lacks.[86] Public conscience would rather include exploring public discussion, academic scholarship, artistic and cultural expressions, individual reflection, collective action and additional means by which society deliberates its collective moral conscience.[87] This would disqualify any metric for understanding public conscience and therefore question the feasibility of the Martens Clause as a practical tool to justify the implementation of restrictions and bans.

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[82] The Hague Convention II. Laws and Customs of War, 1899. https://ihl-databases.icrc.org/en/ihl-treaties/hague-conv-ii-1899.

[83] Ibid.

[84] Ticehurst, Rupert: The Martens Clause and the Laws of Armed Conflict. In: International Review of the Red Cross (1961-1997) 37.317/1997, pp. 125-134.

[85] Horowitz, Michael C.: The ethics & morality of robotic warfare: Assessing the debate over autonomous weapons. Daedalus, 2016, 145(4), pp. 25-36.

[86] Asaro, Peter: Jus nascendi, robotic weapons and the Martens Clause. In: Carlo Ryan (Ed): Robot Law. Edward Elgar Publishing, 2016, pp. 367-386.

[87] Ibid.

In addition, ethical and unethical behaviour are fluctuating concepts that can change over time, particularly during war. This can be exemplified by the unrestricted submarine warfare during WW2. Despite a total of 48 states, including the US and Germany, banning unrestricted submarine warfare prior to WW2, these restrictions were rapidly abandoned during WW2. Germany declared unrestricted submarine warfare with War Order 154 in 1939.[88] Similarly, the US gave the order to execute unrestricted air and submarine warfare against Japan after the devastating attack of Pearl Harbor on 7 December 1941.[89] More recent examples of changing ethical standards during war include the use of cluster munition by the Russian and Ukrainian forces. While Russia and Ukraine are not parties of the Convention on Cluster Munitions that bans this type of munition, the use of cluster munition still needs to adhere to the Geneva Convention. As such, cluster munition is subjected to distinction, proportionality and necessity. However, an indiscriminate use of cluster munition has been documented on several occasions, suggesting that adherence to ethical frameworks may change with the requirements of war.[90] This could lead to the conclusion that nation states may only be violently opposed to AWS and LAWS until these technologies become the decisive factor in winning or losing a war.

This is also reflected in the international development of fully autonomous systems with semi-autonomous modes. For example, the Israeli loitering munition Harpy can operate autonomously, seeking out and destroying radar emitters independently. However, it can also operate in a semi-autonomous mode where a human operator provides target confirmation before the strike. Similarly, the UK Taranis is an experimental unmanned combat aerial vehicle (UCAV) that is designed to carry out deep penetration strikes in enemy territory. In fully autonomous mode, Taranis can fly into a target area, identify a threat and engage the enemy without human supervision, whereas

88 Sondhaus, Lawrence: German Submarine Warfare in World War I: The Onset of Total War at Sea. Lanham: Rowman & Littlefield, 2017.

89 Holwitt, Joel Ira: Execute Against Japan: The U.S. Decision to Conduct Unrestricted Marine Warfare, Vol. 121, Texas: A&M University Press, 2009.

90 cf. on changing academic views on cluster munition: Saint, James: The case for cluster munitions: Amend or withdraw from the convention on cluster munitions. In: Australian Army Journal 19.1/2023, pp. 100-116; Poposka, Vesna/Abdulmecit, Nuredin: Legality of the use of cluster bombs in international law: a short overview. In: Journal of Liberty and International Affairs 10.1/2024, pp. 252-269.

in semi-autonomous mode a human operator makes the engagement decision. The US has recently developed the X-47B, a UCAV that can complete missions fully autonomously or semi-autonomously. These systems highlight the contemporary trend in AWS development, adapting to a potential future use of fully autonomous weapon systems. Recent advancements in swarm-based weapons further evidences the shift towards fully autonomous systems with the US Pentagon's Replicator program on AI-based weapon swarms developing cooperative AI units that can overwhelm or outmanoeuvre more traditional and expensive military assets.[91] With global tensions rising, nations appear to be waiting for an international incident to change their policy guidelines on AWS in order to legalise lethal fully autonomous weapon systems.

This is relevant, particularly in relation to the drawbacks of semi-autonomous systems, which can be exemplified by Russia's unsuccessful use of the Uran-9 unmanned ground vehicle (UGV) in the Ukraine. The Uran-9 is a remotely controlled robotic combat vehicle designed for reconnaissance and fire support. It is equipped with a variety of weapons, including a 30 mm cannon, anti-tank missiles and a machine gun. Despite its advanced design and equipment, the Uran-9 has encountered significant operational problems, providing only limited use for frontline deployment. Besides technical flaws, the Uran-9 has been found to be susceptible to communication disruption. In electromagnetically contested environments, the Uran-9 has experienced frequent losses in connection between the vehicle and its operator. With limited autonomous capabilities, this is a critical flaw as the Uran-9 relies on a remote operator for control and decision-making. By employing various electromagnetic countermeasures, the Ukrainian forces have exploited the UGV's vulnerability and, to date, have been successful in rendering it ineffective on the battlefield. This highlights one advantage of fully autonomous systems and a major incentive for their development. Electromagnetically contested environments may require the use of fully autonomous systems as this would enable an attack to continue without human

[91] Greenwalt, William C.: DOD's Replicator Program: Challenges and Opportunities, 2023. https://policycommons.net/artifacts/5668878/dods-replicator-program/6434352/; Simmons-Edler, Riley et al.: AI-Powered Autonomous Weapons Risk Geopolitical Instability and Threaten AI Research, 2024. https://arxiv.org/pdf/2405.01859.

intervention. In conclusion, the current development of AWS and LAWS in international contexts appears to endorse the opposite of a ban.

Furthermore, even if a legally binding ban on AWS or LAWS were to be implemented, it is questionable whether this ban would be successful. Legally binding treaties have been routinely violated (e.g. Nuclear Non-Proliferation Treaty, Anti-Ballistic Missile Treaty, Intermediate-Range Nuclear Forces Treaty). Research explains the success and failure of treaties on weapon systems by drawing on three key factors: the perceived horribleness of a weapon, its perceived military utility, the number of actors to cooperate for a successful ban.[92] If a specific weapon is perceived to be of little use but very horrific, then a ban is likely to succeed. However, if a weapon is viewed to provide a decisive advantage on the battlefield, the endorsement of a ban is unrealistic. An example can therefore be provided when contrasting chemical and nuclear weapons. Nuclear weapons are more harmful and indiscriminate than chemical weapons but can provide a decisive advantage in war (e.g. unconditional Japanese surrender after the Hiroshima and Nagasaki bombing). This may explain why the Non-Proliferation Treaty's goal of nuclear disarmament has not been met. In comparison, chemical weapons may have some advantages on the battlefield but are not decisive in winning a war. In this sense, many weapons that are perceived to provide few advantages have been banned. Additionally, the number of countries needed to endorse a ban is important. If weapons are difficult to develop and produce, and, therefore, are possessed by few countries, then a ban is likely to be implemented.

The problem with AWS is that these systems may score low on perceived horribleness, high on perceived military utility and require a high number of international actors to enforce a ban. None of the three key factors required for a successful ban are therefore apparent. AWS can be decisive in winning or losing a war due to the speed in processing information and acting on behalf of it that far outpaces human capabilities. AWS may not be perceived

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92 Crootof, Rebecca: The Killer Robots are Here: Legal and Policy Implications. In Cardozo L. Rev. 36, 2014, pp. 1837-1915; Watts, Sean: Autonomous weapons: regulation tolerant or regulation resistant? In: Temp. Int'l & Comp. LJ 30/2016, pp.177-187; Scharre, Paul/ Lamberth, Megan: Artificial Intelligence and Arms Control, 2022. https://arxiv.org/pdf /2211.00065; Scharre, P.: Army of None: Autonomous Weapons and the Future of War. New York: Norton & Company, 2018.

as more horrible than other weapons as it utilises similar kinds of ammunition as non-autonomous weapons and possibly even reduces the risk of collateral damage with improved precision targeting. AWS are also readily available internationally and can even be developed by non-state actors, often in the context of dual-use technology, where civilian innovations can be adapted for military purposes (e.g. commercial drone technology, civilian software development, development of artificial intelligence and robotics in the civilian sector, open-source platforms that provide software).[93] The wide availability of AWS suggests that most nations may possess some form of AWS, although differences in definitions and secrecy surrounding their development make it difficult to provide precise numbers. Enforcing a successful ban on AWS may therefore be challenging, particularly in a state of global tension.

In conclusion, enforcing a total ban on AWS or LAWS may be unrealistic from current perspectives. While prior bans on landmines and cluster munitions indicated that deep-pocketed Western nations are required to act as champions for these issues, Austria's support for a ban may have limited effect in shifting global attitudes. It may be more feasible to engage in discussions surrounding the implementation of global restrictions on the military use of autonomous systems as these have been supported by the majority of states. In its position as a neutral democratic nation, Austria may have opportunities here to facilitate international regulations on AWS and LAWS.

3.2 Strategic opportunities for Austria in finding international solutions for AWS

Austria has unique opportunities to take up leadership in debates surrounding AWS as it does not view AWS through the lens of its own security interests. As a permanently neutral country, Austria maintains its neutral position in all ongoing and future conflicts and avoids military alliances. Belligerents may not invade neutral territory under the Hague Convention (V) Article 1.[94]

[93] World Economic Forum: Why we need to regulate non-state use of arms, 2022. https://www.weforum.org/agenda/2022/05/regulate-non-state-use-arms/.

[94] The Hague Convention (V) respecting the Rights and Duties of Neutral Powers and Persons in Case of War on Land. 1907. https://www.refworld.org/legal/agreements/hague/1907/en/18888.

Although an invasion of Austria by foreign forces may still be possible (e.g. Denmark, Belgium, the Netherlands, Luxemburg during WW2) particularly in relation to contemporary global tensions and the geographic location of Austria, an attack on Austria would be classified as a war crime and therefore be rather unlikely. Austria, as a neutral state, may have little incentive or own agenda in the development and deployment of AWS and so can communicate its aims for ethical standards more credibly and transparently. Here, fostering diplomatic solutions for AWS by bridging divides between states may be a particularly relevant role.

Austria has already proven itself as a diplomatic hub in multiple conflicts. For example, as part of the broader international effort to end the Bosnian war (1992-1995), Vienna was a key location where preliminary discussions took place. While the final peace agreement was signed in Dayton (USA), the negotiations in Vienna set the stage for the final treaty. Vienna was also the main venue for the negotiations that led to the Joint Comprehensive Plan of Action (JCPOA), commonly known as the Iran Nuclear Deal. These negotiations involved Iran and the P5+1 nations (US, UK, France, Russia, China and Germany), aiming to prevent Iran from developing nuclear weapons in exchange for lifting economic sanctions. If current global tensions result in war, Austria could utilise its experience and neutral state to advocate for international restraint in the deployment of AWS. While negotiating regulations on AWS may be more difficult during wartime, Austria's diplomatic relations may help to establish rules of engagement for AWS. The importance of Vienna as a hub for peace initiatives is further highlighted by it hosting various international organisations, including the International Atomic Energy Agency (IAEA) and the Organization for Security and Co-operation in Europe.[95] These organisations have been instrumental in diplomatic negotiations and peacekeeping efforts.

Austria has also already hosted themed conferences on AWS in recent years, such as the two-day Conference to Maintain Human Control in Autonomous

[95] Bundesministerium für Europa Integration und Äußeres (BMEIA): Non-Governmental Organizations and Quasi-International Organizations (2024b). https://www.bmeia.gv.at/en/european-foreign-policy/international-organisations-in-austria/ngos-and-quasi-international-organizations.

Weapon Systems in 2021.[96] More recently, the "Humanity at the Crossroads: Autonomous Weapons Systems and the Challenge of Regulation" conference took place in Vienna in April 2024.[97] This conference aimed to highlight the potential risks associated with AWS and LAWS and to promote global dialogue on the need for a regulatory framework to address these challenges. It played a crucial role in bringing together a diverse group of experts, including diplomats, academics, military personnel and representatives from civil society to discuss complex issues surrounding AWS and LAWS and the need for effective regulation. While the outcomes were generally well perceived by international actors, criticism from certain segments of the international disarmament and NGO community can be inferred from reports following the event. This criticism mostly addressed challenges in achieving consensus during the conference and lacking concrete outcomes,[98] which would imply a lack of success. Essentially, divergent national interests in AWS may require more continuous debates, highlighting the need for an ongoing hub on AWS and an opportunity for Austria to take on leading roles in concretising international ethical and legal guidelines towards AWS.

As an impartial, neutral venue for international discussion and regulation, Austria could advocate for the establishment of a dedicated United Nations forum or working group on definitions and legal implications of AWS under the framework of the CCW. While typical working groups within the CCW focus on specific types of weapons, a working group on definitions and legal implications may serve as a more permanent platform for dialogue, research and negotiation of perspectives on AWS. This may foster nuanced and ongoing debates on unifying definitions and legal implications thereof and allow cutting-edge research to be shared. With more regular meetings, the working group may contribute to the preparation of CCW meetings and may

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96 LAWS Vienna 2021: Safeguarding Human Control over Autonomous Weapons Systems (n.d.). https://eventmaker.at/bmeia/laws_conference_2021.

97 Bundesministerium für Europa Integration und Äußeres (BMEIA): Autonomous Weapons Systems, 2024a. https://www.bmeia.gv.at/en/european-foreign-policy/disarmament/conventional-arms/autonomous-weapons-systems.

98 Klare, Michael: Strong Support at Conference for 'Killer Robot' Regulation, 2024. https://www.armscontrol.org/act/2024-06/news/strong-support-conference-killer-robot-regulation; Aftab, Hira: Vienna Conference: Humanity at the Crossroads – Autonomous Weapons Systems and the Challenge of Regulation, 2024. https://article36.org/updates/vienna-conference-humanity-at-the-crossroads-autonomous-weapons-systems-and-the-challenge-of-regulation/.

lead to more concrete outcomes of these meetings by fostering more homogenous perspectives on definitions and their ethical and legal implications.

In conjunction with establishing continuous global debates and discussions on AWS, Austria could launch a centre for research on the ethical and legal implications of AWS. Utilising its position as neither a major military power nor robotics developer, Austria could represent a neutral location for unbiased research on AWS. Different academic fields could produce high-quality impartial international research on the effects and implications of AWS which could be utilised to inform global policy debates and evidence-based recommendations on AWS. The effectiveness of research centres has been evidenced by the Marx Planck Institute for Comparative Public Law and International Law (MPIL), the Stockholm International Peace Research Institute (SIPRI), the International Institute for Environment and Development (IIED) and the Basel Institute on Governance (BIG), for example. All these centres have produced evidence that guided global governance by influencing international policies and legally binding frameworks. While the establishment of a research centre dedicated to the ethical and legal implications of AWS may require significant funding, it would substantiate Austria's leadership role in shaping strict international guidelines on AWS. In addition, a research centre may help to foster regular multi-stakeholder dialogue, bringing together governments, academics, tech companies and civil societies to discuss the development and use of AWS. By facilitating this dialogue, Austria could encourage responsible innovation and ensure that the perspectives of those developing technologies are considered in regulatory discussions. Additionally, global civil knowledge on the ethical and legal implications of AWS could be improved by investing in producing impartial evidence. This is demonstrated by the MPIL, SIPTI, IIED and BIG, which have all utilised public engagement strategies to increase public knowledge of various global issues. Similar strategies could be employed to improve global public awareness of AWS. By providing fact-based and impartial information, civil society may pressure governments internationally to act and implement regulations on AWS.

Austria may also want to focus on its diplomatic relations to build coalitions with nations that support restrictions and bans on autonomous weapon systems, particularly among non-aligned and smaller states that may feel vulnerable to the proliferation of AWS and LAWS. While Austria has already joined the "Stop Killer Robots" campaign, which aims to ban LAWS, it could engage with the Non-Aligned Movement to help build a broader coalition of states, predominantly in the global south, or build a coalition of middle powers – countries that may not be global superpowers but have significant diplomatic influence (e.g. New Zealand, Canada, Japan). Within the European Union (EU), Austria could form a coalition of EU Member States that put pressure on the EU to take on a leading role in international negotiations surrounding AWS. These coalitions could act as a counterbalance to the resistance towards imposing strict regulations on AWS from major military powers. The relevance of small-country coalitions and coalitions of like-minded states has been well documented throughout history. For example, the Visegrád Group (Visegrád Four/ V4) is a political alliance of Poland, Hungary, Czechia and Slovakia that, while formed in 1991 to aid the transition from communism, now collaborates on areas of common interest. The V4 has successfully opposed several policies proposed by the EU, particularly in relation to EU migration quotas, rule of law mechanisms and climate policies. By establishing coalitions, Austria could steer international discussions and focus on establishing a treaty for legally binding definitions and regulations for AWS.

In conclusion, while Austria has been proactive in the discourse surrounding the regulation of AWS by engaging and hosting meetings, there is further potential in relation to taking on leadership roles. Austria can strengthen alliances and endorse new alliances in order to influence international policy. By continuing to engage in advocacy and collaboration, Austria can harness its position to lead the way in shaping a responsible and sustainable approach to the future use of AWS.

4. Discussion

AWS pose significant ethical and legal challenges. These challenges are mirrored in the global inconsistency in what is to be considered as appropriate in the development and deployment of AWS. To date, there are various governmental definitions on what ought to be considered as AWS, highlighting the complexity of these systems. Issues surrounding AWS are highlighted in consequentialist and deontological strands of normative ethics. From a deontological perspective, the focus on the morality of actions themselves is used as arguments against the deployment and development of AWS. The use of AWS in life-and-death decisions undermines the moral responsibility of humans in ensuring accountability and human oversight in protecting human life. In comparison, consequentialist perspectives focus on the outcome, weighing their potential benefit against their risks. Improved targeting may reduce human suffering and limit human casualties in warfare. However, there are also considerable negative outcomes relating to global stability and the risk of (accidental) conflict escalation.

In conclusion, ethical debates on AWS highlight a fundamental tension between duty and outcome. A balanced ethical debate would require the consideration of both points, highlighting the need for robust regulatory frameworks that ensure accountability while also addressing the potential benefits of AWS. A responsible approach to AWS would require the integration of deontological ethics with consequentialist assessments to navigate the complexities of modern warfare while upholding humanitarian values.

Austria's conservative perspective on AWS is marked by the utilisation of deontological arguments as a theoretical backdrop. Being deeply committed to ethical responsibility and legal compliance, the Austrian approach towards AWS emphasises human oversight in the use of weapon systems. In this sense, Austria assures adherence to international law by aligning its military technology to fundamental human rights. Despite its conservative approach, Austria proactively partook in international dialogue and cooperation to establish regulations governing AWS. While these discussions have not yet produced any concrete outcomes, they are an initial step towards drafting internationally unified understandings of AWS. This is essential as unified definitions of AWS can provide an underlying framework for ethical standards in AWS deployment and development.

While Austria has already played an important role in being an impartial venue fostering international encounters to exchange ideas, to share information and co-ordinate efforts in regulating AWS, more can be done in developing diplomatic leadership. Austria may engage in further diplomatic relations and may attempt to build coalitions with like-minded non-aligned states or middle powers to exert pressure on major military powers. It may also invest in a research centre to provide impartial, fact-based evidence in developing sustainable regulatory frameworks for AWS and to develop global information campaigns on AWS in order to exert pressure on governments to adopt regulatory frameworks.

Importantly, it would be advisable that Austria expedites its endeavour to establish legally binding frameworks on AWS and starts to take on international diplomatic leadership roles in the process. With increasing global tensions, the prompt development of international policies on AWS would be advisable, as these policies can be established more easily during peacetime than in wartime. This would allow global standards to be shaped and responsible innovation to be led to prevent future atrocities committed by autonomous systems.

2. Key points and recommendations

- AWS and LAWS pose significant ethical and legal challenges that, to date, remain unresolved by the international community.
- Definitions of AWS vary internationally and provide space for interpretation and loopholes to further develop fully autonomous AWS and LAWS.
- Narrow consequentialist ethics highlight the potential of AWS in reducing human casualties and improving military effectiveness.
- Broad consequentialist ethics highlight concerns regarding the societal and global impact of AWS.
- Deontological ethics view the development of AWS as critical due to questions surrounding accountability, moral responsibility and human dignity in lethal decisions.
- Austria's views on AWS align with deontological and wide consequentialist perspectives, rooted in ethical, legal and humanitarian concerns.
- While Austria took on a conservative attitude towards AWS, it remains proactive and vocal in outlining concerns about AWS in international debates.
- Austria's neutrality and diplomatic experience provides unique opportunities to position itself as a diplomatic leader and further international discussions to potentially expedite unifying definitions and policy frameworks on AWS and LAWS.
- However, to do so, Austria may need to further invest in AWS knowledge generation and international coalitions.

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Chapter V – Law & Social Ethics

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Law & Social Ethics. Chapter Summary[1]

This Panel assembles three global normative systems:

i) the current supreme legal order, set out by the Charter of the United Nations and its closestly related documents (the Statute of the International Court of Justice and the Universal Declaration of Human Rights)
ii) the International Humanitarian Law, stemming of the pre-UN-world and, as may be realized more and more, in particular when assessing the respective arguments put forward regarding the armed conflict between Israel and Palestine militias, not fully consistent with the UNC principles
iii) the doctrine of the Roman-Catholic Church, which
    - has always claimed global relevance, and may be considered, at least in a way, as a predecessor of the current system of international law as institutionalized by the UNO
    - continues to be of specific relevance for the European Union and her Member States due to the fact that, according to the second recital of the TEU, the values enshrined in its Article 2 "have developed" "from the cultural, religious and humanist inheritance of Europe", implying that not least this Catholic heritage has to be taken into account when interpreting firstly the values and secondly all the other Treaty provisions, those on the Common Security and Defence Policy (Articles 42 – 46 TEU) included.

When presenting this threefold view at the very end of this Conference, it will be interesting to see to which extent

i) these three normative systems overlap or differ
ii) the philosophical approaches presented in Panel 3 have been accepted by (at least one of) these normative systems currently in force.

[1] Alexander Balthasar

"Human Enhancement": The perspective of the Charter of the United Nations[1]

Alexander Balthasar

I. The Charter

As may be inferred from its Article 103, claiming precedence over all other international treaties, and Article 2 (6), claiming applicability also with regard to third parties as far as "the maintenance of international peace and security" are concerned, the Charter holds, (maybe still) currently, the supreme position in positive international law.

This rank reflects the ambition of the founding "United Nations" to restore and to preserve effectively global civilization – against the background that exactly this civilization had been fundamentally challenged by the "axis powers" (the "enemies" within the meaning of Article 107) in the years before and during World War II.

The two **core values** of this global civilization - which in general has also been addressed, as source of law, in Article 38 (1) (c) of the Statute of the International Court of Justice, annexed to the Charter – are enshrined in the Charter, showing a **dialectic** structure, thus resembling to the two **focal points of an ellipse**:

A. The Prohibition of "Aggression"

1. *The Normative Setting*

Already the preamble outlaws the "scourge of war"; hence, "acts of aggression" are to be suppressed (Article 1 [1]).

While it being fully true that, abiding to this principle, all members (but also third parties) "shall settle their international disputes by peaceful means" (Article 2 [3]; Article 1 [1]), the overarching approach for suppressing aggression

[1] Due to the request of the author, no external language revision was provided.

is, however, **not a pacifistic** one, i.e. an absolute command to refrain from military force at any rate, but, right to the contrary, a commitment "to **take effective collective measures** for the prevention and removal of threats to the peace" (Article 1 [1]; cf also the preamble "save in the common interest").

As Chapter VII tells us, these "effective collective measures" comprise

- "the **use of armed force**" (cit Article 41 e contrario), "by air, sea, or land forces" (Article 42 ff), the taking of "*urgent* military measures" (Article 45) included, based on a *decision of the Security Council which the Member States are bound to comply with*
- the exercise of "the inherent **right** of individual or **collective self-defence** if an armed attack occurs … until the Security Council has taken the [necessary] measures …" (Article 51). In the same vein works, already beneath the threshold of an "aggression" ("armed attack"), the more recent concept of the "responsibility to protect".

2. *The Assessment*

When the Charter does not ban outright "military measures", but **clearly distinguishes** between those which are **strictly prohibited** ("acts of aggression") and those not only **permitted** but necessary to restore peace, so that Member States are even **obliged** to take part in these measures, the legitimacy to use military force (the "ius *ad* bellum") has been made dependent again on the legitimacy of the **underlying aim**.

In a considerable contrast to classical international law (including the still current "humanitarian law" as enshrined in the Geneva Conventions and in the Rome Statute [with the exception of its Article 8 bis]), the Charter thus has returned to the medieval concept (stemming from the ancient Romans) of "**iustum bellum**". This means, in a nutshell, that the **law is on the side of the "restorer of peace",** implying that

- while the only lawful option for the aggressor is to put an end to the aggression
- the fight against aggression is not limited to pure "defence" but includes **all effective** – also "offensive" - **means** which might be necessary for the "removal of" the "threat […] to the peace" occurred.

Ultimately this logic is incompatible with the classical approach of an "ius *in* bello" applying tel quel for all parties of an armed conflict, notwithstanding the respective legitimacy of the aim underlying the concrete military action.

Nevertheless even this logic has its **limits for the "restorer"** – as may be inferred from the *transitional* exception clause of Article 107: by exempting military action against the former "enemies" from abiding with the Charter, it has been admitted that *not all military actions* taken by the "United Nations" *before* the adoption of the Charter *would doubtlessly have complied* with it (and that, thus, *in the context of this previous conflict* even necessary *future* measures could still exceed the limits newly set out in the Charter).

This finding reflects the *second focal point*:

B. The Faith in Human Dignity

1. The content

According to the preamble of the Charter, "the Peoples of the United Nations" are also "determined … to reaffirm faith" not only "in fundamental human rights", but "in" their ultimate conceptual root, "the dignity and worth of the human **person**."

Even more precise, the *preamble* of the Universal Declaration of Human Rights speaks of the "**recognition**" of "the **inherent** dignity … of all members of the human family", thus, by employing the same term as used in Article 51 of the Charter where "inherent right" is, in the official French version, the equivalent to "droit **naturel**", stipulating that not only the right to self-defence, but also the concept of "human dignity" has **not been constituted** by the positive legislator, "the Peoples of the United Nations", but is rooted in **Natural Law** superior to positive law which **can only be "recognized"** by any legislator.

In order to be able to protect human dignity, we have not only to know what the very nature of any human being really is but what its **specific "worth",** its specific **telos**, is, which justifies the said reaffirmation.

Well, the fourth question of *Immanuel Kant*: “What is the human being?” has been answered, for our purposes, by Article 1 UDHR, stating (as “a **common standard of achievement**” for all peoples and all nations):

“**All** human beings are born **free** and equal in dignity and rights. They are endowed with **reason** and **conscience** and should act towards one another in a spirit of **brotherhood**.”

This is fully compatible with *Kant’s* famous “self-purpose formula”, stipulating that every **human being** is – at least also – an **end in itself** and, therefore, should not be fully instrumentalized for the sole benefit (profit) of others. This formula does, however, not only apply to individuals, but also – even primarily – to the “humanity” as a whole (as a general term, as an etirety [as an “universal”]), thus also comprising the **collective** dimension.

And again: this collective dimension is, in current international law, not only addressed, from the negative perspective of criminal law, by the “**crime against humanity**” (which is, in German language, more often than not misunderstood as “Verbrechen gegen die Mensch*lich*keit” instead of “Verbrechen gegen die Menschheit”), but, as already mentioned, by calling not any majority, but only the “**civilized** nations” to be considered as a positive source of international law, and by the purpose of the UNO enshrined in Articles 1 (3) and 55 (a) and (b), respectively.

Given the inevitable atrocities even of most legitimate military actions it is in particular this collective dimension which allows to comply with the commands of preserving human dignity even in this very extreme area, as presupposed not only by the “Martens clause”, but also by the doctrine of “iustum bellum” already mentioned, also in its Catholic version (leaving aside only the most recent encyclical “Fratelli Tutti” which, however, might very well be already outdated, having been published right before 24/2/2022), and by *Kant* himself (cf § 55 of his “Rechtslehre”).

2. *Application*

In sum, human dignity is respected also in the extreme area of military actions if these actions

- contribute, at least in the **collective** dimension, to promoting conditions that allow, in the status quo post, a **more close approach to the ideal of Article 1 UDHR**
- while refraining from any interference with the **individual** dimension **not strictly necessary** (and, thus, **disproportionate**) to the legitimate end of the actions at issue.

II. Human Enhancement

A. "Enhancement" versus "Reduction"

When applying this yardstick of the UNC to the question at issue – the normative limits set out by the Charter for human enhancement measures, in particular in the military context – we should first dispute the term "enhancement":

Not every measure interfering with human beings (individually or collectively) for the sake of strengthening military effectiveness should be labelled "enhancement", in particular **not measures widening the gap** between the reality and the "common standard of achievement", and certainly **not measures depriving the human beings concerned of the essentials of a "human person",** i.e. approaching them to either a **machine** (robot) or to a non-human **animal** or to a fundamentally unfree human (a **slave**).

These measures should better be called "measures of human **reduction**" and dealt with separately – if necessary at all: why reducing human beings instead of refraining from using any human element and relying on **pure robots & artificial intelligence**, if pressing need be also on animals?

B. Principle of Effectiveness

The main divergence between the traditional humanitarian law and the UNC being that the former sets out the *very same rules* for the aggressor and the attacked, while the latter allows the aggressor nothing but to stop the aggression, whereas the attacked is allowed to defend itself also collectively effectively until the aggression has been suppressed, it is obvious that also human enhancement measures are **not allowed to the aggressor**, whereas in principle there can be **no objection against employing** these means **by the attacked** or by anyone of its defenders, even and if the aggressor should not dispose of these means.

Or, to put it differently: a military conflict is not considered by the UNC to follow the logic of a sports competition where fair and equal conditions should apply to each competitor (one reason, why doping is strictly prohibited). Right to the contrary, every means putting the attacked in a better position is, **in principle**, highly welcome.

C. Limits of the Consequences of the Principle of Effectiveness

Nevertheless, there are some limits:

- As already mentioned, all measures have to be **proportionate** (according to the general fundamental rights' interference test). However:

  Given that not only compulsory military service is not as such disproportionate, but that also the inevitable consequences of military operations may by far exceed the limits of "inhuman treatment" (within the meaning of Article 5 UDHR), the proportionality test will not be a strong limit, in particular not with regard to measures enhancing immediate capabilities at the cost of even heavy adverse effects later (not least because it is very likely that without the enhancing measures the soldier would not even have survived the operation).
- Measures transcending the individual dimension will deserve more caution than measures the effects of which are limited to certain individuals.
- Lastly: while it may be fully compatible with the requirements of respecting human dignity to call even human beings equipped with prostheses to taking part in military action, it seems obvious that the respect for the integrity (not only of the mind, but also of the body) of a human being would strictly forbid any mutilation for the purpose that thus the military capacities of the soldier concerned could be enhanced.

Human enhancement in light of classical humanitarian law

Diana zu Hohenlohe-Oehringen

I. Introduction

The idea of increasing the physical and psychological strength, the stamina and efficiency of soldiers through some form of enhancement is probably almost as old as the history of warfare itself. In the past, regular combatants as well as fighters from non-state groups have been keen to experiment, especially when it comes to mind-altering or mood-enhancing substances. For example, in the second half of the 19th century, rum consumption was widespread among British soldiers, and it is estimated that the approximately 36,000 men in the British army drank 550,000 gallons of rum a year; that is around 70 litres per person. At the time, it was believed that rum made soldiers better fighters.[1]

During the First World War, the role of alcohol in boosting the morale of the troops was widely recognised. Doctors recommended it in the British Medical Journal, not least for the treatment of mental disorders in soldiers, and a medical officer gave evidence to a parliamentary committee on the issue of 'shell shock' among soldiers (today known as PTSD in psychiatric classification): "Had it not been for the rum ration, I do not think we should have won this".[2] During the Second World War, German and Japanese soldiers used psychostimulants such as methamphetamines.[3] During the Vietnam War, amphetamines were available to US soldiers in industrial quantities. The search for alternatives with fewer side effects led to the discovery of new drugs such as Modafinil and Ritalin.[4]

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1 Puscas, Iona M.: Military Human Enhancement, In: Boothby, William H.: New Technologies and the Law in War and Peace, 2018, p. 188.

2 Fussel, Paul: The Great War and Modern Memory, as cited in Kamieński, Łukasz: Shooting Up. A Short History of Drugs and War, 2016, p. 19.

3 Shunk, Dave: Ethics and the Enhanced Soldier of the Near Future, Military Review, 2015, p. 93.

4 Puscas, Iona M.: Military Human Enhancement, In: Boothby, William H.: New Technologies and the Law in War and Peace, 2018, p. 188.

It is not apparent that the use of alcohol and drugs has influenced how the law of armed conflict has evolved to the present day. A battalion that consumed alcohol or other stimulants raised few legal concerns. This does not mean, of course, that the soldiers in question would have been permitted to commit atrocities; but as long as their behaviour remained within the prevailing parameters of the norms of warfare, the focus was on how they followed orders and used their weapons. As soldiers physically remained human beings, apart from prostheses to compensate for the function of lost limbs, no difficulty was seen in distinguishing them from a weapons system, a means or a method of warfare.[5] In this respect, there is no provision in classical international law of war that explicitly deals with human enhancement. In view of the rapid progress of enhancement technologies, however, questions arise regarding the permissibility and the limits under international law to the use of various human enhancement measures in armed conflict. Answers are to be sought in international humanitarian law, international criminal law and human rights law, although the issues are closely interlinked.

II. Basic parameters for the use of weapons and soldiers in war

International humanitarian law comprises such rules which, in the event of war or other international armed conflict, aim to protect people, buildings and infrastructure as well as the natural environment as far as possible from the effects of hostilities. One central principle is that of military necessity. This means that every military measure must be necessary in terms of the way it is carried out, its temporal and spatial scope and its expected effects based on the specific military strategy and tactics. Military action that is not necessary under these aspects must therefore be avoided.

The permissibility of military measures is also limited by the rights and legally protected interests of (potentially) affected persons and nations, which are addressed either directly or indirectly in international law of war. In this respect, important provisions require the avoidance of unnecessary suffering and accordingly prohibit the use of weapons, projectiles and material as well as methods of warfare that are likely to cause superfluous injury or unnecessary suffering.[6] Interestingly, the First Protocol Additional to the Geneva

[5] Puscas, Iona M.: Military Human Enhancement, In: Boothby, William H.: New Technologies and the Law in War and Peace, 2018, p. 190.

[6] Dinniss, Harrison/Kleffner, Jann K.: Soldier 2.0: Military Human Enhancement and International Law, International Law Studies, 92, 2016, pp. 439-443.

Conventions in this regard does not differentiate between a state's own soldiers, foreign soldiers and third parties (see Article 35 para. 2),[7] meaning that a state is also obligated to protect its own soldiers from superfluous injury and unnecessary suffering.

The principle of human dignity is the normative background and guiding principle for interpreting the relevant protective provisions.[8] In his contribution, Alexander Balthasar[9] has already very clearly shown what the protection of human dignity means in the context of the United Nations Charter.[10] The norms of the classical international law of war provide valuable additional points of reference for the permissibility and limits of the various forms of human enhancement. For example, the Geneva Conventions unanimously oblige the parties to treat persons not actively taking part in hostilities, including members of armed forces who have laid down their weapons and persons who have been put out of action as a result of sickness, wounding, detention or any other cause, with humanity in all circumstances (see Articles 3 para. 1 and 12 of the First Geneva Convention; Articles 3 para. 1 and 12 of the Second Geneva Convention; Articles 3 para. 1 and 13 of the Third Geneva Convention; Articles 3 para. 1 and 27 para. 1 of the Fourth Geneva Convention).[11] This constitutes an implicit reference to human dignity. How-

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7 International Committee of the Red Cross (ICRC), Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (First Geneva Convention), 75 UNTS 31, 12 August 1949.

8 Shah, Morial: Genetic Warfare: Super Humans and the Law, North Carolina Central University Science & Intellectual Property Law Review, 12, 2019, p. 19; Sawin, Christopher E.: Creating Super Soldiers for Warfare: A Look into the Laws of War, Journal of High Technology Law 17, 2016, pp. 112-116.

9 See Balthasar, Alexander; "Human enhancement" – The perspective of the Charter of the United Nations. In chapter LAW & SOCIAL ETHICS in this publication.

10 United Nations, Charter of the United Nations, 1 UNTS (XVI), 24 October 1945.

11 International Committee of the Red Cross (ICRC), Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (First Geneva Convention), 75 UNTS 31, 12 August 1949; International Committee of the Red Cross (ICRC), Geneva Convention for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea (Second Geneva Convention), 75 UNTS 85, 12 August 1949; International Committee of the Red Cross (ICRC), Geneva Convention Relative to the Treatment of Prisoners of War (Third Geneva Convention), 75 UNTS 135, 12 August 1949; International Committee of the Red Cross (ICRC), Geneva Convention Relative to the Protection of Civilian Persons in Time of War (Fourth Geneva Convention), 75 UNTS 287, 12 August 1949.

ever, the Geneva Conventions also explicitly prohibit any impairment of personal dignity, namely in the form of humiliating and degrading treatment (see Articles 3 para. 1 lit. c of the Geneva Conventions).

Mirroring this, the provisions of international criminal law that deal with crimes against humanity not only protect the collective legal interest in international peace and global security, but also specific individual rights, such as the right to life, physical integrity, freedom and personal autonomy and thus, ultimately, also human dignity. In addition, human dignity is a protected right under a number of criminal law provisions relating to war crimes. This applies, in particular, to the criminal defence of torture or inhuman treatment, including biological experiments (Article 8 para. 2 lit a sublit. ii of the Rome Statute of the International Criminal Court),[12] the intentional infliction of great suffering or serious harm to physical integrity or health (Article 8 para. 2 lit. a sublit. iii of the Rome Statute) and the physical mutilation of persons who are under the control of an opposing party or the carrying out of medical or scientific experiments of any kind on such persons which are not justified by their medical, dental or hospital treatment or are carried out in their interest and which lead to their death or seriously jeopardise their health (Article 8 para. b lit. x of the Rome Statute). Interestingly, a distinction is made only in the latter case, where prisoners of war are granted protection, while a state's own soldiers are not. Lastly, again formulated neutrally, the impairment of personal dignity is also expressly mentioned as a criminal offence (Article 8 para. b lit. xxi of the Rome Statute).

Against the backdrop of this stocktaking, it can be concluded that human dignity is the fundamental yardstick by which the permissibility or impermissibility of the various measures from the spectrum of human enhancement is to be judged. In order to narrow down and make manageable the concept of human dignity in this context, which is heavily laden with ideas and legal theory, and on which Eugen Dolezal[13] makes some further comments in his contribution, it should be noted that human dignity in international humanitarian law is primarily associated with serious interventions in physical and

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12 UN General Assembly, Rome Statute of the International Criminal Court (last amended 2010), ISBN no. 92-9227-227-6, UN General Assembly, 17 July 1998.

13 See Dolezal, Eugen: Human enhancement or human reduction? Theological and ethical perspectives on human enhancement in the military sector. In chapter LAW & SOCIAL ETHICS in this publication.

mental integrity. Accordingly, the International Criminal Tribunal for the former Yugoslavia (ICTY) in the Tadić case, for example, placed a violation of human dignity on the same level as a serious injury to the body, mental or physical health (Case No. IT-94-1-T, Judgment, para. 729).[14] At the same time, the Tribunal made it clear in various other judgments that temporary humiliation is not sufficient to constitute a crime against humanity or a person-related war crime. Instead, such a crime requires damage that leads to a serious and long-term impairment of the ability of the person(s) concerned to lead a normal and constructive life (see, for example, Cases No. IT-98-33-T, paras. 510 and 513 – Krstić;[15] IT-05-88/2-A, paras. 201-202 – Tolimir).[16]

It can therefore already be stated at this point that human enhancement that is not associated with integrity violations, for example, an externally applied arm prosthesis to increase shooting accuracy, does not constitute a violation of human dignity for the soldier concerned. Conversely, however, violations of human dignity are obvious in cases of, for example, the ordering of the consumption or even the forced administration of substance-altering drugs that are not medically indicated, the replacement of a healthy eye with a night-vision or image-transmitting eyepiece or comparable amputations to enable the application of components from robotics, or even the implantation of brain-computer interfaces (BCIs).

Autonomy is another central element of protection arising from human dignity, particularly in relation to interventions on the body. On the one hand, autonomy in international humanitarian law is limited by the fact that persons protected under the Geneva Conventions cannot waive their rights enshrined therein (see Article 7 of the First Geneva Convention, the Second Geneva Convention and the Third Geneva Convention; Article 8 of the Fourth Geneva Convention). This relates to the fact that human dignity and

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14 International Tribunal for the Prosecution of Persons Responsible for Serious Violations of International Humanitarian Law Committed in the Territory of Former Yugoslavia since 1991, IT-94-1-T, 7 May 1997.

15 International Tribunal for the Prosecution of Persons Responsible for Serious Violations of International Humanitarian Law Committed in the Territory of Former Yugoslavia since 1991, IT-98-33-T, 19 April 2004.

16 International Tribunal for the Prosecution of Persons Responsible for Serious Violations of International Humanitarian Law Committed in the Territory of Former Yugoslavia since 1991, IT-98-33-T, 19 April 2004; Milaninia, Nema: Understanding Serious Bodily or Mental Harm as an Act of Genocide, 51 Vanderbilt Law Review, 2021, pp. 1381-1420.

its core contents are indispensable. On the other hand, soldiers are integrated into a military hierarchy. This is already a conceptual feature of combatant status (see Article 4 para. A subpara. 2 lit. a of the Third Geneva Convention).

It is meanwhile recognised that people who are in a so-called special relationship of power are also entitled to fundamental rights. However, in the case of the military, there are - in principle - greater possibilities for restrictions arising from military necessity and obligation. The military ethicist Michael L. Gross has rightly pointed out that the state curtails individual autonomy in the armed forces, particularly in times of armed conflict, and establishes 'benign paternalism' in its military.[17] As a consequence, it can be assumed that minor interventions in a soldier's body that have no negative long-term consequences are, in any case, permissible if they can be justified by the fact that they increase the troop's chances of survival. Accordingly, the US Uniform Code of Military Justice, for example, allows for soldiers to be punished for refusing to be vaccinated (Article 15).[18] Moreover, in a number of countries, soldiers are obliged to accept a procedure that is considered a standard measure and are expected to undergo medical treatment, namely in preparation for war deployment.[19]

In any case, the boundary of impermissibility is likely to be crossed if soldiers are deprived of their ability to control their bodies or thoughts autonomously or to make moral or other decisions independently, for example, through cybernetic implants, human-human interfaces or moral engineering.[20] Such human enhancement, which would probably be more of a degradation or reduction, would also have an impact on individual responsibility under international criminal law.[21]

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17 Gross, Michael: Bioethics and Armed Conflict: Mapping the Moral Dimensions of Medicine and War, Hastings Centre Report, 34:6, 2004, p. 23.

18 Robbins, Lauren: Refusing to Be All That You Can Be: Regulating against Forced Cognitive Enhancement in the Military, in Gross & Carrick, Military Medical Ethics for the 21st Century, 2013, p. 128.

19 Puscas, Iona M.: Military Human Enhancement, In: Boothby, William H.: New Technologies and the Law in War and Peace, 2018, pp. 214-215.

20 Dinniss, Harrison/Kleffner, Jann K.: Soldier 2.0: Military Human Enhancement and International Law, International Law Studies, 92, 2016, pp. 445-446, 447-448, 463-467 and 477-478.

21 Ibid., pp. 476-482.

III. Specific issues

In the following, two specific issues in the context of human enhancement will be assessed on the basis of central principles of international humanitarian law.

1. ‘Enhanced’ soldiers as ruse of war

Let us first turn the perspective away from the individual soldier and their legal protection to the perspective of the state deploying the soldier, or even the enemy. This raises the question of whether the deployment of soldiers who have undergone unrecognisable human enhancement constitutes a perfidious or insidious act contrary to international law or a permissible stratagem. To illustrate, let us take the fictitious example of a soldier who has two neural devices implanted in their brain. The first device enables them to transmit environmental information to the military base in real time. The second neural device establishes a brain-computer connection that enables the soldier’s brain to exercise direct control over a weapon system. The last of these enhancement technologies could qualify as part of a means of warfare, and both neural implants could be categorised as methods of warfare. Despite these enhancements, however, the soldier looks completely normal to an outside observer. This raises the question of whether such a soldier can be deployed.

According to The Hague Regulations Respecting the Laws and Customs of War on Land,[22] ruses of war and the employment of methods necessary for obtaining information about the enemy and the country are considered permissible (Article 24). The first Protocol Additional to the Geneva Conventions adds, in this respect, that ruses of war are acts intended to mislead an enemy or induce them to act recklessly, but which infringe no rule of international law applicable in armed conflict and are not perfidious because they do not invite the confidence of the enemy to rely on the protection afforded by that law (Article 37 para. 2). In addition, the manuals that states have issued on the law of armed conflict contain further guidance on the meaning

[22] Second International Peace Conference, The Hague, Convention (IV) Respecting the Laws and Customs of War on Land and Its Annex: Regulations Concerning the Laws and Customs of War on Land, International Conferences (The Hague), 18 October 1907.

and delimitation of deception and perfidy. They argue, for example, that ruses of war are lawful if they are not treacherous or deceitful and do not violate an express or tacit agreement (see, for example, LOAC Manual of Canada, 2001).[23] Surprise, deception and dishonesty were among the basic principles of war and gave the army a tactical and even strategic advantage. There was no obligation for either side to act 'transparently' towards the enemy.[24]

It follows that the use of forms of human enhancement that are not already a priori illegal under international law due to a violation of human dignity do not have to be disclosed to the enemy. Instead, states can even use the legal provisions on deception to justify the use of 'enhanced' soldiers. However, problems may arise if such persons are taken as prisoners of war.

2. Detention of 'enhanced' personnel

The second scenario that comes to mind could be that an 'enhanced' soldier with an implanted chip for operating a weapon system or an espionage eyepiece is captured. On the one hand, this could make it impossible for him to obtain the protected status of a prisoner of war under the Third Geneva Convention, which already indicates that the use of such an enhancement is contrary to human dignity. On the other hand, the question arises as to whether the detaining state can remove the chip or eyepiece as part of a medical operation or destroy the chip or eyepiece, even if the person concerned suffers brain damage or becomes blind as a result. This could constitute a prohibited mutilation or a prohibited medical or scientific experiment that is not justified by the medical treatment of the prisoner of war concerned and is not in their interest.

In the case of other 'enhanced' soldiers, one possible scenario could be that the enhancement technology used is such that those affected return to a normal initial state without medication or other means, which corresponds to that of a soldier who has not been 'enhanced' but is otherwise fit for service.

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23 The law of armed conflict at the operational and tactical level (LOAC) Manual of Canada, Office of the Judge Advocate General, 21 March 2001.

24 Manual on the Rules of Warfare of Israel, Military Advocate General's Corps: IDF School of Military Law, 2006.

This scenario appears to be unproblematic. However, if the nature of the enhancement is such that a lack of supply of appropriate medication or resources would lead to serious and permanent impairment of the detainee's initial condition and the detaining power is unable to provide the appropriate treatment at its detention facilities, the detainee must be transferred to a military or civilian medical facility where the appropriate treatment can be provided (see Article 30 para. 2 of the Third Geneva Convention). Alternatively, the person concerned may be returned to their home country (see Articles 109 and 110 of the Third Geneva Convention).[25] However, without disclosure of the enhancement status, the necessary decisions may come very late, perhaps too late.

IV. Conclusion

This brief survey has shown that various forms of human enhancement pose problems under the classic law of war, and in some cases are not even permissible. An attempt was also made to define legal boundaries for the use of human enhancement in military contexts. It appears that the dominant principle in that regard is the protection of human dignity.

[25] Dinniss, Harrison/Kleffner, Jann K.: Soldier 2.0: Military Human Enhancement and International Law, International Law Studies, 92, 2016, pp. 451-452.

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Human enhancement or human reduction?[1]

Theological and ethical perspectives on human enhancement in the military sector

Eugen R. Dolezal

Introduction

In the context of biblical texts, the topics of human ingenuity, cooperation and technical ability are addressed in various places. Probably the most well-known passage that illustrates the potential of the combination of technical ability and a cooperative spirit is the Tower of Babel (Gen 11:1-9), which did not remain without consequences for humanity. The scattering of people through the confusion of languages reminds us of a boundary that man should not cross. In this case, human self-exaltation, their hubris, is set as a religious boundary. However, man is by no means bound to limit his ingenuity, inventiveness and ability to cooperate excessively.

Here is another example: In Chapter 17 of the book of Exodus, a warlike encounter between the people of Israel and the Amalekites (Ex 17:8-11) is depicted. Moses stood on a rock above the battlefield and prayed to God with his arms raised. As long as he did this, the Israelites had a military advantage. However, the battle lasted for a long time and Moses became tired. As soon as his arms sank to the ground, the Amalekites strengthened and began to turn the tide of battle. To support Moses, it was decided to ensure his "ability to pray" by technical means, by providing him with a seat, but also by having Aaron and Hur support Moses' arms. If a technical solution had been sought instead of human help, such as building an armrest out of stones or constructing a supporting structure out of wood, this would hardly fall into the category of self-exaggeration that can be found in the Babel narrative, even though similar or even the same technologies were used.

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1 AI tools for translation (deepl.com) and improvement (deepl.com/write) were used in some sections to produce and refine the English text. Many thanks for the professional revision of the print-ready version in terms of language and style.

Given the human enhancement debate, this very rudimentary and narrative field of tension also opens up. To what extent is the use of certain technologies a legitimate and natural expression of the human creative spirit, and where, if at all, should boundaries be drawn?

This article attempts to find a limit to the use and development of technology in the human condition and to argue that the use of human enhancement technologies that do not place people in their entirety at the centre do not represent improvements but rather subject people to an instrumentalizing reduction.

Definition of human enhancement

One feature of the discourse on human enhancement is the conceptual vagueness of what could, should and may actually be considered an enhancement, i.e. an improvement of the human being. There are many definitions and delimitations, and this article also attempts to argue for the necessity, or at least the favourability, of a conceptual distinction. For this to succeed at all it is necessary to examine at least one formulation of the term human enhancement, which can then be supplemented, criticised and expanded. This approach is coherent with the other contributions to this publication in employing the working definition of human enhancement developed in the respective interdisciplinary and multidisciplinary working groups contributing as a starting point. The comments on the working definition are merely intended to prepare the ground for the discussion of what can be considered human enhancement from an ethical-theological perspective.

Working definition of human enhancement

"Human enhancement refers to the use of technologies, methods or substances to improve people's (physical or cognitive) abilities beyond what is normal and considered natural."

The working definition, which was developed during the conference "Human enhancement as a security policy factor" for the purpose of this publication, is based on the criteria of exceeding "natural" boundaries. Although this inherently raises the question of what is natural and what reference value is required to determine the limit of the "natural", the working definition allows for an intuitive demarcation that is clear in its poles, but vague at the actual points of distinction. For example, technical aids such as glasses and crutches are excluded from the sphere of enhancement, as are social improvements such as education and cognitive training practices such as specific forms of meditation.[2] At the same time, optical prostheses, which would allow perception of the infrared or ultraviolet spectrum, for example, are clearly within the realm of enhancement. Even in the area of vaccinations, we find ourselves in the aforementioned vague border area: an active vaccination, which stimulates the body's immune defence system to independently form antibodies on its own and thus results in increased resistance to the specific pathogen, can easily be located within the natural sphere of differentiation. However, passive vaccinations that specifically target a pathogen that the body is not naturally able to fight, such as the rabies pathogen, would already be classified as an enhancement under the working definition.[3] In addition, due to the lack of clarity as to what may or can be considered "natural", it remains unclear how to deal with those technologies which, depending on the person to whom they are applied, can either lie within the boundaries of the "natural" or allow them to be exceeded.[4] At this point it becomes clear that naturalness, despite or precisely because of its inherent normative character, is – at least to a certain extent – subject to social dynamics and is therefore subject to processes of change.[5]

Despite these general limitations, the working definition remains meaningfully applicable and useful for the scope of the military context, as it (i) lends itself to locating human enhancement in the larger conceptual context of human augmentation and human performance optimisation relevant to the

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2 UK Ministry of Defence/Bundeswehr Office for Defence Planning: Human Augmentation – the Dawn of a New Paradigm: A strategic implications project, 2020. https://www.bundeswehr.de/resource/blob/5016368/fdc7f1c529ddfb014d4e321e8b666a2d/210111-sip-ha-data.pdf.

3 Chaddah, Maya Rani/Mak, Tak W./Saunders, Mary: The Immune Response: Basic and Clinical Principles, 1st ed., Amsterdam: Elsevier, 2006, pp. 695-749.

4 Here, exceeding can be considered plausible at least in the statistical sense of the average capacity of human cognition.

5 Birnbacher, Dieter: Therapie und Enhancement in der Biomedizin – Leiden lindern oder den Menschen verbessern?" In: Manzeschke, Arne/Niederlag, Wolfgang (eds.): Ethische Perspektiven auf Biomedizinische Technologie. 1st ed., Health Academy Series 3. Berlin, Boston: Walter de Gruyter GmbH, 2020, pp. 34-35.

military,[6] and (ii) as it inherently focuses on the human being with its focus on the "natural" and introduces this as a normative variable.

The first point, positioning in the conceptual field and in the military context, should only be briefly touched upon here for the sake of completeness.[7] The UK Ministry of Defence, in cooperation with the Office for Defence Planning of the German Bundeswehr, published a strategy paper in 2020 that proposes the terms human augmentation, human performance optimisation and human performance enhancement for the military sector. Human augmentation means "the application of science and technologies to temporarily or permanently improve human performance."[8] The subcategories of human performance optimisation and human performance enhancement are, in turn, differentiated based on natural limitations, in this case, the biological limitations of humans. Therefore, human performance optimisation is described as "the use of science and technologies that improve human performance up to the limit of biological potential without adding new capabilities."[9] Human performance enhancement, in turn, begins precisely at the limits of the biological potential described above. The UK Ministry of Defence and the Office for Defence Planning of the German Bundeswehr therefore restrict the definition of "naturalness" to maximum biological capacity and not to statistical averages. Moreover, the emphasis is placed on "performance", that is to say, performance in a specific situation. As a result, the human being is seen as a platform that performs on different levels.[10] A distinction is made between physical, psychological and social performance. These differentiations provide the necessary conceptual clarity to be able to articulate strategic considerations with sufficient specificity. However, what

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6 UK Ministry of Defence; Bundeswehr Office for Defence Planning: Human Augmentation – the Dawn of a New Paradigm: A strategic implications project, 2020. https://www.bundeswehr.de/resource/blob/5016368/fdc7f1c529ddfb014d4e321e8b666a2d/210111-sip-ha-data.pdf., p. 18.

7 More information can be found in the article Schulyok, Bernhard/Gruber, Markus/Grangl, Lukas: Human enhancement from a military perspective – WHY, WHAT and HOW? In chapter MILITARY in this publication.

8 UK Ministry of Defence; Bundeswehr Office for Defence Planning: Human Augmentation – the Dawn of a New Paradigm: A strategic implications project, 2020. https://www.bundeswehr.de/resource/blob/5016368/fdc7f1c529ddfb014d4e321e8b666a2d/210111-sip-ha-data.pdf.

9 Ibid., p: 18.

10 Ibid., p. 19.

is immanent here is the human being, both as a being with "natural" biological boundaries and as a platform that unites different levels within itself. The following section is dedicated to this naturalness of being human, i.e. the second point, from a perspective that goes beyond the biological.

Being human as a distinguishing criterion

Any recourse to the "natural" in relation to human performance or even its very existence necessitates a selective reflection on and consideration of the implications of being human. One method of delineating the concept of humanity is through the notion of the *human condition*. The Latin "conditio" is translated as "condition" in the context of the human being (humana). Conditio humana therefore means "an all-encompassing and exhaustive operational definition of 'human' [...], in the sense of specifically human, uniquely human, which is unique to the human being, a meaning that emphasises the special nature of the human being in contrast to other organisms."[11] The following sections attempt to demonstrate the diversity of this conditio humana.

Contingency

From a theological perspective, an essential element of what constitutes the human condition is specifically human limitations and contingency. This leads to obvious potential for tension with technologies that are designed to empower individuals beyond their natural limits. It is crucial to emphasise that the use and development of technologies,[12] eo ipso, is a core element of being human, which can be understood as the creative and formative empowerment of human beings. The tension between the fact that humans can be understood from their (natural) limitations on the one hand, but specifi-

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11 Hutterer, Robert: Das Paradigma Der Humanistischen Psychologie. Vienna: Springer, 1998. https://doi.org/10.1007/978-3-7091-7493-7, 15, as quoted from: Schmölz, Alexander: Die Conditio Humana Im Digitalen Zeitalter, Medien Pädagogik: Zeitschrift für Theorie und Praxis der Medienbildung, 2020, p. 212, https://doi.org/10.21240/mpaed/00/2020.11.13.X.

12 In recourse to the Aristotelian understanding of τέχνη, technology is understood here as poietic, i.e. productive capacity of human activity, which encompasses both the modern understanding of (mechanical and digital) technology, but also craftsmanship, medicine, artistic activity, meditative-cognitive exercises, science, etc.

cally their empowerment over these limitations on the other at first glance seems to be resolvable only to the detriment of one of the two poles, contingency and technical empowerment. The fact that the increase in technical potential also increases the negative effects or the possibilities of using it for questionable goals is a concern expressed by the Church's magisterium: "Never has humanity had such power over itself, yet nothing ensures that it will be used wisely, particularly when we consider how it is currently being used" (LS 104).[13] It is important to emphasise that these church positions are not inherently hostile to technology, but rather possess a human-centred scepticism of technology. In close proximity to the aforementioned quote, reference to the work entitled "The End of the Modern World" by the German priest and philosopher Romano Guardini (1885-1968), who criticises "economic and scientific-technical progress [...] justified by purely formal criteria of progress […]"[14] is made. The fundamental premise of this criticism is the assumption that any augmentation in technical capability is inherently progress, which entails an "increase in security, benefit, welfare, vitality, value saturation [...]."[15] The magisterial position follows on from this and points out that there is a tendency to assume the emergence of truth, reality and the good from technological and economic power itself (LS 105). This is precisely why a warning is issued, as: "'The risk is growing day by day that man will not use his power as he should'; in effect, 'power is never considered in terms of the responsibility of choice which is inherent in freedom' since its 'only norms are taken from alleged necessity, from either utility or security'" (LS 105).[16] Aspects of this freedom in relation to the responsibility of choice will be discussed later. The warning remains clear that man's Promethean

13 Pope Francis: Laudato Si': On Care for our Common Home, 24 May 2015, https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html. References to doctrinal documents are usually assigned an abbreviation and paragraph number directly in the text.

14 Guggenberger, Wilhelm: Zu viele Werkzeuge, zu wenig Ziele: Technikskepsis in der Enzyklika Laudato si‘. In: Datterl, Monika et al. (eds.): Papst Franziskus: Ein erstes Resümee. 1st ed., Theologische Trends Band 26. Innsbruck: innsbruck university press, 2016, p. 44.

15 Guardini, Romano: Die Macht: Versuch Einer Wegweisung, Würzburg: Werkbund Verlag, 1965, p. 87.

16 Guardini, Romano: Das Ende der Neuzeit, 9th ed., Würzburg 1965, p. 87, as cited in Pope Francis: Laudato Si': On Care for our Common Home, 24 May 2015, https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html.

endeavour should not allow him to degenerate into a mere instrument and platform for progress. The importance of contingency in this debate becomes apparent in this context: It is precisely owing to the vulnerability of humanity and its environment that the understanding of man is often not that of the literal forward-thinking Prometheus, but rather takes after his brother Epimetheus, who accepts a gift despite warnings, unaware of its consequences. This perspective on contingency, which encompasses the need for protection of the human being born with vulnerability, is the origin of the striving for technical improvement. However, it also provides a normative framework.[17]

The inherent vulnerability and the limited nature of human beings gives rise to a moral duty to create conditions that preserve their dignity and integrity. These obligations become particularly clear in situations of existential dependency - for example, in childhood, old age, illness or social hardship. This necessity for protection is also evident in warlike contexts in which people are exposed to particular dangers both as civilians and as soldiers. From a military perspective, this engenders a dual ethical obligation: On the one hand, the protection of the civilian population from the devastating consequences of acts of war, and on the other, the protection of soldiers who, despite their voluntary or compulsory deployment, do not relinquish their basic human dignity. International humanitarian law[18] explicitly addresses these obligations, seeking to ensure the protection of civilians as well as prisoners of war, the wounded and combatants. Soldiers find themselves in a position of duality, caught between their role as actors of military force and their simultaneous need for protection as human beings. The contingency of human life is particularly evident in view of the uncertainty, unpredictability and existential threat that characterise warfare.

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17 Fittingly, in Greek mythology, man's need for protection is specifically a consequence of Epimetheus' recklessness, which is compensated for by fire, but also by social competence, justice and the responsibility for others that goes with it (Plato, Protagoras 320d-322a).

18 See Hohenlohe, Diana zu: Human enhancement in light of classical humanitarian law. In chapter LAW & SOCIAL ETHICS in this publication.

Imago Dei (image of God) and dignity

The prime theological example and fundamental framework of understanding is humankind being created in the image of God. On the one hand, this functions as a defining criterion, while on the other hand it also serves as a framework for understanding humanity from a theological perspective. What is essential here is that a humanistic understanding of dignity can readily be integrated into the Christian view of humanity and that caution should be exercised in this regard, particularly in the context of contemporary tendencies to pit these concepts against one another.[19] The central passage for this is Genesis 1:26:

> Then God said, 'Let us make man in our image, after our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the earth, and over every creeping thing that creeps upon the earth.'

The mythical concept in Genesis 1 serves as an introduction to the creation of man and indicates that humankind has a central role to play in the divine plan of creation, through which God wants to establish and consolidate his rule in the world. The image metaphor in Genesis 1 adopts the idea of a statue, such as those erected by rulers in the provinces of their empire as a symbol of their rule. In a similar way, humankind becomes the representative of divine rule on earth. The phrase "in our image and likeness" serves to emphasise the significant role of man in the divine plan of creation, without implying the deification of man. The designation of man as the image of God refers not only to his functions or abilities (such as reason, language or morality) but to his entire being. As God's mandatary, man is able to fulfil his task only because he is recognised as an independent counterpart, and his actions are an expression of his nature.[20]

The image of God contradicts the reduction of human beings to their usefulness as tools for military purposes. Soldiers must not be limited to functions such as combat performance or strategic availability, as this would jeop-

[19] Brandscheidt, Renate: Die Heiligkeit des Lebens im Urteil der Bibel, In: Brandscheidt, Renate et al.(eds.): Herausforderung „Mensch", Paderborn et al.: Ferdinand Schöningh Paderborn, 2012, p. 66.

[20] Ibid., p. 68.

ardise their identity as independent, free and morally responsible subjects. Moreover, a relationship of responsibility is derived from being made in the image of God. In it, man acts as a co-creator of creation, as he shapes and alters the world around him. However, this does not imply unbridled freedom, as the concept of limitations inherent in human nature is also emphasised. Any interventions that undermine human autonomy or reduce individuals to mere instruments of other people's purposes are therefore incompatible with this theological insight. Especially in the military sphere, where the risk of instrumentalising human beings is particularly high. The image of God demands that human beings should not be treated as mere objects of technical optimisation. Consequently, being made in the image of God establishes an ethical standard that marks the limits of human enhancement within the military sector. However, such a limitation should not be interpreted as a categorical prohibition, as human desire for development is also a fundamental element of human existence in creation:

> The fact that man is a living being who wants to go beyond himself, who by his spiritual nature is designed to explore the limits of what is possible and, if necessary, redefine these limits through cultural development, science and technology, also corresponds to the purpose of man from a Christian theological point of view.[21]

The notion of dignity – Ontological, moral, social and existential dimensions

As previously indicated, the concept of human dignity serves as a fundamental reference point for theological and ethical reflections on human enhancement. While human dignity is widely acknowledged as a core normative principle, its precise meaning is subject to multiple interpretations. One of these interpretations is laid down in the document *Dignitas Infinita* (DI)[22] by the dicastery for the doctrine of the faith, where four dimensions of human dignity – ontological dignity, moral dignity, social dignity and existential dignity

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[21] Brantl, Johannes: Gut erschaffen - manchem aber nicht gut genug: Normethische und tugendethische Überlegungen zur medizinisch assistierten Selbstverbesserung des Menschen, In: Brandscheidt, Renate et al. (eds.): Herausforderung „Mensch", Paderborn et al.: Ferdinand Schöningh Paderborn, 2012. p. 143. Translated with deepl.com.

[22] Dignitas Infinita: On Human Dignity. Dicastery for the Doctrine of the Faith, 2024. https://www.vatican.va/roman_curia/congregations/cfaith/documents/rc_ddf_doc_20240402_dignitas-infinita_en.html.

– are described. Each of these dimensions provides a specific perspective on the boundaries between genuine human enhancement and human reduction.

Ontological dignity refers to the intrinsic worth that every human being possesses by virtue of their very existence. This dimension of dignity is addressed in the *Universal Declaration of Human Rights (1948)* and the binding international contracts derived from it (DI 2). From a theological perspective, this dimension of dignity is rooted in the already described principle of Imago Dei (DI 11). Ontological dignity is independent of any actions, abilities or social status; it is inalienable and indestructible (DI 7). Irrespective of factors such as age, health or functional capacity, every person possesses ontological dignity simply because they exist as human beings.

Moral dignity pertains to human beings' capacity for moral agency and autonomy. The theological concept of moral dignity is linked to the concept of conscience – the human capacity to discern right from wrong and to act according to moral principles. When individuals act against their conscience, they act in a manner that contradicts their status as beings loved by God and exhorted to love others, according to the canon beliefs of the church (DI 7). Although conscience calls human beings to act in accordance with the moral good, the exercise of freedom always entails the possibility of choosing otherwise. This dual potentiality is a defining feature of human nature. Individuals may obscure the visibility of their moral dignity by choosing actions that contradict the law of love revealed in the Gospel. Their behaviour can appear to lack humanity and dignity, even if their ontological dignity – their inherent worth as human beings – remains intact.

In the context of human enhancement, the preservation of moral dignity assumes particular significance. Military enhancement technologies that influence soldiers' moral decision-making capacity would lead to impairments of their moral dignity. If soldiers are compelled to act according to external stimuli or programmed directives, their status as moral agents would be compromised. This violates the principle of autonomy, which demands that moral choices arise from a person's own conscience. Furthermore, the use of unjust coercive enhancement programmes in the military could undermine moral dignity. Soldiers may be pressured to accept enhancements solely for a performance boost or to remain competitive. It is therefore vital that soldiers are free to make moral choices, even within such hierarchical and military structures.

Social dignity pertains to the quality of the social conditions in which an individual lives. When people are forced to live in conditions that contradict their ontological dignity –such as extreme poverty or marginalisation – their social dignity is compromised (DI 8). Additionally, the plurality of the social existence of human beings should be considered under this dimension of dignity. A person fulfils and acts in various social contexts and roles, each of which is part of their personhood. Therefore, in military contexts, social dignity is particularly relevant for the purpose of reintegrating soldiers following their service. Irreversible augmentations or enhancement applications, which pin the human being to the role and function of a soldier, infringe their social dignity.

Existential dignity addresses the subjective experience of human beings as they navigate suffering, hope and personal flourishing. It refers to the extent to which people experience their lives as meaningful, joyful and hopeful (DI 8). In military contexts, existential dignity is directly related to the psychological well-being of soldiers. The implications of technological enhancements – such as pharmaceutical desensitisation drugs – that interfere with emotional stability, empathy or emotional processing for existential dignity are profound. Furthermore, existential dignity is threatened when soldiers become psychologically dependent on enhancement technologies. If soldiers can no longer experience "normal" human emotions or cognitive functioning without technological support, they are at risk of facing an existential crisis.

As these dimensions of dignity are inherently connected to what it means to be human, they can guide the differentiation between genuine human enhancement and functional reduction, as infringements in any dimension of dignity indicate reductive tendencies.

Autonomy and freedom of conscience

Another essential aspect of human existence is autonomy and freedom of conscience. Freedom of conscience, repeatedly linked to religious freedom in the context of Catholic teaching,[23] describes another facet of what was

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[23] Pope Paul VI.: Dignitas Humanae: On the Right of the Person and of Communities to Social and Civil Freedom in Matters Religious, 7 December 1965, https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_decl_19651207_dignitatis-humanae_en.html.

presented regarding moral dignity. From a Catholic perspective, freedom of conscience is a persistently relevant aspect that is particularly emphasised in its focus on the morally good.[24] According to Thomas Aquinas, conscience is assumed to be oriented towards the truth, i.e. the grasp of reality par excellence.[25] Although a foundation of conscience in the truth and thus God himself is assumed, there is a relationship with reason, which can also lead to misguided judgements: "Errant reason presents its judgement as truth, and consequently as derived from God, from whom all truth is."[26] The distinctive attribute of this reliance on reason is that even if it leads conscience astray, the fundamental nature of conscience remains anchored in the pursuit of truth. This leads to the view that obligation and responsibility arise from the truth-seeking nature of conscience, even if the factual intellectual judgement is clouded.[27] In short: "An erroneous conscience binds."[28] It is evident that this does not legitimise the deliberate misleading of the mind and, consequently, thus of conscience, irrespective of whether this occurs through lies, misinformation or technical manipulation of the brain. This also indicates a further limitation in the domain of technical augmentation: All those technologies that mislead the mind or alter the faculties of conscience itself inherently compromise its dignity of conscience, something that arises from the manipulation and impairment of the subject[29] rather than from the factual truth or falsity of judgement: "Hence the more right conscience holds sway, the more persons and groups turn aside from blind choice and strive

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24 Vatican News: Pope Francis: Freedom of conscience must be respected always and everywhere, last modified 17 June 2020, https://www.vaticannews.va/en/pope/news/2020-06/pope-francis-day-of-freedom-of-conscience.html.

25 Hoye, William J.: Die verborgene Theologie der Säkularität, Das Bild vom Menschen und die Ordnung der Gesellschaft (Wiesbaden, Heidelberg: Springer VS, 2018), p.188.

26 Aquinas, Thomas: Summa theologiae, I–II, q. 19, a. 5, ad 1. As cited from: Aquinas, Thomas: Summe der Theologie: 2. Die sittliche Weltordnung, 3. durchges. u. verb. Aufl., Kröners Taschenausgabe 106. Leipzig: Kröner, 1985. In the latin original: "Ratio errans iudicium suum proponit ut verum, et per consequens ut a Deo derivatum, a quo est omnis veritas."

27 Hoye, William J.: Die verborgene Theologie der Säkularität, Das Bild vom Menschen und die Ordnung der Gesellschaft. Wiesbaden, Heidelberg: Springer VS, 2018, p. 189.

28 Aquin, Thomas von: De veritate, q. 17, a. 4, as cited from: Aquin, Thomas von: Vom Gewissen: Quaestiones disputatae de veritate 16-17. Freiburg: Herder, 2021, Latin-German.

29 Hoye, William J.: Die verborgene Theologie der Säkularität, Das Bild vom Menschen und die Ordnung der Gesellschaft. Wiesbaden, Heidelberg: Springer VS, 2018, p. 190.

to be guided by the objective norms of morality. Conscience frequently errs from invincible ignorance without losing its dignity (GS 16)."[30] In that regard, conscience is also essential for the common good and human social relations (GS 16). Conscience-based technical interventions, whether for military utility or for other reasons, do not only infringe on human dignity, but also on the human community as a whole.

The freedom of conscience, as well as the dignity of the human person, is expressed in the autonomy to act which is such an essential part of the human being that it does not permit any unjust restrictions. 'Unjust' is explained in terms of the appropriateness of autonomous action as emphasised and formulated in the course of the Second Vatican Council: "Acting in a Christian manner means acting appropriately, without the false directness of ecclesiastical regulation, which would contradict the inherent demands, that are grounded in the things themselves and the difference between the Church and the Kingdom of God […]."[31] Interventions in autonomy, including ecclesiastical interventions, are not permitted. However, it is important to note that autonomy does not entail unbridled freedom for the individual. Instead, insofar as the ecclesial concept of autonomy is a just autonomy (iusta autonomia), which essentially includes relational aspects, since the objectivity of creation only becomes comprehensible through the constant, reciprocal relationship with the individual.[32] However, this obligation to others, which is incumbent upon human beings in the context of autonomy, also includes protection. It is vital to recognise that human beings must not be illegitimately restricted in their highly individual freedom of action. Furthermore,

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[30] Pope Paul VI.: Gaudium et Spes: Pastoral Constitution on the Church in the Modern World, 7 December 1965, https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_en.html.

[31] In the german original: „Christlich handeln heißt sachgerecht handeln, ohne falsche Direktheit kirchlicher Reglementierung, die dem Eigenanspruch der Dinge und der Differenz zwischen Kirche und Reich Gottes widerspräche, aus der die Vorläufigkeit und die Begrenzung seiner innerweltlichen Kompetenz resultiert." Complete translated version: „Acting in a Christian manner means acting appropriately, without the false directness of ecclesiastical regulation, which would contradict the inherent claim of things and the difference between the Church and the Kingdom of God, from which the provisional nature and limitation of its inner-worldly competence results." Ratzinger, Josef: Die letzte Sitzungsperiode des Konzils. Köln: Bachem, 1966, p. 48.

[32] Losinger, Anton: Iusta Autonomia: Studien zu einem Schlüsselbegriff des II. Vatikanischen Konzils, Abhandlungen zur Sozialethik 28, Paderborn, Munich, Vienna, Zurich: Schöningh, 1989.

it is crucial to ensure that they are able to exercise their autonomy fairly with regard to their social environment, society and the environment. This fits into the dimension of social dignity, but now a different perspective is shown. The prohibition to restrict the soldier to one role is not only founded by individual reasons, but also out of obligation to others.

Irrespective of whether one shares the theological perspective on the human condition, or whether it is assumed that the human condition has been fundamentally transformed by technology to the extent that physical and cognitive limitations can no longer be assumed for humans, as they redefine their humanity through technological progress, it is indisputable that normative and ethical orientation is highly necessary.[33] This necessity arises from two fundamental sources: Firstly, normativity emerges as a response to protect human beings in the course of their contingency and in the face of their inherent vulnerability. Secondly, it arises from the assumption that contingency can be overcome technologically,[34] from the need for dignity-preserving orientation in a space of almost limitless possibility.[35]

Enhancement vs. Reduction

Based on the perspectives on people presented above, this section briefly summarises the criteria that distinguish "genuine enhancement" from functional reduction when using technologies and methods to improve people.

Genuine enhancement is characterised by its respect for the inherent dignity and complexity of individuals, ensuring that no aspects of their essential characteristics or abilities are diminished. The theological and ethical principles of the image of God and the human condition provide a normative

33 Grunwald, Armin: Converging technologies: Visions, increased contingencies of the conditio humana, and search for orientation," Futures 39, no. 4, 2007, https://doi.org/10.1016/j.futures.2006.08.001.

34 At this point, it is necessary to add some clarification: Contingency is to be understood here as the physical and mental limitations of human beings, since a categorical transgression of contingency is conceptually almost inconceivable. This is due to the fact that terms such as "contingency" are categorically relative, whereby they eo ipso define external and internal boundaries.

35 Grunwald, Armin: Converging technologies: visions, increased contingencies of the conditio humana, and search for orientation," Futures 39, no. 4, 2007, p. 391. https://doi.org/10.1016/j.futures.2006.08.001.

framework within which such genuine enhancements are to be evaluated. Technologies and augmentations that are regarded as genuine enhancement must:

1. **Respect human dignity:** any form of enhancement must not reduce people to a mere means or a mere platform.
2. **Attune to vulnerability:** enhancement measures must neither exploit nor conceal a person's vulnerability.
3. **Protect the freedom of conscience:** freedom of conscience, as an expression of moral autonomy, must be preserved. Technologies that interfere with or manipulate moral decision-making represent a fundamental threat.
4. **Guarantee autonomy:** interventions that impair autonomy contradict the idea of positive enhancement. Technologies should aim to support freedom of choice and self-realisation.

The human being is irreducible in its entirety. This is particularly important to take into consideration when scientific or technical images of humans are formed from the need for modelling and abstraction, which postulate a comprehensive description of the human form on the basis of far-reaching individual sciences.[36] However, even if all of the above-mentioned criteria are met, it is important to recognise the need for protection from lasting consequences of the use of technology. It is therefore also important to ensure that enhancements are reversible and do not cause dependencies.

Reversibility is therefore not merely a technical requirement. Instead, it constitutes a fundamental ethical principle. Its purpose is to protect human integrity by ensuring that technologically induced changes can be reversed. This is crucial in order to maintain control over one's own body and mind and to prevent permanent dependency on technology. In the military context in particular, where the application of augmentations must be conceived within a sphere of existential, social and hierarchical pressure, reversibility becomes an indispensable element of human rights protection.

[36] Schüßler, Werner: Was ist der Mensch? „Mensch sein“ und „Mensch werden“ aus philosophischer Sicht. In: Brandscheidt, Renate et al.: Herausforderung „Mensch“, Paderborn et al.: Ferdinand Schöningh Paderborn, 2012, p. 19.

Technologies that engender psychological, physical or social dependencies are incompatible with the idea of autonomy and self-determination. Such dependencies may incur long-term negative consequences for both individual and social life. Enhancement technologies could reinforce hierarchies and social inequalities by restricting their accessibility to a select group of individuals. This contradicts the principle of equality and justice, which is fundamental to ethical and theological discourse. Consequently, future technological developments must take into account not only individual autonomy but also social structures to ensure that such technologies do not cause harm but promote the common good.

It is therefore important to note that, as a result of their various anthropological insults,[37] humans are attempting to compensate for an inferiority complex through technology. This leads to a refusal to accept "the anthropological characteristics of finiteness, conditionality, inadequacy, lowliness and vulnerability, in short: human contingency as a natural default."[38] Ultimately, the legitimacy of human enhancement in the military hinges on a balance between technological possibilities and ethical imperatives. Ensuring reversibility and independence is vital in upholding the dignity and autonomy of individuals, aligning with the broader ethical framework that distinguishes them from human reduction. This approach necessitates a commitment to continuous ethical reflection and adaptation in recognition of the complex and dynamic nature of human enhancement in military settings.

37 Beginning with Siegmund Freud's description that man is neither the centre of the universe (cosmological insult) nor the crown of a creation that is directed towards him (evolutionary insult), and not even a complete master of his consciousness (psychological insult), numerous other insults concerning man have been identified and described.

38 Brantl, Johannes: Gut erschaffen - manchem aber nicht gut genug: Normethische und tugendethische Überlegungen zur medizinisch assistierten Selbstverbesserung des Menschen. In: Brandscheidt, Renate et al. (eds.): Herausforderung „Mensch", Paderborn et al.: Ferdinand Schöningh Paderborn, 2012, p. 142.

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Pope Francis: Laudato Si': On Care for Our Common Home. 24 May 2015. https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html.

Pope Paul VI.: Dignitas Humanae: On the Right of the Person and of Communities to Social and Civil Freedom in Matters Religious. 7 December 1965. https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_decl_19651207_dignitatis-humanae_en.html.

Pope Paul VI.: Gaudium Et Spes: Pastoral Constitution on the Church in the Modern World. 7 December 1965. https://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_en.html.

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Chapter VI – Military

Jemastock/Adobe Stock

Military. Chapter Summary

The first part of this chapter explores the growing significance of Human Enhancement (HE) within the military domain, addressing three fundamental questions: *WHY* pursue HE? *WHAT* aspects of human capability are targeted for enhancement and *HOW* can these enhancements be implemented?

From the Austrian perspective, even though some HE technologies may currently be infeasible or misaligned with national policies, proactive engagement is essential. The focus extends beyond individual optimisation to include the enhancement of team capabilities and operating effectively within established fitness and operational parameters.

Key issues include the distinction between optimisation and enhancement, particularly in the context of the 'human-as-a-platform' concept. To systematically assess the impact of HE, the article introduces three-dimensional analytical frameworks that examine physical, cognitive, and social dimensions. These frameworks help to evaluate technologies such as exoskeletons, cognitive enhancers, and genetic modifications, and ensure a structured approach to analysing their military applications.

The article delves into the ethical, legal and societal challenges associated with HE, addressing issues such as voluntariness, fairness and the long-term implications for soldiers and society. In addition, the article outlines strategic approaches for integrating HE into military decision-making, using the OODA (Observe, Orient, Decide, Act) loop to enhance cognitive superiority and promote continuous adaptation in complex operational environments.

Finally, it underlines the importance of a regulated and responsible approach to the development of HE technologies aimed at enhancing military effectiveness while respecting ethical standards and societal values.

The second part of the chapter examines emerging technologies regarding physical and cognitive enhancement - such as genetic engineering, brain-computer interfaces and pharmaceutical interventions - and their transformative potential for soldier performance and military strategy.

The report provides a comprehensive analysis of emerging trends, technological innovations and their implications for future warfare, culminating in strategic recommendations for policymakers and military planners. By balancing innovation with ethical considerations, these advances can be harnessed to create a resilient and adaptive military force capable of meeting the dynamic challenges of modern conflict. Currently, the EU appears to be paying relatively little attention to human enhancement and rather considerable attention to artificial intelligence. However, these research themes are inextricably linked, particularly in areas such as human-machine teaming and decision support systems. A more integrated approach could maximise technological synergies and foster industrial innovation and economic competitiveness in the defence sector.

Human enhancement from a military perspective – WHY, WHAT and HOW?

Bernhard Schulyok, Lukas Grangl, Markus Gruber

Military conflicts have shifted from physical dominance to cognitive and technological enhancements, raising ethical, social and legal concerns. This article explores WHY they are pursued, WHAT enhancements are sought and HOW they are feasible, considering the associated implications.

1. Fundamental considerations

Military operations under international bodies such as the UN, NATO or the EU involve varied conditions. Enhancements, such as the use of Modafinil® by US personnel, raise ethical and legal issues due to potential adverse effects such as prolonged recovery and aggression. Alternatives like training or meditation and competing technologies like robotics also necessitate careful evaluation. For example, US military personnel use Modafinil® to promote wakefulness during tasks requiring sustained attention, while German forces can only use it with a prescription for specific medical reasons.[1]

1.1 Interlinked overview

1.1.1 On the necessity of distinguishing nuanced terms of use for enhancement and optimisation in military applications

The discourse surrounding human augmentation in military, defence and security applications is becoming increasingly nuanced, reflecting the rapid ad-

1 Erley, Oliver M./Vergin, Annika/Haggenmiller, Christian/Sammito, Stefan: Human Enhancement – alter Wein in neuen Schläuchen oder tatsächlich eine Herausforderung für die Wehrmedizin? 2019. https://wmm.pic-mediaserver.de/index.php?f=artikel&a=201910_originbalarbeit, pp. 375-380, accessed 21 April 2024.

vancements in technology and the ethical considerations they entail.[2] Within this multifaceted landscape, the differentiation between enhancement and optimisation emerges as a pivotal concern. Understanding and delineating these concepts are paramount for several reasons:[3]

- **Ethical and moral imperatives**: the ethical implications of augmenting certain individuals' capabilities while others remain unaltered necessitate careful consideration. Differentiating between enhancement and optimisation is essential to address fairness in military operations, especially regarding equality. Informed consent is crucial, with individuals needing to understand the risks and benefits associated with each approach. Ensuring no individual or group within the military is unfairly disadvantaged or placed at significant risk is vital to maintain moral integrity and trust in augmentation

[2] DCDC, UK Ministry of Defence: Human Augmentation – The Dawn of a New Paradigm. 2020. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed May 2024; Ministry of Defence: Human-Machine Teaming. 2020. https://assets.publishing.service.gov.uk/media/5b02f398e5274a0d7fa9a7c0/20180517-concepts_uk_human_machine_teaming_jcn_1_18.pdf, accessed 26 June 2024; Puscas, Ioana M.: *Military Human Enhancement*. In: W. H. Boothby (ed.). New Technologies and the Law in War and Peace. Cambridge: Cambridge University Press, pp. 182-229. 2018.

[3] Various comprehensive sources provide valuable insights as a basis for the overview outlining the different concepts: see Harrison Dinniss, H. A./Kleffner, J. K.: Soldier 2.0: Military Human Enhancement and International Law. International Law Studies. 94, accessed 26 June 2024. 2018, pp. 163-205 https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=1695&context=ils; NATO Science & Technology Organization. (n.d.): Neuroenhancement in Military Personnel: Conceptual and Methodological Promises and Challenges (STO-TR-HFM-311). Belgium: NATO STO. Retrieved from https://www.sto.nato.int/publications/STO%20Technical%20Reports/STO-TR-HFM-311/$TR-HFM-311-Pre-Release-ALL.pdf, accessed May 2024; NATO Science & Technology Organization. (n.d.). Biotechnology, Human Enhancement and Human Augmentation: A Comprehensive Overview of Its Topical Content (STO-TR-HFM-ST-335). Belgium: NATO STO. https://www.sto.nato.int/publications/STO%20Technical%20Reports/STO-TR-HFM-ST-335-A/$TR-HFM-ST-335-A-ES.pdf, accessed May 2024; Puscas, Ioana M.: Military Human Enhancement. In: W. Boothby (Ed.), New Technologies and the Law in War and Peace. Cambridge: Cambridge University Press. 2018, pp. 182-229:

policies. Ethical principles, such as proportionality and informed consent, are essential to responsibly manage these concerns.[4]

- **Strategic and tactical significance**: military organisations must balance resources between augmenting capabilities and optimising existing systems and personnel. Distinguishing between enhancement and optimisation guides strategic decisions, aligning priorities with operational contexts to maximise mission success and effectiveness.
- **Societal and legal implications**: transparent communication concerning military augmentation is crucial for public trust. Differentiating enhancement from optimisation informs legal frameworks and regulations, ensuring responsible technology use while safeguarding individual rights.

Elucidating the distinction between enhancement and optimisation is paramount in the discourse on human augmentation in military applications. By comprehensively understanding each approach's nuances, military stakeholders can navigate the ethical, strategic and societal dimensions of human augmentation with greater clarity and foresight.

1.1.2 The three pillars of the human-as-a-platform model[5]

Conceptualising the human-as-a-platform is fundamental to understanding the potential impact and limitations of human augmentation approaches and identifies three main areas:

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4 Whetham, David/Purves, Duncan/Nericcio, Lorenzo et al.: Ethical Human Augmentation in the Military - A Comparison and Analysis of National and International Frameworks, Regulation, and Approval Processes. 20 July 2022. Preprint (Version 1) available at Research Square. https://doi.org/10.21203/rs.3.rs-1826964/v1, accessed 29 June 2024.

5 UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2020. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed 17 May 2024.

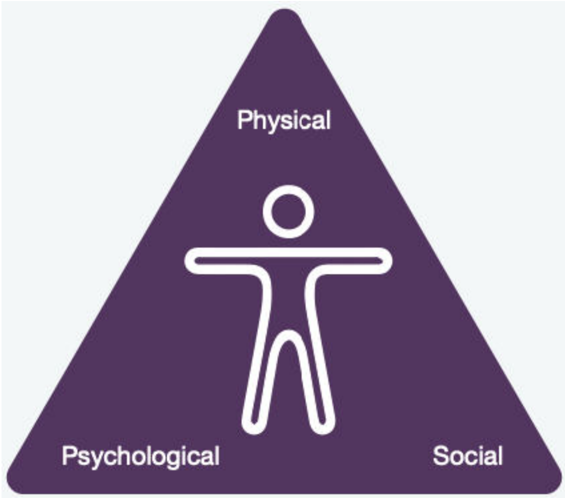

Figure 1: The human-as-a-platform model.[6]

- **Physical performance**: involves navigating and engaging with the physical environment. Key attributes include strength, dexterity, speed and endurance, with technologies such as exoskeletons enhancing these capabilities.
- **Psychological performance**: focuses on cognition, emotion and motivation, highlighting the interplay of mental processes, emotional states and behavioural drivers. Strategies such as targeted training and cognitive enhancers optimise cognitive functions.[7]
- **Social performance**: emphasises interpersonal, group and societal dynamics, and collaborative efforts. Skills such as communication, empathy and teamwork are crucial, with leadership training and com-

6 UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2020, p. 12. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed 17 May 2024.

7 For more details, see Grinschgl, Sandra: Cognitive enhancement – A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication. Grinschgl explains that the scientific evidence for psychological enhancement via medication is currently not very promising. One of the reasons for this is that many relevant drugs have been developed for disease states.

munication technologies fostering team cohesion and enhancing social performance.[8]

1.1.3 Bringing it all together OR introducing the conceptional framework for human augmentation analysis

Building on the human augmentation spectrum differentiation and the human-as-a-platform model, our conceptual framework introduces a novel approach to analysing human augmentation technologies and their military applications. By considering the degree of change, invasiveness and target area, our framework offers a thorough understanding of these technologies. It uses a three-axis model for a comprehensive analysis:

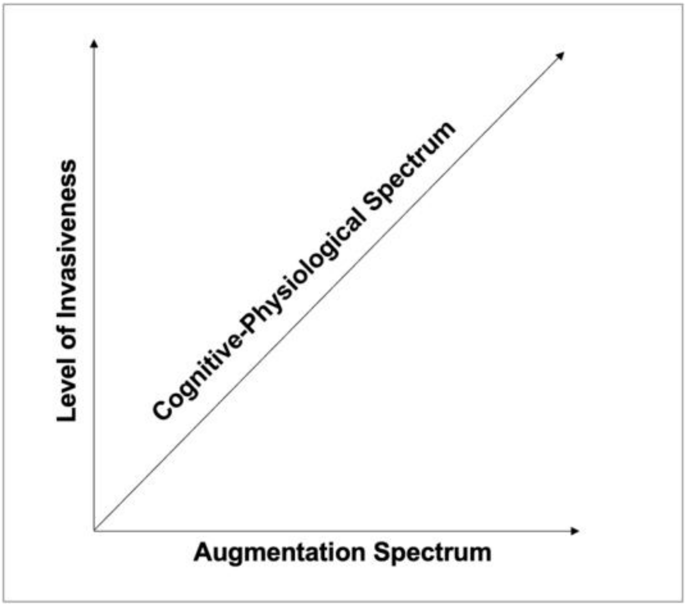

Figure 2: Human augmentation analysis framework. Source: Authors.

[8] UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2020. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed 17 May 2024.

- **Augmentation Spectrum** (X-axis): represents the degree of change, from *optimisation* (refining existing capabilities) to *enhancement* (fundamentally altering human potential).
- **Invasiveness** (Y-axis): reflects the level of physical intrusion, from non-invasive (e.g. wearables) to highly invasive (e.g. neural implants).
- **Cognitive-Physiological Spectrum** (Z-axis): distinguishes between technologies targeting cognitive functions (e.g. memory, decision-making) and physiological functions (e.g. strength, endurance).

Visualising human augmentation technologies within a three-dimensional framework allows for thorough analysis, moving beyond a binary view. This approach is invaluable for assessing military applications, considering ethical and practical implications across various dimensions.

1.2 Definitions and terms

1.2.1 Human performance augmentation and enhancement

To clearly define human optimisation options, it is essential to differentiate between augmentation and optimisation.

<u>Human (performance) augmentation</u>

Human performance augmentation refers to using science and technology to temporarily or permanently improve human performance.[9] This concept bridges technology-centred human-machine interactions.[10]

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9 Planungsamt der Bundeswehr: Human Augmentation – Die Verbindung von Mensch und Maschine. 2021. https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/planungsamt-der-bundeswehr-/human-augmentation-verbindung-mensch-maschine-planungsamt-5016384, accessed 7 April 2024.

10 Idem.

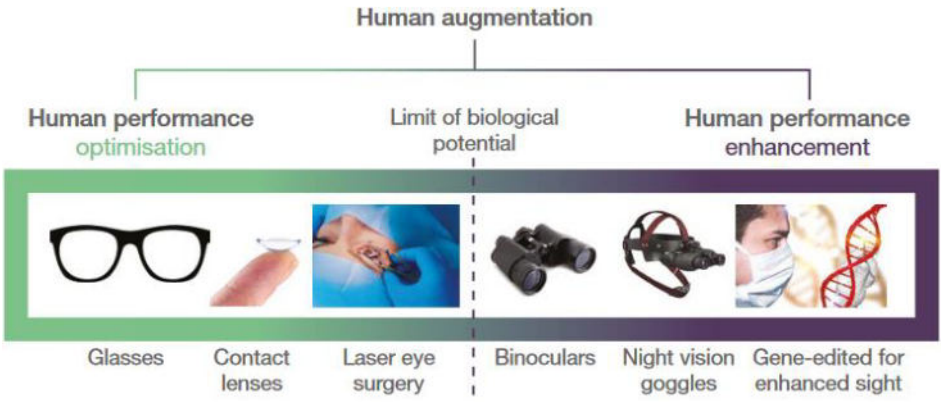

Figure 3: Human performance enhancement (HPE) within the spectrum of human augmentation.[11]

Human performance optimisation (HPO)

HPO involves measures to develop or maintain individual performance, especially when natural abilities are compromised. It focuses on optimising capabilities up to biological limits, such as using an implanted knee joint to restore movement or correcting defective vision.[12]

Human enhancement (HE) or human performance enhancement (HPE)

HE or HPE encompasses all measures that extend performance beyond the individual's maximum potential. This involves physical and/or psychological, but also sensory or cognitive capabilities ("super-human capabilities"). It also includes measures that uncover new characteristics, e.g. new sensory

[11] UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2021, p. 18. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed 28 April 2024.

[12] Planungsamt der Bundeswehr: Human Augmentation – Die Verbindung von Mensch und Maschine. 2021. https://www.bundeswehr.de/de/organisation/weitere-bmvg-dienststellen/planungsamt-der-bundeswehr-/human-augmentation-verbindung-mensch-maschine-planungsamt-5016384, accessed 7 April 2024.

abilities through implants. HE measures can be subdivided into the following categories:[13]

- **Biochemical approaches**: pharmacological, nutrition-based and genetic performance enhancements.
- **Non-invasive approaches**: transcranial stimulation, exoskeletons, augmented reality, silent speech interface systems.
- **Invasive methods:** smart drugs, invasive brain stimulation or brain-computer interfaces.
- **Biomonitoring methods**

Human (performance) enhancement in the military

The use of human enhancement (HE) in the military raises key questions about its integration and systematic definition. HE is defined as any improvement that enhances soldiers' capabilities beyond the standard performance levels required for their roles. These standards are typically measured through fitness criteria and performance metrics. HE is considered when capabilities surpass natural limits, focusing on average performance rather than individual extremes. This approach is aimed at systematically applying biological and technical solutions to boost military performance and operational capability, rather than creating "super soldiers".

It should not be overlooked that the demand for and potential of HE is heavily dependent on the respective field of application. A military pilot operates in a different environment than an engineer or infantryman. In each case, there are different requirements and challenges with regard to what appears accessible and sensible for optimisation in the three dimensions of the physical, psychological and social. From a military perspective, their strategic integration into the overall organisation is crucial.[14]

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13 Erley, Oliver M./Vergin, Annika/Haggenmiller, Christian/Sammito, Stefan: Human Enhancement – alter Wein in neuen Schläuchen oder tatsächlich eine Herausforderung für die Wehrmedizin? 2019, pp. 375-380. https://wmm.pic-mediaserver.de/index.php?f=artikel&a=201910_originbalarbeit, accessed 21 April 2024.

14 See Kunze, Michael/Harbich, Harald: Human Enhancement –biological-neurological aspects from a military perspective. In chapter MEDICINE in this publication.

Moreover, human performance optimisation (HPO) and HE can also address performance issues at the lower end of military capability. For example, as the number of unfit individuals increases, enhancing performance to meet minimum thresholds can improve team cohesion. This concept is known as human performance degradation (HPD), where enhancements help manage or mitigate declines in performance.

Human performance degradation (HPD)

HPD describes performance decline due to stress or tactics aimed at impairing an adversary's capabilities,[15] such as contaminating supplies to impair the enemy's performance.[16] Conversely, it can be used positively to manage hyperactivity, such as treating ADHD to enhance collaboration within a military team.

1.2.2 Humans and technology

One area not to be neglected is the realm of optimisation or enhancement of human capabilities closely intertwined with technology, machinery and artificial intelligence, with particular regard to social, ethical and legal questions of responsibility.

Human-machine teaming (HMT)

Human-machine teaming (HMT) blends human and machine capabilities to enhance collaboration through continuous mutual learning. Artificial intelligence in this context augments human abilities rather than replacing them.

Manufacturing has embraced collaborative robots, or cobots. These machines work alongside human workers, enhancing productivity and safety on the factory floor. Robots can perform repetitive and physically demanding

15 Ibid.

16 Such tactics should be mentioned as they are ancient. The use of HPD tactics in a modern setting must be subject to rigorous legal, ethical and political scrutiny.

tasks, allowing humans to focus on more skilled and creative aspects of production.[17]

In the military, the British Army is pioneering the integration of humans with Robotics and Autonomous Systems (RAS). These systems, supported by robust networks, work within Human-Machine Teams to provide data for faster, better decision-making. Soldiers are equipped with digital skills to understand and trust these systems, even as the number of human soldiers decreases in favour of more numerous and cost-effective platforms that enhance combat effectiveness while reducing risk.[18]

As technology and AI advance, there are concerns surrounding diminishing human roles in decision-making. However, maintaining "human-in-the-loop" (HITL) or "human-on-the-loop" (HOTL) systems remains crucial for legal and operational reasons. Even with fully automated systems, human oversight is essential, and optimising these roles can enhance overall system performance.

Machine enhancement

Machine enhancement focuses on optimising machines to better meet human needs, contrasting with human augmentation, which improves human capabilities for better machine interaction.
As technology advances, including AI and self-learning systems, the role of humans in these interactions remains critical for decision-making and legal responsibility, even as systems become more automated.

1.3 Individual and collective interdependence

From a military perspective, optimising soldiers involves enhancing individual strengths and specialisations. However, cohesive teamwork often outweighs individual performance. Leaders must balance individual and team skills, both physical and cognitive ones, to ensure that no member becomes a liability. Decisions on human enhancement should reflect these priorities.

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17 Ewell, Russ: The Human-AI Collaboration: How Humans and Machines Are Working Together. 2023. https://www.infineon.com/cms/en/discoveries/human-machine-interaction/, accessed 7 April 2024.

18 The British Army: Our Future. Human Machine Teaming. 2023. https://www.army.mod.uk/our-future/modernise/human-machine-teaming/, accessed 7 April 2024.

1.4 HPE challenges for the military[19]

In a military context, biomedical and technological interventions aimed at enhancing individuals' physical or cognitive abilities beyond their natural limits present both opportunities and ethical challenges.

One central dilemma lies in the question of voluntariness and human dignity. The obligation to undergo such enhancements could undermine soldiers' personal autonomy and introduce a new form of coercion. Additionally, access to these technologies could trigger an arms race between nations, where technological superiority takes precedence over diplomacy and disarmament.

Moreover, there are health and societal risks associated with human enhancement.

The long-term health effects of these technologies are often unclear, posing risks to both physical and mental well-being. Furthermore, the introduction of enhancements could lead to a two-tiered society, where enhanced and non-enhanced individuals are treated differently.

Against this backdrop, the international community faces the challenge of developing clear rules and standards for the use of human enhancement within the military. Without proper regulation, human rights could be jeopardised, and global stability and security could be compromised. Careful consideration of the opportunities and risks, as well as an international consensus on ethical and regulatory frameworks, is therefore essential to manage and mitigate the long-term consequences of such technologies.

19 Lin, Patrick: More Than Human? The Ethics of Biologically Enhancing Soldiers. *The Atlantic*, 17 February 2012. https://www.theatlantic.com/technology/archive/2012/02/more-than-human-the-ethics-of-biologically-enhancing-soldiers/253217/.

2. The questions of WHY, WHAT and HOW regarding human enhancement in the military

2.1 WHY human enhancement in the military?

Human enhancement in the military aims to improve operational effectiveness, enhance survivability and maintain a competitive edge. This is driven by the need to adapt to evolving threats and maximise the potential of military personnel.

2.2 WHAT areas can and should be optimised?

Human enhancement in the military can target **physical**, **psychological (cognitive and sensory)** and **social** components. Physical improvements include power, speed, endurance and coordination skills. Psychological optimisation focuses on decision-making, reaction times, resilience and sensory perception. Social enhancements improve teamwork, communication and leadership. Together, these lead to better mission execution and overall performance.

2.3 HOW does the military intend to achieve human enhancement?

The military plans to achieve human enhancement through advanced research and development, integrating new technologies and specialised training programmes. This includes exploring genetic modifications, cognitive enhancers and biomechanical augmentations.

3. Possibilities for optimising abilities through human enhancement

Building on this framework, various methods of HPE/HPO are presented below. The optimisation of human abilities for military performance requires a comprehensive approach that addresses physical, psychological and social dimensions.

3.1 Physical enhancement

Furthermore, the positive impact of physical activities or exercise on cognitive performance complicates the distinct organisational categorisation of human enhancement (HE) measures. Hence, we will initially examine general overlapping areas, and subsequently, where feasible, furnish specific categorisations.

3.1.1 Generalities

Enhancing military physical capabilities involves using purpose-driven tools such as exoskeletons. These devices, designed to be lightweight yet durable, boost lifting, carrying, speed and jumping abilities while offering protection and maintaining mobility. Key factors include seamless human-machine interaction, comfort and reliable energy supply.

Exoskeletons,[20] innovative wearable devices, enhance human mobility and strength. These external structures, designed to support the musculoskeletal system, come in two main categories: passive and active.

- **Passive exoskeletons**: unpowered, they reduce physical strain and injury risk by redistributing weight and supporting proper posture, beneficial in tasks such as heavy lifting and repetitive motions.
- **Active exoskeletons**: powered, they interpret neural signals or amplify natural movements, restoring mobility for disabled individuals and enhancing strength and endurance for able-bodied users. They are used in rehabilitation, industrial and military applications.[21]

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[20] UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2021. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed 28 April 2024.

[21] Idem.

Pharmacological enhancement: substances that affect alertness, concentration, attention or memory, e.g. methylphenidates (e.g. Ritalin) or amphetamine salts such as Adderall[22]

Prosthetics and implants:[23] technological advancements in physical enhancements include prosthetics, joint replacements, artificial lenses, cochlear implants, dental implants, pacemakers, brain stimulators and plastic surgery implants. These innovations address physical limitations and improve body functionality.

Human biomonitoring:[24] wearable sensors to track fitness, stress and physiological metrics. It enables personalised feedback and adjustments through training, pharmaceuticals or human-machine interface improvements.

Biosensors, wearable biomedical systems:[25] over the next two decades, advanced systems will monitor soldier health in real time, detecting biomarkers for CBRN agent exposure, disease management and biomedical research.

Optogenetic bodysuit sensor web:[26] this emerging technology offers sensory feedback for muscle control, potentially enhancing physical performance within 20 years.

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22 For more on this, see Grinschgl, Sandra: Cognitive enhancement – A critical reflection from psychology and neuroscience. In chapter MEDICINE in this publication. Grinschgl refers to the fact that both long-term risks and side effects have not been sufficiently explored. In addition to ethical considerations, both must be carefully evaluated before any use can even be considered.

23 Schuster, Inge: Transhumanismus - der Mensch steuert selbst seine Evolution. 2019. https://scienceblog.at/transhumanismus-der-mensch-steuert-selbst-seine-evolution, accessed 28 April 2024.

24 NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains. 2023 pp. 63 and 69. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol2.pdf, accessed 28 April 2024.

25 Ibid., pp. 63 and 89; for more on this see Kunze, Michael/Harbich, Harald: Human Enhancement –biological-neurological aspects from a military perspective. In chapter MEDICINE in this publication.

26 Ibid., 64.

Implanted chips for monitoring and identification:[27] implanted chips monitor health and identity, issuing alerts for timely interventions and facilitating secure environmental interactions.

Brain-computer interfaces (BCI):[28] allow individuals to control external devices using their brain activity, particularly in the cognitive area, as mentioned in point 2.2.2.

Detection and treatment of wounds:[29] AI-supported systems can improve wound detection and treatment, especially in high-demand environments, ensuring effective care and triage.

Below, individual aspects of physical capability optimisation are examined in detail.

3.1.2 Power and speed

Power and speed can be enhanced through training, mechatronic devices such as exoskeletons, nutrition and physical enhancement drugs. However, drugs such as stimulants and steroids often have serious side effects and limited applicability.[30]

3.1.3 Endurance

Increasing resilience and endurance involves various forms of endurance, including strength endurance and speed endurance. With regard to prolonged endurance performance, an optimally coordinated alternation be-

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27 Idem.

28 Vilela, Marco/Hochberg, Leigh R.: Applications of brain-computer interfaces to the control of robotic and prosthetic arms. 2020, pp. 87-99. https://www.sciencedirect.com/science/article/abs/pii/B9780444639349000081, accessed 28 April 2024.

29 Chaichulee, Sitthichok/Chairat, Sawrawit et al.: AI-Assisted Assessment of Wound Tissue with Automatic Color and Measurement Calibration on Images Taken with a Smartphone. 2023. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9858639/, accessed on 3 May 2024.

30 Shao, Shuyu/Wu, Jintao/Zhou, Qianxiang:Developments and Challenges in Human Performance Enhancement Technology. 2021. https://www.sciencedirect.com/science/article/pii/S2590093521000394, accessed 28 April 2024.

tween exertion and recovery phases is crucial. While stimulants such as caffeine to amphetamines and Modafinil® enhance endurance capacity for up to 40 hours,[31] sleep aids and tranquilisers are intended to promote more effective recovery. Studies showed that prolonged use carries more serious risks. These potential risks encompass the development of conditions such as arrhythmia, high blood pressure, and a compromised immune system.[32]

3.1.4 Coordination and Life Kinetik

Special methods, including Life Kinetik training, improve coordination, reaction speed and cognitive performance, enhancing movement techniques and athletic performance.[33]

3.1.5 Genetics

The exploration and application of genetic characteristics for enhanced performance are still in the development phase. This concept draws inspiration from elite sports, where genes of exceptional athletes are considered for gene therapy to enhance the performance of others.

CRISPR/Cas9 (clustered regularly interspaced short palindromic repeats)[34]

Germline engineering alters an organism's entire genetic makeup and is heritable, impacting future generations, whereas somatic modification targets specific cells, affecting only the treated individual. CRISPR/Cas9 technology

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31 Tovey, Mark: British troops 'kept awake on smart drugs': How MoD has spent up to £800,000 on more than 12,500 doses of controversial stimulant modafinil over the last eight years², in https://www.dailymail.co.uk/news/article-10707005/Thousands-smart-drugs-bought-MoD-soldiers-awake-40-hours-straight.html, accessed 28 April 2024.

32 Idem.

33 Komarudin, Komarudin/Awwaludin, Patriana Nurmansyah: Life Kinetik Training in Improving the Physical Condition of Football Athletes. 2019. In https://www.researchgate.net/publication/336722602_Life_Kinetik_Training_in_Improving_the_Physical_Condition_of_Football_Athletes, accessed April 2024.

34 UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2021, p. 95. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm, accessed 28 April 2024.

allows precise gene manipulation, achieving notable success in treating genetic disorders, such as a 2019 case where it addressed a lethal condition.

Genetic modification, including DARPA's pursuit of creating super soldiers with extraordinary abilities, offers significant potential for human enhancement. However, it also raises profound ethical and societal concerns, such as the blurring of moral boundaries, unequal access to enhancements and unintended consequences for human evolution.

3.2 Cognitive (psychological) enhancement

Beyond physical capabilities, cognition presents a vast realm for human performance optimisation (HPO) and enhancement (HPE). Derived from the Latin "cognition", meaning "knowledge", cognition encompasses all mental information processing processes. This includes perceptual and cognitive functions, both conscious and unconscious ones. Cognition involves the intake/perception, processing, storage and retrieval of information, with a focus on problem-solving skills and motivation.

3.2.1 Sensory (reception of the environment)

Commonly known as sensorics, this involves enhancing sensory perception across the **five senses (sight, hearing, touch, taste, smell)**, viewing humans as sensors interacting with their environment. Improvement in this area enables quicker and more comprehensive intake of information, complemented by optimised cognitive processing.

General and multi-sensor measures in human performance optimisation (HPO) and enhancement (HPE) are outlined, along with specific measures related to sight, hearing and touch. In a military context, taste and smell are not prioritised for HPO and HPE, as alternative solutions, such as technical or canine olfactory capabilities, are more suitable.

<u>Sense of sight</u>

In the visual area, the diversity of options provided by HPO and HPE is particularly evident. Consequently, only a selection can be presented here.

Ocular enhancements involve overlaying data streams onto a soldier's retinal wall, potentially expanding their vision beyond visible light. For instance, soldiers equipped with such implants might gain the ability to see objects within the infrared range, allowing them to detect hidden threats or navigate environments with low visibility, such as smoke-filled battlegrounds or dark subterranean areas.[35]

<u>Cross Reality (XR)</u>[36]

Cross Reality (XR) includes **Virtual Reality (VR)**, **Mixed Reality (MR)** and **Augmented Reality (AR).** Extended Reality (XR) encompasses Virtual Reality (VR), Mixed Reality (MR) and Augmented Reality (AR). In military aviation, XR has been used for years through head-up displays, helmet systems and flight simulators, with expanding applications due to reduced costs. VR is applied in education, medicine, gaming and entertainment, while AR is increasingly utilised in advertising and retail. In defence, VR is used for training, and AR improves situational awareness by overlaying information onto the real world. XR's utility is limited by energy, processing power, broadband speeds and data security. The UK's Royal Navy, for instance, uses AR glasses to enhance situational awareness and decision-making on frigate bridges, showcasing XR's impact on military operations.[37]

Cross Reality has emerged as game-changer, reshaping the landscape of military training, e.g.:[38]

- Immersive VR and AR simulate battlefields and enhance tactical readiness, decision-making and marksmanship.

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35 The National Interest, Task and Purpose: DARPA is Eyeing a High-Tech Contact Lens Straight Out of 'Mission: Impossible'. 2019. https://nationalinterest.org/blog/buzz/darpa-eyeing-high-tech-contact-lens-straight-out-mission-impossible-54617, accessed 28 April 2024.

36 UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2021, pp. 36f. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm.

37 Idem.

38 Proven Reality: 20+ Applications of VR and AR in Military Training. https://provenreality.com/virtual-reality/applications-of-vr-and-ar-in-military-training/, accessed 29 April 2024.

- AR aids target identification, tactical data overlay and cost-effective environmental and cybersecurity training.
- VR stress inoculation and AR fitness programmes prepare soldiers physically and psychologically.
- AI integration and wearable AR promise enhanced realism and battlefield awareness.

Neil Harbisson, a colour-blind artist, uses a head-mounted antenna with a colour sensor that converts colours into sounds, enhancing his perception. This showcases how technology can expand sensory capabilities, providing new modes of perception.[39]

Head-up displays (HUDs)[40]

Overlay targeting symbols on real-world targets, enhancing situational awareness and decision-making. These displays overlay targeting symbols on real-world targets, enhancing situational awareness and decision-making by providing vital information directly to the user's field of view.

In the near future, head-up displays will undergo further development with a focus on three key areas.

- Improvements in the power efficiency of micro-displays
- Advancements in optical fabrication techniques for free-form optical surfaces, and
- Integration and proliferation of smartphones and wireless data links.

Auditory sense

Auditory enhancements could protect soldiers from overexposure to loud noises while also increasing sensitivity to low-amplitude sounds. For example, soldiers with auditory implants might have the capability to detect faint sounds that could signal approaching danger or communicate discreetly with

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39 Donahue, Michelle Z.: Ein farbenblinder Künstler wurde zum ersten Cyborg der Welt. https://www.nationalgeographic.de/wissenschaft/2017/04/ein-farbenblinder-kuenstler-wurde-zum-ersten-cyborg-der-welt, accessed 29 April 2024.

40 NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains, 2023. p. 66, https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol2.pdf., accessed 28 April, 2024.

fellow soldiers using specialised frequencies. This heightened auditory perception could enhance situational awareness and communication on the battlefield, potentially saving lives in high-stress environments.[41]

The development of ocular and auditory implants could become feasible approximately 30 years from now.[42]

<u>Sense of touch – Fine motor skills</u>[43]

Fine motor skills are crucial in military tasks such as weapon handling, equipment operation and medical procedures. Stressors such as psychological pressure, physical fatigue and loud noises can impair these skills by causing brain overstimulation, concentration issues and anxiety.

Experience can mitigate stress impacts on fine motor skills, with seasoned personnel often showing better stress management, cognitive function under pressure and motor performance.

Understanding the interplay between stress, experience and fine motor skills is essential for developing effective training and support strategies. Tailored training and mental health support can enhance performance and safety. Further research is needed to better understand these relationships and improve training protocols.

3.2.2 Cognitive processes

Enhanced sensory perception should lead to improved cognitive function. Cognitive training, neurofeedback technologies and brain stimulation aid in enhancing cognitive performance in areas such as thinking, memory retrieval, learning, problem-solving and accelerated decision-making.

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41 U.S. Army Combat Capabilities Development Command Chemical Biological Center: Researchers Help DoD Consider Challenges of Human Enhancement. 2019. https://www.cbc.devcom.army.mil/newspost/researchers-help-dod-consider-challenges-of-human-enhancement/, accessed 28 April 2024.

42 Idem.

43 Stergiou, Maria/Aladro-Gonzalvo, Arian R./Tornero-Aguilera, José F. et al.: Influence of Combat Experience on Psychophysiological and Fine Motor Skill Responses in Air Force Warfighters under Acute Stress. 2023. https://revistamedicinamilitara.ro/wp-content/uploads/2024/01/RJMM-vol-CXXVII-nr-5-din-2024-part-1.pdf, accessed 29 April 2024.

Improvements have been observed in cognitive functions and procedural processes from transcranial stimulation, such as voluntary motor skills and memory. Long-term enhancements are achievable through device-based treatment and tailored training.[44]

Non-invasive methods for synaptic plasticity:[45] increase synaptic plasticity for improved cognitive performance and learning, supporting rapid and practical training of military personnel in complex tasks.

Decision-Making under Stress: Mixed Reality Applications for Cognitive Training:[46]

The U.S. Army's Synthetic Training Environment (STE) programme uses mixed reality technology to create immersive training environments. Soldiers engage in realistic scenarios that challenge cognitive abilities, such as decision-making under stress, enhancing their cognitive skills in simulated combat situations.

Commercialisation and accessibility:[47] consumer-grade EEG headsets, like those from NeuroSky, democratise access to neurofeedback technology, enabling users to monitor brain activity and engage in brain-controlled applications and games for cognitive enhancement. Neurofeedback therapy with tools such as MindReflector has shown significant improvements in PTSD symptoms among veterans, enhancing sleep, reducing irritability and improving concentration, thus enhancing their quality of life and relationships.

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44 Coffman, Brian A./Clark, Vincent P./Parasuraman, Raja: Battery powered thought: Enhancement of attention, learning, and memory in healthy adults using transcranial direct current stimulation. In: NeuroImage, Volume 85, Part 3, 15 January 2014, pp. 895-908, https://www.sciencedirect.com/science/article/abs/pii/S1053811913008550?via%3Dihub, accessed 12 August 2024.

45 Defense Advanced Research Projects Agency (DARPA): Boosting Synaptic Plasticity to Accelerate Learning. 2016. https://www.darpa.mil/news-events/2016-03-16, accessed 29 April 2024.

46 Novogradac, Michael M.: Soldiers test new synthetic training environment. 2024. https://www.army.mil/article/274266/soldiers_test_new_synthetic_training_environment, accessed 29 April 2024.

47 NeuroSky: Neurofeedback for Military Veterans with PTSD. 2017. https://neurosky.com/2017/09/neurofeedback-for-military-veterans-with-ptsd/, accessed 29 April 2024.

Neurological interfaces and brain-machine interfaces (BMIs) **and direct neural enhancement:**[48] BMIs record and stimulate brain activity to enhance brain function, including devices such as cochlear and retinal prostheses.

Brain-computer interfaces (BCIs):[49] BCIs translate brain activity into commands for controlling external devices, aiding individuals with severe motor disabilities in communication and interaction through neural activity recording and decoding.

Neuralink®:[50] founded by Elon Musk, Neuralink integrates brain waves with artificial intelligence to enhance cognitive capabilities and technological integration.

Cognition-enhancing drugs:[51]

Cognition-enhancing drugs, or nootropics, include substances like caffeine, nicotine, amphetamines, methylphenidate and modafinil, which boost alertness and focus. Anti-dementia drugs improve long-term memory, while beta-blockers reduce stage fright and enhance memory consolidation. Interest is also growing in psychedelic drugs such as LSD and MDMA for their therapeutic potential. Herbal supplements, such as Rhodiola rosea and Ginkgo biloba, help reduce fatigue and enhance memory in the elderly, and amino acid supplements such as D-serine and L-tyrosine show promise in improving cognitive function under acute stress. Modafinil® is widely used to increase wakefulness and alertness, particularly in individuals with sleep disorders.

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48 Andrews, Russel J./Perdikis, Serafeim: Neurotechnology: brain-computer and brain-machine interfaces. 2023. https://www.medlink.com/articles/neurotechnology-brain-computer-and-brain-machine-interfaces, accessed 29 April 2024.

49 Vilela, Marco/Hochberg, Leigh R.: Applications of brain-computer interfaces to the control of robotic and prosthetic arms, 2020, pp. 87-99. https://www.sciencedirect.com/science/article/abs/pii/B9780444639349000081, accessed 28 April 2024.

50 Der Standard: Ist Elon Musks Neuralink-Implantat die Zukunft der Menschheit? 2024. https://www.derstandard.at/story/3000000206178/ist-elon-musks-neuralink-implantat-die-zukunft-der-menschheit, accessed 29 April 2024.

51 UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2021, p. 87f. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm.

These substances primarily impact alertness and memory rather than overall intelligence and can alter brain states with potential trade-offs between cognitive styles. In military settings, they may enhance performance, mitigate fatigue and improve situational awareness, but require careful monitoring for safety and effectiveness.[52]

The legalisation of cannabis in Germany presents specific issues for military personnel. While soldiers face no legal repercussions for recreational cannabis use outside of duty, it remains prohibited in military settings, with penalties for infractions. Some advocate revisiting this zero-tolerance policy, similar to Canada's approach, considering factors such as military readiness, soldiers' health and societal attitudes towards cannabis.[53]

3.2.3 Concentration and vigilance

To enhance concentration and sustain attention, various biochemical and pharmacological methods for performance enhancement are available. Modafinil®, for instance, was previously cited as an example. Additionally, advancements in attention (vigilance) over prolonged periods have been achieved through techniques such as transcranial stimulation.[54]

Peripheral nerve stimulation for cognitive enhancement: non-invasive brain stimulation techniques such as transcranial direct current stimulation (tDCS), which can enhance cognitive functions, similar to the example of tDCS being used for cognitive enhancement in military training scenarios.[55]

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52 Idem. It is important to note that the transfer of results of studies with sick patients cannot occur without further ado and is scientifically presuppositional. This opens up a field of extensive research.

53 Bombeke, Yann: Cannabis wird in Deutschland legal – aber auch für Soldaten? 2023. https://www.dbwv.de/aktuelle-themen/blickpunkt/beitrag/cannabis-wird-in-deutschland-legal-aber-auch-fuer-soldaten, accessed 1 May 2024.

54 Brühl, Annette/d'Angelo, Camilla/Sahakian, Barbara J.: Neuroethical Issues in Cognitive Enhancement: Modafinil as the Example of a Workplace Drug? 2019. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7058249/, accessed 2 May 2024.

55 Idem.

3.2.4 Memory

Improvement in memory and recall. Improvements in memory have been achieved with transcranial stimulation.[56]

3.2.5 Communication

Interaction with other people - communication as a means[57]

Human interaction with the environment involves three key processes:

- Perception: gathering information through sensory input.
- Cognition: interpreting, processing, storing information and preparing responses.
- Action: responding to the environment through communication, which can be verbal or nonverbal (e.g. facial expressions, gestures, written signs). To prevent misunderstandings in the interpretation of information, knowledge of cultural peculiarities and foreign language skills are advantageous.[58]

Social media has profoundly transformed communication in the past 15 years, influencing the social, economic and political spheres. With over 3.5 billion daily users – representing 45% of the global population –it has become a powerful tool in shaping perceptions and behaviours, making it crucial for considerations in defence, security and safety.[59]

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[56] Phipps, Connor J./Murman, Daniel L./Warren, David E.: Stimulating Memory: Reviewing Interventions Using Repetitive Transcranial Magnetic Stimulation to Enhance or Restore Memory Abilities. 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8533697/#:~:text=Specifically%2C%20transcranial%20magnetic%20stimulation%20(TMS,symptomatic%20treatment%20for%20memory%20loss, accessed 1 May 2024.

[57] Der Standard: VR-Brille soll Sprachenlernen Leichter machen. 2017. https://www.derstandard.at/story/2000054546715/vr-brille-soll-sprachenlernen-leichter-machen, accessed 1 May 2024.

[58] Idem.

[59] NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains. 2023, p. 67. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol2.pdf, accessed 28 April 2024.

Silent speech interface (SSI) systems[60]

In aerospace and defence, AR and VR interfaces often face issues with cumbersome input mechanisms. Silent speech interfaces using non-invasive EMG electrodes offer a potential solution for controlling military equipment, such as head-up displays (HUDs) and AR systems. Developing seamless, low-profile input methods is crucial in maintaining discretion and efficiency in military contexts. While current interfaces are proof-of-concept, further research is needed to validate their feasibility and integrate them with devices such as Microsoft HoloLens for practical AR applications.[61]

3.2.6 Strengthening the will and motivation

There are several ways to strengthen motivation and willpower. On one hand, techniques and specific motivation training can be used to enhance mental strength and perseverance. On the other hand, medications, with careful consideration of risk and benefit, can also be supportive in achieving this goal.

Motivation, the drive to achieve goals, is a key focus of smart drugs such as stimulants, which target arousal and the dopaminergic system.[62] Attention, closely linked to motivation, is influenced by the cholinergic system. Besides drugs, software interventions can fine-tune motivation by directing attention and employing conditioning techniques.[63] Managing boredom, attention and drive is crucial across contexts. However, substances used for motivation enhancement can have unintended side effects, prompting the exploration of nanomaterials for precise control. Emotional enhancements such as trust and empathy are vital, requiring breakthroughs in neuropsychology and ethical considerations. Strengthening willpower can prioritise long-term goals, while addressing boredom is essential to enhance motivation.[64]

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60 Flanagan, Riley/Rivas, Tania: Wearable Silent Speech Interface for Augmented Reality Applications. 2020. https://commons.erau.edu/cgi/viewcontent.cgi?article=1550&context=discovery-day, accessed 1 May 2024.

61 Idem.

62 UK Ministry of Defence: Development, Concepts and Doctrine Centre (DCDC): Human Augmentation – The Dawn of a New Paradigm. 2021, p. 89. https://www.gov.uk/government/publications/human-augmentation-the-dawn-of-a-new-paradigm.

63 Idem.

64 Ibid., p. 90.

3.3 Social enhancement

Social enhancements emphasise improving communication, leadership and teamwork abilities. Training programmes and advanced communication tools are crucial in enhancing these skills.

Social media and networks:[65] aids in intelligence collection, targeting, command and control, defence and psychological warfare, enhancing overall operational effectiveness by leveraging information from social platforms.

- **Increasing complexity in research**: advanced methods for understanding, modelling and simulating social networks are enhancing our grasp of human social behaviour.
- **Predicting emergent properties**: this complexity aids in predicting the emergent properties of social systems, crucial in tackling disinformation and hybrid warfare campaigns.
- **Virtual reality applications**: the use of virtual reality to augment social interactions is growing, with significant implications for both civil and military sectors.
- **Link to human-machine teaming**: developments in social network dynamics and virtual reality are increasingly intersecting with human-machine teaming strategies.[66]

4. Humans in the information environment – Information as the key

Crucial to human enhancement is a holistic perspective; individual optimisations yield little benefit if they cannot be efficiently processed and implemented. Remember: it is all about the systematic applicability of biological-technical solutions to increase military performance and operational capability. This goal constantly raises new questions, the answers to which require information to be processed and decisions to be made. In an environment inundated with stimuli, individuals are only capable of optimised performance *when they can adapt and improve their cognitive abilities and decision-making processes*. Figure 4 illustrates this cycle and its dependencies.

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[65] NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains. 2023, p. 66. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol1.pdf.

[66] Idem.

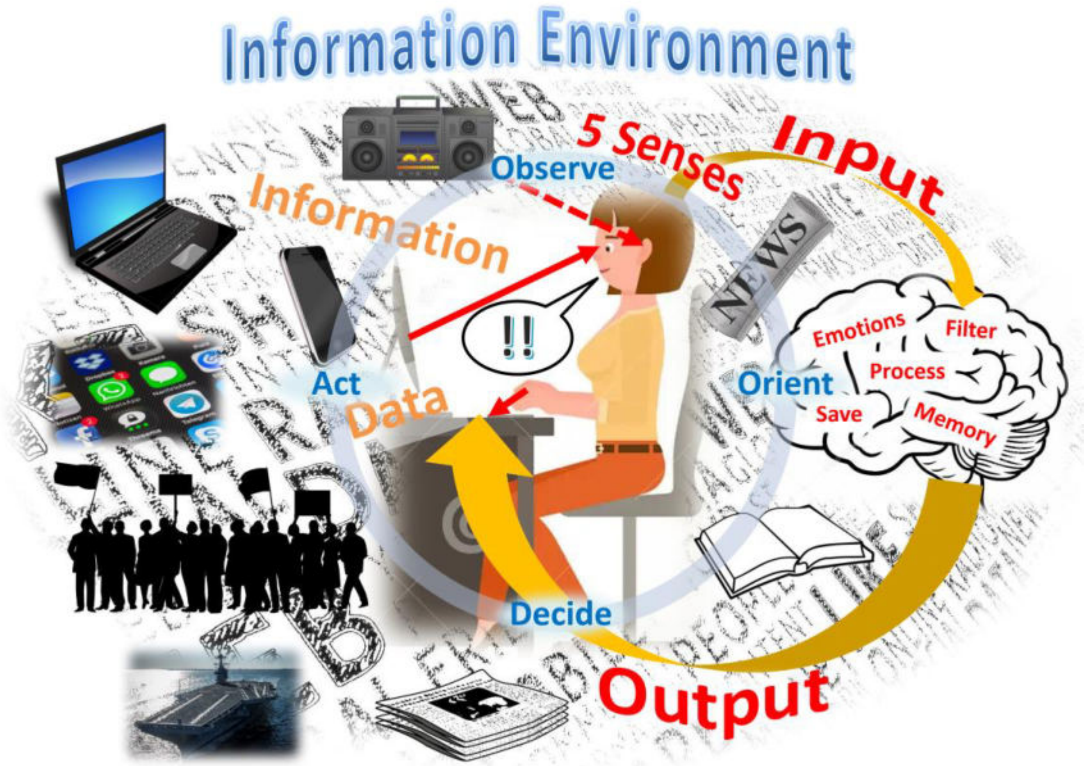

Figure 4: The human in the information environment – The cycle of cognition consists of perceiving information through the senses, further filtering it within the cognitive process, processing it considering emotions and experiences, storing it and then re-entering into interaction with the environment through communication. Information can be diverse, both physical and digital – data becomes information when it is individually of interest. HPO and HPE serve to optimise or improve individual steps within the OODA loop, while considering the overall value. Source: Authors.

The following are some of these dependencies and developmental steps:

Neural interfaces:[67] enable rapid data transfer and control between the brain and devices, improving situational awareness and decision-making.

[67] Idem.

Bioinformatics:[68] utilised for the collection, classification, storage, retrieval and analysis of biological and biochemical data, supporting predictive diagnostics and personalised medicine.

Personalised training and performance metrics:[69] enable tailored training programmes and real-time performance monitoring, optimising individual and team performance.

5. Human augmentation and the OODA loop – Optimising the cognitive edge and fostering continuous improvement

In today's information-saturated environment, quick and effective decision-making is essential. Optimising cognitive processes is crucial in distinguishing useful patterns from noise.[70] This chapter explores how the OODA loop – a cyclical decision-making framework developed by military strategist Colonel John Boyd – enhances cognitive performance in dynamic situations.[71] The OODA loop, comprising Observe, Orient, Decide and Act, provides a robust template for continuous improvement in military contexts and human augmentation.

Why the OODA loop and not another model

The OODA loop's iterative and adaptive approach sets it apart from linear decision models, which often struggle in rapidly changing environments. Its cyclic nature allows for continuous adjustments based on new information, crucial in maintaining initiative and strategic agility. This model aligns well with the need for ongoing learning and optimisation, especially in military applications where rapid decision-making is paramount.[72]

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68 Idem.

69 Idem.

70 Lynn, Spencer K./Barrett, Lisa F.: "Utilizing" signal detection theory. 2014. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4304641/, accessed 26 June 2024.

71 Coram, Robert: Boyd. The Fighter Pilot who changed the Art of War. New York: Hachette Book Group. 2010; Boyd, John. Patterns of Conflict. Defense and the National Interest. Atlanta, accessed in April 2024 and available in PDF format at http://www.d-n-i.net; Boyd, John: Destruction and Creation. U.S. Army Command and General Staff College. 1976; Brown, Ian T.: A New Conception of War: John Boyd, the U.S. Marines, and Maneuver Warfare. Marine Corps University Press. 2018.

72 Wetzel, Tyson: *The New Green Book: The Need for an Anthology of John Boyd's Work,* https://www.colonelboyd.com/understanding-war, accessed 30 June 2024.

5.1 The OODA loop – Enhancing military performance through continuous improvement

The OODA loop transcends immediate decision-making, serving as a framework for continuous improvement at all levels of military operations:

- **Observation:** soldiers and units actively collect performance data through after-action reviews, live-fire exercises, fitness assessments and feedback mechanisms.
- **Orientation:** data is scrutinised to identify individual skill deficiencies, team tactic weaknesses and operational gaps. Understanding underlying causes – whether inadequate training, equipment constraints or communication breakdowns – is critical.
- **Decision:** informed choices lead to tailored improvement initiatives. Individual soldiers may undergo specialised training, teams might adopt new communication protocols and leadership could pivot strategies based on evolving dynamics.
- **Action:** decisions translate into targeted skill-building exercises, revised tactics and enhanced communication protocols. Leadership implements changes in deployment strategies, technology applications and training regimens.

<u>Benefits of the OODA loop for military improvement:</u>

- *Rapid learning*: continuous feedback fosters rapid adaptation from diverse experiences.
- *Mission optimisation*: constant evaluation improves operational strategies and tactics.
- *Maintaining the competitive edge*: the cycle ensures adaptability in the face of evolving threats and technologies.

<u>Examples of the OODA loop in military applications:</u>

- *A Special Forces unit*: observes enemy tactics, identifies a defensive vulnerability, decides on a new infiltration approach and executes a surprise attack.

- *A fighter pilot*: analyses after-action reports, identifies areas for improvement, decides on specific training exercises and practises manoeuvres.
- *Military leadership*: reviews intelligence reports, identifies weaknesses, decides on new hardware acquisitions or training programmes and implements changes.

5.2 The OODA loop and the cognitive dimension

The OODA loop offers a powerful framework for optimising information processing within the human brain, a crucial enhancement avenue for military human augmentation. This section focuses on the core information processing capabilities of the human mind and how augmentation can enhance them.

<u>Elevating cognitive performance –
The human element in military operations</u>

In military operations, cognitive processes are crucial for soldiers navigating complex and high-pressure environments.[73] Focusing on training to refine perception, thought processes and actions is essential in enhancing cognitive performance. This approach complements technological advancements by focusing on the human element as a primary enhancement avenue.

<u>Tapping into the powerhouse with the OODA loop to optimise information processing as an enhancement aspect in human augmentation</u>[74]

The OODA loop highlights the stages of information processing in military contexts: observation, orientation, decision and action. Integrating augmen-

[73] Schulyok, Bernhard/Grangl, Lukas/Gruber, Markus: The Importance Of Cognitive Superiority – A Primer On The Functional Trinity Of The Information Environment. In: *The Defence Horizon Journa*l. 2023. https://doi.org/10.5281/zenodo.8405013, accessed 25 May 2024.

[74] Overview compiled and synthesised from contributions and inspirations from the following authors and their respective works: Department of the Navy. 2018; Warfighting, MCDP-1; Department of the Navy United States Marine Corps (USMC). Washington; Brown, Ian T.: A New Conception of War: John Boyd, the U.S. Marines, and Maneuver Warfare. Marine Corps University Press. 2018; Coram, Robert: Boyd. The Fighter Pilot who changed the Art of War. Hachette Book Group. New York. 2010; McChrystal, G. S. et al.: Team of Teams. Portfolio Penguin. 2015.

tation technologies within this framework offers potential for optimisation at each stage.

Observe

- Soldiers actively gather and prioritise critical information from their environment. Augmentation can enhance observation through improved data collection and interpretation.
    - **Application example:** wearable sensors and brain-computer interfaces (BCIs) could refine data collection and filter irrelevant sensory inputs, focusing on critical cues and accelerating threat detection.

Orient

- Soldiers interpret and contextualise information to understand the battlefield. Augmentation can expedite this process through real-time analysis and enhanced situational awareness.
    - **Application example:** BCIs could provide real-time data analysis and augmented mental maps, aiding in quicker orientation and better informed decision-making.

Decide

- Rapid and accurate decision-making is crucial under pressure. Cognitive enhancement strategies can improve decision speed and accuracy.
    - **Application example:** Nootropics and targeted brain stimulation could enhance focus, while decision support systems via BCIs offer real-time aids and optimal action suggestions.

Act

- Translating decisions into action efficiently involves coordination and adaptability. Physical training and motor skill development are currently essential, but future technologies may enhance this process.
    - **Application example:** exoskeletons or neural interfaces could improve motor control and reaction times, while BCIs might enable more direct control over weaponry and communication systems.

The OODA loop enhances military information processing by optimising perception, thought processes and action, fostering sharper cognitive abilities and efficient decision-making. Its dual role as both tool and framework supports continuous improvement and adaptation, crucial in enhancing military effectiveness through human augmentation.

6. Outlook

Systematic integration for military enhancement

A holistic approach integrating biological and technical solutions is vital to boost military performance. This involves optimising cognition – sensing, processing and interacting with information – to enhance operational capability.

Technological and cognitive advancements

Neural interfaces and bioinformatics advance situational awareness and personalised medicine. These technologies enable rapid brain-device data transfer, efficient data management and support predictive diagnostics and tailored training for performance optimisation.

Ethical and strategic considerations

Cognitive and technological enhancements raise ethical, social and legal concerns. Using frameworks like the human-as-a-platform model helps ensure responsible development, balancing enhancements with ethical considerations to maintain public trust and gain strategic advantages.

The integration of disruptive technologies with artificial intelligence enables developments that were unthinkable just a decade ago. The following table presents, for example, NATO's assessed necessity of development and identifies areas for focused research (Fig. 5):[75]

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[75] NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains. 2023, p. 73. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol2.pdf, accessed 28 April 2024.

Survey Results

The following table presents the assessed potential impact, state and rate of development and identifies areas for focused research.

Table C.1: Biological and Human Enhancement Technologies (BHET) 2023 - 2043.

EDT	Technology Focus Areas	Impact	TRL	Horizon
BHET	Bio-engineering & Genetics	High	5-6	2030-2035
	Bio-informatics	High	7-8	2025-2030
	Bio-manufacturing	High	3-4	2030-2035
	Bio-sensors & Bio-electronics	High	3-4	2030-2035
	Cognitive Enhancement	Revolutionary	3-4	2035 or (+)
	Human-Machine Symbiosis	Revolutionary	3-4	2035 or (+)
	Physical Enhancement	High	5-6	2030-2035
	Social Enhancement	High	5-6	2030-2035

Figure 5: NATO's assessed necessity of development and identified areas for focused research (*TRL – Technology Readiness Levels, EDT – Emerging and/or Disruptive Technology)*

Civilian and military research efforts, exemplified by DARPA, are increasingly intertwined, highlighting the need for vigilance as humanity transitions towards advanced combat technologies. DARPA's work includes remote-controlled helmets using transcranial ultrasound to enhance attention, manipulate emotions and reduce sensitivity to fear and pain.[76]

Bio and human enhancement technologies (BHETs) expected in the next 20 years will redefine soldiers, sailors and aviators.[77]

DARPA's advancements in bioengineering and genetics aim to revolutionise military operations with novel biotechnologies. Initiatives such as the BRAIN programme focus on neurostimulation and brain-computer interfaces to enhance soldiers' decision-making and cognitive functions, optimis-

[76] Der Standard: G.I.s durch Ultraschall aus dem Helm stimuliert. 2010. https://www.derstandard.at/story/1282979404209/zukunftsaussicht-gis-durch-ultraschall-aus-dem-helm-stimuliert?ref=article, accessed 1 May 2024.

[77] NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains. 2023, p. 64. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol1.pdf, accessed 1 May 2024.

ing resilience and effectiveness in combat[78] and shaping the future of warfare in information-rich environments.[79]

In the realm of bio and human enhancement technologies, a plethora of innovative advancements are on the horizon, each poised to revolutionise military capabilities and operations:[80]

- **Super sensing:** enhancing human senses and cognitive abilities through neurotechnology, improving learning speed and reaction times.
- **Body self-repair:** utilising DNA restructuring and synthetic biology for wound healing and tissue regeneration.
- **Bio-databases:** employing living organisms for secure and efficient data storage and processing.
- **Human-machine integration:** augmenting soldiers with exoskeletons or internal enhancements for increased strength, balance and speed.
- **Chemical or biological analysis:** instant substance identification to bolster threat detection and situational awareness.
- **Health monitoring:** continuous tracking of individual health to optimise performance and resilience.
- **Realistic training environments:** using virtual or augmented reality to create immersive, lifelike training scenarios.
- **Psychotic effects:** researching the remote induction of mass hysteria or hallucinations for psychological warfare.
- **Genetic targeting:** designing targeted pathogens or antidotes for strategic defence and offence.
- **Bio-infrastructure:** developing stealth infrastructure with bio-concrete for covert operations in austere environments.
- **Living sensors:** utilising bacteria to detect mines, monitor intrusions and identify early CBRN threats.

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78 NATO: Science and Technology Trends 2023-2043 – Across the Physical, Biological, and Information Domains. 2023, p. 74. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/3/pdf/stt23-vol2.pdf, accessed 28 April 2024.
79 Idem.
80 Idem.

6.1 Takeaways

- **Holistic human enhancement:** combining biological and technical solutions optimises sensing, processing and decision-making to enhance military performance.
- **Advancements in technology and cognition:** neural interfaces and bioinformatics improve situational awareness, decision-making and personalised medicine, supporting predictive diagnostics and tailored training.
- **Ethical and strategic considerations:** developing high performance optimisation (HPO) and human performance enhancement (HPE) technologies requires ethical frameworks, such as the human-as-a-platform model, to align with military goals and maintain public trust.
- **Monitoring and response:** continuous monitoring of HPO and HPE advancements ensures adaptability to technological changes and global challenges.
- **Mission integration:** incorporating HPO and HPE into military strategies boosts teamwork, mission success and overall operational effectiveness.

6.2 To-dos

- **Develop integrated solutions:** implement biological and technical innovations to optimise cognitive processes and enhance military performance.
- **Invest in key technologies:** focus on neural interfaces, bioinformatics and related technologies to improve situational awareness, decision-making and medical support.
- **Establish ethical guidelines:** create clear ethical guidelines for the responsible development and deployment of HPO and HPE technologies, addressing ethical, societal and legal aspects.
- **Maintain vigilance and adaptation:** set up mechanisms for ongoing monitoring and adaptation to swiftly respond to technological advancements and geopolitical changes.

- **Integrate into military strategies:** incorporate HPO and HPE enhancements into training programmes and operational planning to optimise teamwork and mission success.

This article highlights advancements in military HPE, emphasising the importance of discerning technology adoption. Beyond technical feasibility, these enhancements are crucial in improving teamwork and mission success. As fitness levels decline, HPO and HPE offer significant opportunities for individual readiness. The OODA loop remains a key tool for evaluating these enhancements, and continuous monitoring is vital to address global challenges, particularly those from nations with fewer ethical constraints.

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Outlook into the future of warfare with innovation race regarding human enhancement

Joachim Klerx

Abstract

The future of warfare is undergoing a transformative shift driven by the rapid advancement of human enhancement technologies and their integration with artificial intelligence. These innovations promise to revolutionise military operations by augmenting the physical and cognitive capabilities of soldiers, enabling unprecedented efficiency and adaptability on the battlefield. This paper explores the profound implications of this innovation race, analysing the strategic, operational and geopolitical impacts of human enhancement technologies. While these advancements offer significant advantages, such as enhanced soldier performance and strategic dominance, they also introduce complex ethical, legal and societal challenges. Unequal access to enhancements risks exacerbating global inequalities, while the blurred lines between soldiers and technological assets challenge existing international norms. This study employs a game-theoretic model to evaluate the dynamics of competition in human enhancement and artificial intelligence, highlighting potential risks such as arms-race instabilities and ethical dilemmas. Ultimately, this research underscores the urgent need for comprehensive frameworks to guide the responsible development, integration, and regulation of human enhancement technologies in military contexts, ensuring their deployment aligns with ethical principles and global security objectives.

Introduction

The future of warfare is rapidly evolving, shaped by the unprecedented pace of technological advancements and the increasing complexity of modern conflicts. Technological sophistication, hybrid operations, and the integration of autonomous systems are becoming defining characteristics of military strategies. As these transformations unfold, the success of any nation on the modern battlefield increasingly hinges on its ability to adapt to emerging forms of warfare, leverage advanced technologies cost-effectively, and maintain resilient and flexible military structures. This shift necessitates a holistic understanding of the opportunities and challenges posed by disruptive innovations, particularly in the realms of human enhancement and artificial intelligence.[1]

Amid this transformation, human enhancement technologies have emerged as a critical area of innovation, with profound implications for military operations. These technologies promise to amplify physical and cognitive capabilities, enabling soldiers to perform tasks once deemed to be beyond human limitations. Simultaneously, the integration of artificial intelligence is reshaping battlefield dynamics, offering enhanced decision-making capabilities and operational efficiencies. Together, these advancements are not merely incremental but revolutionary, carrying the potential to redefine combat strategies and geopolitical[2] power structures.

This paper examines the innovation race surrounding human enhancement technologies and its implications for future warfare. It explores the profound ways in which enhanced soldiers and AI-driven systems are altering military capabilities, strategies and the balance of power among nations. Furthermore, it delves into the ethical, operational and geopolitical challenges posed by these advancements, emphasising the need for comprehensive frameworks to navigate this complex and rapidly changing landscape. By analysing these transformative trends, this study seeks to provide a nuanced understanding of the future of warfare in an era of accelerated technological innovation.

The future of warfare is increasingly characterised by technological sophistication, hybrid operations and the integration of autonomous systems. Success on the modern battlefield depends on a nation's ability to adapt to new forms of warfare, cost-effectively leverage advanced technologies and maintain resilient and flexible military structures.

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1 Gormus, Evrim: NATO's Artificial Intelligence Strategy and Interoperability Challenges: The Case of Turkey. JOURNAL OF BALKAN AND NEAR EASTERN STUDIES. 2024. https://doi.org/10.1080/19448953.2024.2414174.

2 Horowitz, Michael/ Schwartz, Joshua: To compete or strategically retreat? The global diffusion of reconnaissance strike. JOURNAL OF PEACE RESEARCH. 2024. https://doi.org/10.1177/00223433241261566.

By developing and proposing a game-theory analytical framework for analysing the military innovation race for future disruptive innovations, this paper is contributing to the assessment of the military implications of actual and upcoming human enhancement innovations.

Establishing the analytical framework for strategic capability development

The impact of human enhancement technologies, both internal and external to the human body, on military operations and tactics is profound and multifaceted. Enhanced soldiers, equipped with advanced physical and cognitive capabilities, can fundamentally alter the nature of warfare. These enhancements include – from a soldier's perspective – increased strength, endurance, speed and agility, allowing soldiers to perform tasks that were previously beyond human capability. From a strategic perspective, this will make military conflicts more complex and more lethal. Enhanced cognitive functions, either internal or external (with artificial intelligence), such as improved memory, faster decision-making and heightened situational awareness, enable soldiers to process information more quickly and accurately, making them more effective in complex and rapidly changing environments.

With these enhancements, traditional combat strategies will be redefined. Enhanced soldiers can carry heavier loads, move more swiftly and operate effectively in extreme conditions, thereby expanding the range of possible military operations. For instance, missions that require prolonged endurance or a rapid response to unexpected threats can be executed with greater efficiency and success. Enhanced cognitive abilities also mean that soldiers can better manage the vast amounts of data generated on the battlefield, leading to more informed and timely decisions. However, it is not clear how humans will cope with the ubiquitarian autonomous systems equipped with tactical and strategic artificial intelligence.

The integration of human enhancements into military units leads to the development of new tactics that leverage these superior capabilities.[3] Small,

[3] Green, Brendan/ Long, Austin: Conceal or Reveal? Managing Clandestine Military Capabilities in Peacetime Competition. INTERNATIONAL SECURITY 44(3), 2019, pp. 48f. https://doi.org/10.1162/ISEC_a_00367.

highly mobile units of enhanced soldiers can conduct operations that would typically require larger forces, increasing operational flexibility and reducing logistical burden. Additionally, the ability to sustain peak performance for extended periods can shift the dynamics of prolonged engagements, providing a strategic advantage in endurance-based conflicts.

Moreover, the psychological impact on both the enhanced soldiers and their adversaries can be significant. Enhanced soldiers might experience heightened morale and confidence, knowing they possess superior abilities. Conversely, adversaries may be intimidated or demoralised when facing opponents who exhibit extraordinary physical and mental capabilities.

Overall, the impact of human enhancement technologies on military operations and tactics involves a comprehensive transformation of how wars are fought. Enhanced physical and cognitive abilities lead to more effective and adaptable combat strategies, creating new opportunities and challenges in modern warfare.

The geopolitical consequences of unequal enhancements are significant and multifaceted, affecting international relations, power dynamics and global security. As nations develop and deploy human enhancement technologies at different rates and levels of sophistication, disparities in military capabilities can lead to shifts in global power balances. Countries with advanced enhancement programmes may gain considerable strategic advantages, potentially leading to new forms of deterrence and coercion. These technological disparities can create an uneven playing field, where technologically superior nations might exert increased influence or control over those less advanced.

In the discussion of military implications of human enhancement research, it is helpful to formalise the military innovation race regarding future disruptive innovations. The following model provides the methodical instruments to discuss this based on strategic formalisation of the situation.

A game-theory model for military innovation race

In this chapter, a game-theory model of an innovation race for military advantage in artificial intelligence (AI) and human enhancement (HE) is developed to provide the instruments for discussing the military implications of human enhancement innovations. This model is, by necessity, simplified, but it illustrates many of the key strategic features that arise when two rival powers (or groups of powers) compete for technological supremacy. You can expand or adapt these components to reflect more realistic or domain-specific details (e.g. uncertainty[4] in R&D outcomes, multi-stage investment decisions, alliances, etc.).

1. **Assume the following players:**

- **Player A**: a major power (country or coalition) seeking a military advantage.
- **Player B**: a rival major power (country or coalition).

Both players compete in two key technology domains:

- **AI (Artificial Intelligence)**
- **HE (Human Enhancement)** which could include biological, genetic or cybernetic augmentations to soldiers or intelligence analysts.

2. **Definition of the strategic setting**

- Each player can invest resources in R&D of either AI or HE, or potentially split their resources between both.
- Investments made in each period translate into "technological progress" that accumulates over time.
- The first player to achieve a technological threshold in either AI or HE could gain a significant military advantage.
- However, aggressive investment is costly (economically, socially, ethically), and there may also be risks involved (e.g. AI arms-race instability, unforeseen side effects of human enhancement).

[4] Kaplow, Jeffrey/ Gartzke, Erik: The Determinants of Uncertainty in International Relations. INTERNATIONAL STUDIES QUARTERLY 65(2), 2021, pp. 306-319. https://doi.org/10.1093/isq/sqab004.

3. Time structure

We can model the innovation race as a repeated or multi-stage game with discrete time steps t=1,2,…,T in each period:

- **Simultaneous moves**: Both players choose an investment strategy for that period.
- **Outcomes/Updates**: Their technology levels in AI and HE are updated based on the new investments.
- **Payoff realisation**: Partial payoffs (or costs) for that period are realised, but the ultimate advantage may depend on the relative technology levels over time.

For simplicity, we can assume a fixed time horizon T or an indefinite horizon with discount factor $\delta \in (0,1)$.

4. Strategies

Let x_t^A and x_t^B be the fraction of resources (or budget) invested by Player A and B, respectively, in **AI** at time t. Similarly, let y_t^A and y_t^B be the fraction of resources invested in **HE**. For simplicity, assume that each player has a total resource budget normalised to 1 each period:

$$x_t^A + y_t^A \leq 1, x_t^B + y_t^B \leq 1$$

(They could also choose to invest less than the total budget if they wish to save or allocate it elsewhere, but typically in an arms race model it is assumed they invest fully.)

A **pure strategy** at time t is then the pair (x_t, y_t). A **mixed strategy** could involve randomising the investment proportions or adding uncertainty.

5. Technology accumulation

Let:

- AI_t^A be Player A's AI capability level at time t.
- HE_t^A be Player A's human enhancement capability level at time t.

Similarly, for Player B: AI_t^B,. HE_t^B.

A simple way to model capability growth is via a production function. For instance:

$$AI_{t+1}^{A}=AI_{t}^{A}+f_{A}(x_{t}^{A}),\ HE_{t+1}^{A}=HE_{t}^{A}+g_{A}(y_{t}^{A})$$

$$AI_{t+1}^{B}=AI_{t}^{B}+f_{B}(x_{t}^{B}),\ HE_{t+1}^{B}=HE_{t}^{B}+g_{B}(y_{t}^{B})$$

where f_A , g_A , f_B and g_B are (usually concave) functions capturing the "return on investment" in each domain. This might be diminishing marginal returns in each period, or more sophisticated functional forms reflecting synergy (e.g. better AI might boost HE research, etc.). For AI and HE it would be realistic to assume exponential increasing returns, which will be discussed later.

6. Payoffs

A common approach to calculate the payoffs is to have a **terminal payoff** at time T that depends on the relative advantage in AI or HE. For instance, we could define:

- If Player A's AI level AI_t^A **exceeds** Player B's AI level AI_t^B by some threshold, Player A gains a significant payoff (military advantage) in the AI domain.
- Similarly, if Player A's HE level HE_t^A exceeds Player B's HE_t^B , Player A gains a payoff in the HE domain.

We can write an example of a terminal payoff for Player A:

$$U_A^{terminal}= \propto *1(AI_t^A\text{-}AI_t^B>\Delta_{AI})+\beta*1(HE_t^A\text{-}HE_t^B)\text{-}C_A$$

where:

- α is the value of achieving AI dominance beyond some threshold Δ_{AI}.
- β is the value of achieving HE dominance beyond some threshold Δ_{HE}.
- C_A represents the total cost of investments or associated risks over time.
- 1 is an indicator function (1 if condition is met, 0 if not).

Likewise for Player B:

$$U_B^{terminal} = \propto *1(AI_t^B\text{-}AI_t^A > \Delta_{AI}) + \beta * 1(HE_t^B\text{-}HE_t^A)\text{-}C_B$$

In some scenarios, **intermediate payoffs** for each period symbolise partial progress or incremental advantages (e.g. improved intelligence-gathering abilities, advanced weaponry). That might be something like:

$$u_A(, x_t^A y_t^A, x_t^B, y_t^B) = R_A(AI_t^A, HE_t^A)\text{-}Cost_A(x_t^A, y_t^A)$$

where $R_A(\cdot)$ might capture the short-run benefits of better technology at time t, and $Cost_A(\cdot)$ is the cost of the investments at time t. Then you could use a discounted sum of the period payoffs:

$$U_A = \sum_{t=1}^{T} \delta^{t\text{-}1}\, u_A(x_t^A, y_t^A, x_t^B, y_t^B)$$

The payoff U_A (utility of Player A) in the model encapsulates the military impact of human enhancement by quantifying the strategic advantages derived from surpassing a threshold in human enhancement capabilities relative to the rival, Player B. This utility reflects not only the immediate operational benefits, such as the increased physical and cognitive performance of soldiers, but also the broader strategic leverage gained through dominance in the enhancement domain. By incorporating factors such as the cost of investment, risks and potential synergies with other technologies, U_A offers a comprehensive measure of how advancements in human enhancement translate into tactical measurement for military superiority, deterrence and shifts in geopolitical power dynamics.

Application to disruptive military innovations (HE and AI)

The application of the model to disruptive innovations is intrinsically linked to future military human enhancement innovations as it drives the development and integration of groundbreaking technologies that redefine combat capabilities. Disruptive innovations such as advanced artificial intelligence, biotechnology and cybernetics create the foundation for enhancing human physical and cognitive abilities, enabling soldiers to outperform traditional limitations. These innovations not only transform individual performance but also influence strategic military doctrines by fostering new operational possibilities and reshaping the balance of power. As military forces increasingly adopt these technologies, the interplay between disruption and enhancement accelerates, setting the stage for a new era of warfare driven by augmented human potential.

For simplicity, only artificial intelligence (AI) and human enhancement (HE) are selected, knowing that these can be exchanged - to some extent – for biotechnology and cybernetics research in the model.

Assumptions for discussion of the ongoing innovation race in HE and AI:

- **AI vs HE allocation**: Each player faces a strategic decision: how to allocate resources between AI and human enhancement. Focusing on one domain might yield dominance there, but ignoring the other could be risky if the opponent invests heavily in it.
- **Arms race and instabilities**: Rapid investment in AI might lead to untested or unsafe systems that pose catastrophic risks (e.g. accidental escalation, loss of control). Similarly, pushing the boundaries in human enhancement might have social or ethical blowback.
- **Spillovers and synergies**: Achievements in AI could accelerate some aspects of HE (e.g. better AI-driven drug discovery). Conversely, breakthroughs in HE (e.g. cognitively enhanced scientists) might speed up AI research. Modellers can introduce coupling between f_A and g_A (or f_B and g_B) to represent synergy or complementary effects.
- **Signalling and information asymmetries**: In many real-world scenarios, players do not perfectly observe the other's investment or progress, leading to incomplete-information games and the possibility of signalling. One might use Bayesian games to model strategic deception or secrecy in R&D.

Application of the strategic toolbox for a simple one-period HE vs AI model:

1. **List of actions**:
   - Each player simultaneously chooses (x,y) with $x+y \leq 1$.
2. **Calculation of possible outcomes**:
   - Final technology: $AI_A=f_A(x_A)$ and $HE_A=g_A(y_A)$; similarly for B.
   - Payoffs:

$$U_A= \propto *1[AI_A\text{-}AI_B>\Delta_{AI}]+\beta*1[HE_A\text{-}HE_B>\Delta_{HE}]\text{-}C_A(x_A,y_A)U_B= \propto *1[AI_B\text{-}AI_A>\Delta_{AI}]+\beta*1[HE_B\text{-}HE_A>\Delta_{HE}]\text{-}C_B(x_B,y_B)$$

Assuming that both players maximise their utility over time, the Nash Equilibrium is the most promising concept:

Nash Equilibrium (in the repeated or dynamic sense): A set of strategies $\{x_t^A, y_t^A, x_t^B, y_t^B\}$ for each period (and for each history of play) such that no player can unilaterally deviate to improve their total expected payoff.

Discussion of the Nash Equilibrium:

- Each player weighs the probability (or indicator) of surpassing the other in AI vs HE, net of their investment costs.
- Typically, you might get a **mixed strategy** equilibrium if neither domain is clearly more valuable or if cost structures are uncertain.
- Or one domain might be more cost-effective and valuable, leading both to heavily invest there, risking a "winner-takes-most" scenario.

Other equilibrium concepts:

- **Subgame Perfect Equilibrium** (in a dynamic game): It is very likely that in real-world AI and HE competition nations' strategies form a Nash Equilibrium in every subgame, ensuring time consistency of strategies.

- **Markov Perfect Equilibrium**: In a dynamic real-world setup with state variables (like $AI_t^A, HE_t^A, AI_t^B, HE_t^B$), a Markov Perfect Equilibrium is where each player's strategy depends only on the current state (not on the full history) in a way that remains a Nash Equilibrium in every state.
- **Stackelberg Equilibrium**: If one player can commit to a strategy first (a leader-follower framework), we might get a Stackelberg model. For instance, if Player A is the global technology leader, they might set a strategy that Player B responds to optimally. It is very likely that the dominant nations take this opportunity.

The extended equilibrium considerations point to practical implications for military capability planning:

1. **Multiple actors**: The strategic analysis needs to be extended from two to multiple players, which allows alliances with other smaller states and corporate actors.
2. **Dynamic signalling and secrecy**: If players hide or misrepresent their technology levels, you can model it as a Bayesian game with incomplete information, focusing on how each side attempts to infer the other's progress and intentions.
3. **Cooperative outcomes**: Players might negotiate arms control or mutual transparency measures to avoid dangerous races, leading to "cooperative equilibria" if enforceable.
4. **Risk aversion and uncertainty**: Incorporating probabilistic R&D outcomes, where large investments do not always guarantee large breakthroughs.
5. **Catastrophic risks or ethical costs**: Adding terms in the payoff function that penalise players for pushing too fast (e.g.,. AI safety concerns, human enhancement side effects).

This game-theory model sketches out the core elements of an innovation race for military advantage in AI and human enhancement. While highly simplified, it illustrates how:

1. **Payoff structures** (military advantage, costs, risks) shape equilibrium strategies.
2. **Dynamic & repeated** considerations (accumulating technology, discounting, potential for negotiation) affect long-term outcomes.

3. **Strategic substitutes/complements** (AI vs HE, synergy effects) complicate investment decisions.

Researchers, defence analysts or policymakers can refine this framework to better reflect real-world details (budgets, uncertainty, espionage, alliances, ethical constraints) and thus help forecast or guide strategic behaviour in emerging military-technology races.

With reference to the military impact of HE and AI research, the arms-race dynamic is notable. When each side fears the other's advantage, both may over-invest, potentially harming both via costs and risk of accidents (a "prisoner's dilemma" dynamic).

The same is true for technological **dominance vs diversification strategies**. If one domain is believed to be more critical, both players might concentrate investments there. Alternatively, each might diversify to hedge against uncertainty. The opposite, yet often used military innovation strategy is **commitment & détente**. In repeated or multi-stage settings, there may be an incentive to form partial agreements or share minimal technology constraints, preventing runaway escalation.

The **risk of an arms race** in human enhancement is a critical concern. As nations strive to outpace each other in developing superior soldiers, this competition can lead to escalating investments in enhancement technologies, diverting resources from other critical areas such as economic development and social welfare. This new arms race can also drive rapid advancements in technology, sometimes at the expense of thorough ethical and safety considerations.

Unequal enhancements as seen in recent times exacerbate global tensions and contribute to regional instability. Nations lagging in enhancement capabilities may feel threatened and seek alliances or develop asymmetric warfare strategies to counterbalance the superior forces of their adversaries. This is already leading to increased militarisation and the potential for conflicts as nations attempt to secure their positions in the global hierarchy.

The geopolitical consequences of unequal enhancements include shifts in global power balances, an increased risk of arms races, heightened global tensions, ethical and political challenges and the need for new international legal frameworks. These factors collectively shape the future landscape of international relations and global security in a world where human enhancement technologies play a pivotal role.

The integration of human enhancement technologies with conventional military capabilities involves a **multifaceted approach** that aims to create a cohesive and effective fighting force. Enhanced soldiers, equipped with advanced physical and cognitive abilities, can significantly augment traditional military operations.

First, enhanced soldiers can operate synergistically with existing systems such as drones, robotics and cyber warfare tools.[5] For example, soldiers with **enhanced cognitive functions** can process and interpret data from unmanned aerial vehicles (UAVs) more quickly and accurately, allowing for better decision-making and more efficient mission execution. This integration enhances situational awareness and enables real-time adjustments to tactical plans.

Enhanced physical abilities, such as increased strength and endurance, allow soldiers to carry more advanced and heavier equipment, including sophisticated weapons and communication systems. This capability improves the overall operational effectiveness of military units, as soldiers can sustain peak performance for longer periods and in more demanding environments.

Training programmes need to be adapted to ensure that enhanced soldiers can maximise the benefits of their new capabilities. This includes specialised training in the use of advanced equipment and systems, as well as conditioning to seamlessly integrate with non-enhanced soldiers. Cohesion and teamwork[6] remain critical, requiring enhanced soldiers to work effectively within conventional military units.

Logistical support also needs to evolve to accommodate the needs of enhanced soldiers. This includes providing necessary maintenance for cybernetic implants or pharmaceutical supplies to sustain cognitive and physical enhancements. Efficient logistical frameworks ensure that enhanced soldiers remain operationally effective at all times.

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[5] Kostyuk, Nadiya: Allies and diffusion of state military cybercapacity. JOURNAL OF PEACE RESEARCH 61(1), 2024, pp. 44-58. https://doi.org/10.1177/00223433241226559.

[6] Vold, Karina: Human-AI cognitive teaming: using AI to support state-level decision making on the resort to force. AUSTRALIAN JOURNAL OF INTERNATIONAL AFFAIRS 78(2), 2024, pp. 229-236. https://doi.org/10.1080/10357718.2024.2327383.

Ethical and legal considerations play a crucial role in the integration process. Establishing clear guidelines and frameworks is essential to govern the use of enhancement technologies in a manner that respects human rights and adheres to international laws. This involves addressing issues related to consent, the long-term effects of enhancements and the potential for misuse.

Finally, the development of interoperable systems is vital for successful integration. **Military equipment and software need to be compatible with the enhancements soldiers** receive, ensuring seamless communication and coordination during operations. This includes ensuring that enhanced soldiers can interface effectively with command and control systems, enabling them to contribute to strategic and tactical planning processes. Integrating human enhancement technologies with conventional military capabilities involves enhancing synergy with existing systems, adapting training programmes, evolving logistical support, addressing ethical and legal considerations and developing interoperable systems. This comprehensive approach ensures that enhanced soldiers can effectively augment traditional military operations, creating a more capable and responsive military force.

All these elements could be included in the model to bring more realistic results. However, the disadvantage is that the model becomes more complicated and loses the easy-use approach. In a subsequent analytical step, the connection between military domains and disruptive innovations is used to understand the long-term trends in competitive military capability development.

Military domains and disruptive innovations

The development of military domains reflects the evolution of warfare and strategic thinking influenced by technological advancements and changing geopolitical needs. To examine the evolving landscape of military engagement as technological advancements and geopolitical shifts redefine the nature of conflict.

The following figure shows the interdependence and dynamics of military domain concepts and corresponding disruptive innovations, where traditional battle lines blur, and new military domains emerge, when new disruptive innovations change the nature of military tactics.

Figure 1: Historical overview of military domain concepts and corresponding disruptive innovations

Spatially based military Domains

Domain	Disruptive Innovation
Space 1985 US	Rockets, 1942, D Satellites, 1957, UDSSR
Air (world war I)	Air power theory, 1921, IT, Giulio Douhet Strategic Bombing 1921, D, Billy Mitchell Guided rockets, 1950, D/US Nuclear bombs, 1945, US/D Hypersonic weapon, 2018, RU
Navy (Roman Empire)	Maneuverable fleet, 899, UK, Alfred the Great (later Age of Exploration 16th Century) Submarine, 1900, US Torpedos, 1866, UK Unmanned Underwater Vehicle, 1980
Land (Ancient time)	„Understanding the terrain“, SunTzu, CH, 500 BCE Mountain warfare, Xenophon, EL Tunnel warfare and Cavalry, 500 BCE fire arrows 1232 CH, later rockets Quadcopter, 2000, US, MacCready Drone swarms, 2021, Israel/ CH/US

Functional based military domain concept

Info Domains		Strategic Domains	
Domain	**Disruptive Innovation**	**Domain**	**Disruptive Innovation**
Psycho-logy (world war I)	Post Traumatic Stress Disorder (PTSD), WW I Military Deception, 1923, Edward Bernays, A/US Cognitive Psychology 2023, UK	**Strategic planning (Ancient time)**	"The Art of War", Sun Tzu 500 BCE "On War", 1800, Clausewitz OODA loop, 1990, John Boyd Escalation-dominance, 1960, Herman Kahn Mosaic warfare, 2017
Cognitive domain (not yet)	Alter perception, Affect decision-making, NL, 2023	**Multi-Domain Operations (2023)**	"AirLand Battle" doctrine, 1980, US US Army doctrine in 2023
Infor-mation domain (1953)	Information Operations, US/RU 1953, Influence global affairs, 2010, RU Information superiority, 2010 US	**Infra-structure and protection (Ancient time)**	Infrastructure protection, Roman Empire, Integrated protection measures across all domains, 2021, US Including under see cables, 2023, NATO/RU

Electromagnetic Domain (Electronic Warfare)

Source: authors compilation

By exploring a range of historical domain-change scenarios, it became obvious that there are two basic domain concepts. The first and most well-known domain concept builds upon the location within a three-dimensional space. Land, sea, air and space are typically related to the devices required to fight in a specific geographic situation. Historically, warfare was predominantly concentrated on land and at sea. Ancient and medieval conflicts primarily involved large-scale land battles and naval confrontations. Maritime technology's advancement led to powerful navies that were central to empire-building and the control of global trade routes, with European powers like Britain and Spain taking leading roles.

The introduction of the air domain marked a significant shift. The use of aircraft in combat was pioneered during World War I and drastically expanded in World War II. Air power became a critical element of military strategy, enabling rapid and wide-reaching strikes. This era saw the development of strategic bombing concepts and the use of aircraft for reconnaissance and support roles.

The mid-20th century introduced the concept of nuclear warfare, adding a new strategic dimension that emphasised deterrence and escalation control. The Cold War period was characterised by a nuclear arms race and the development of intercontinental ballistic missiles, which brought about the space domain as a critical military and strategic arena.

In recent decades, the information[7] and cyber domains have emerged as vital components of military strategy, reflecting the increasing role of digital technology in society and warfare. Cyber warfare capabilities enable states to conduct espionage, sabotage and influence operations without traditional physical engagement.

Simultaneously, the electromagnetic domain has become more prominent with the advent of advanced electronics and communications technology, highlighting the need to control the electromagnetic spectrum to ensure the effectiveness of sensors, communications and guided weapons systems.

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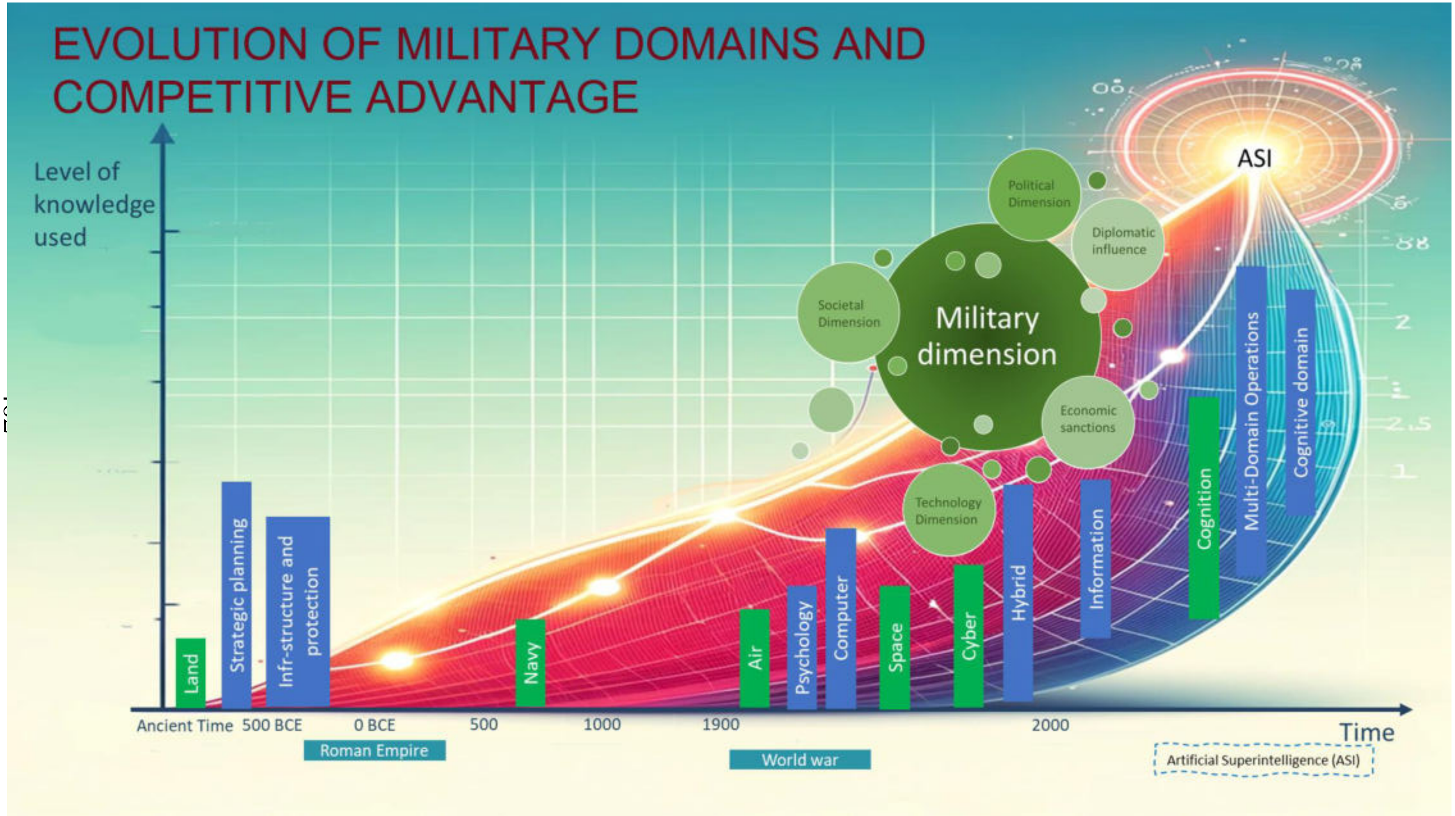
[7] Thayer, Bradley: The political effects of information warfare - Why new military capabilities cause old political dangers. SECURITY STUDIES 10(1), 2000, pp. 43-85.

Today, military strategies increasingly focus on multi-domain operations (MDO), which integrate these disparate elements into cohesive strategies that leverage capabilities across all domains to achieve overwhelming tactical and strategic advantages. This approach is dynamic and continuously adapts to technological advancements and the changing landscape of global power. This approach is inherently knowledge-intensive and requires new approaches to military knowledge management.

The following figure summarises the emergence of military domains over time and their knowledge used. Knowledge is symbolised by number of publications, number of patents, number of communications and data numbers available on the internet. All of these figures are growing exponentially.

Figure 2: See next page.

Figure 2: The evolution of military domains and corresponding knowledge



Source: authors compilation

Besides the emanation of new different military domains following disruptive innovation, which lead to a shift in competitive advantages. Since 2000, the figure shows cyber as the last commonly accepted military domain. However, disruptive innovations in hybrid military tactics, innovations in the information domain and in cognitive capabilities lead us to anticipate that the cognitive domain will be the next commonly accepted military domain.

Human enhancement and other disruptive innovations

There are a large number of new technologies on the horizon. Based on the results from my other contribution,[8] this chapter delves into the dynamic and rapidly evolving field of emerging technologies in the context of transhumanism, which are poised to transform both civilian life and military operations. This chapter explores the latest technology advancements on a higher level and the potential they hold for reshaping military strategies, tactics and overall capabilities. As we stand on the brink of significant technological breakthroughs, it is crucial to understand not only the innovations themselves but also their broader implications. From artificial intelligence and robotics to quantum computing and biotechnology, the technologies discussed here are not just enhancements but are pivotal in driving forward the next generation of military and societal transformations. This chapter aims to provide a comprehensive overview of these developments, assessing both opportunities and challenges that lie ahead.

- **Technological integration (digitalisation)**: embracing advanced technologies such as AI, drones and precision munitions.
- **Cyber and electronic warfare (cyber domain)**: mastery of digital domains to disrupt enemy capabilities.
- **Information dominance (cognitive domain, ASI)**: controlling the narrative and utilising information and automatic reasoning as a weapon. (Complexity and dilemmas beyond human capabilities)
- **Adaptability (nootropics)**: rapidly adjusting strategies and tactics in response to evolving threats.

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8 Klerx, Joachim: The future of human enhancement in the military domain. In chapter TECHNOLOGY in this publication.

- **Integrated defence systems (metaverse)**: protecting assets through multi-layered defence mechanisms.
- **Essential: Human capital, research and material costs**: investing in training and human-machine collaboration to enhance overall effectiveness.

These emerging technologies are created in a never-ending innovation race for the most useful military technologies. Results of the innovation race are new or improved military capabilities which transform into competitive military advantages, which have a number of different strategic implications.

Military implications of human enhancement

Human enhancement research holds profound implications for the future of military operations, promising to revolutionise how wars are fought and won. By augmenting physical, cognitive and emotional capabilities, these advancements empower soldiers to exceed natural limitations, enhancing endurance, decision-making speed and adaptability in dynamic and high-stress environments. These innovations not only redefine individual performance but also reshape broader military strategies, enabling smaller, more agile units to operate with unparalleled precision and efficiency. However, the integration of such technologies also raises critical challenges, including ethical dilemmas, operational dependencies and geopolitical consequences, underscoring the need for careful evaluation and governance in their military application.

Figure 3: Fight regarding the cognitive domain, the different building blocks

Source: Own compilation with symbolic pictures from different internet

The figure illustrates a conceptual framework integrating cutting-edge technologies and human enhancements in military operations, emphasising their synergy, to create effective operational capabilities.

1. **Sensors**: both aerial drones and space-based satellite sensors are shown as critical tools for real-time data collection and situational awareness. These technologies provide comprehensive reconnaissance, surveillance and target acquisition, ensuring that commanders have accurate and up-to-date information about the battlefield environment.
2. **Soldiers with Human-brain interfaces (HBI)**: enhanced soldiers, equipped with advanced gear and potentially nootropics or cybernetic implants, exhibit increased physical endurance, cognitive acuity and adaptability in complex tactical situations. Their ability to process data from multiple sources, including the military metaverse, allows for better decision-making and coordination.
3. **AI (artificial intelligence)**: the central role of AI in this framework is evident, as it analyses vast amounts of sensor data, predicts enemy actions and supports decision-making processes in the command and control centre. AI enhances the speed and accuracy of tactical and strategic planning, reducing human cognitive burdens.
4. **Effector systems**: these include robotic platforms such as humanoid robots and automated weapons systems, which provide logistical support, reconnaissance and direct combat capabilities in high-risk or inaccessible areas. They reduce risk to human soldiers while maintaining operational effectiveness.
5. **Command and control (military metaverse)**: at the core is the military metaverse, a digitally integrated command and control hub that combines data from sensors, AI analysis and human inputs to create a cohesive operational picture. This platform enables real-time strategy formulation, team coordination and the simulation of tactical scenarios, and improves training by providing digital twins of expensive weapon systems.

Together, these components form a multi-domain operational ecosystem where human enhancements, digital technologies and autonomous systems collaborate to maximise efficiency, adaptability and success in complex tactical environments.

Future risks

The adoption of human enhancement technologies and newly identified advancements carries several significant risks that require careful consideration. These risks encompass a wide range of ethical, legal, operational and societal concerns.

One of the primary risks associated with human enhancement technologies[9] is the ethical and moral implications. Enhancing human abilities beyond natural limits raises questions about the fundamental nature of humanity and the potential for creating a societal divide between enhanced and non-enhanced individuals. Issues of consent are paramount; ensuring that individuals fully understand and agree to undergo enhancement procedures is critical. The long-term effects of enhancements, both physical and psychological, are not yet fully understood, posing potential health risks to individuals undergoing these procedures.

Legally, the integration of human enhancement technologies challenges existing frameworks governing warfare and human rights. Current international laws may not adequately address the complexities introduced by enhanced soldiers, necessitating the development of new regulations. There is also the risk of unequal access to enhancement technologies, which could exacerbate global inequalities and lead to geopolitical instability. Countries with advanced enhancement programmes might gain disproportionate power,[10] leading to new forms of coercion and dominance on the international stage.[11]

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9 Rossiter, Ash: Hyping emerging military technology: probing the causes and consequences of excessive expectations. INTERNATIONAL RELATIONS. 2023. https://doi.org/10.1177/00471178231186256.

10 Jo, Sam-Sang: Why Change Prevails over Continuity? Critical Junctures, Motivations, Cognitions, and Temporals in Japanese Security Policy Tradition. ASIAN PERSPECTIVE, 2024, 48(4). https://doi.org/10.1353/anp.2024.a944265.

11 Martill, Benjamin/ Sus, Monika: Winds of change? Neoclassical realism, foreign policy change, and European responses to the Russia-Ukraine War. BRITISH JOURNAL OF POLITICS & INTERNATIONAL RELATIONS. 2024. https://doi.org/10.1177/13691481241280170.

Operationally, the use of human enhancement technologies introduces several risks. Enhanced soldiers may become overly reliant on their augmented capabilities, potentially leading to vulnerabilities if these enhancements are compromised or fail. The integration of these technologies requires significant changes in military training and logistics, which can be complex and costly. Additionally, the potential for cyber-attacks on enhancement systems poses a significant security threat, as adversaries could exploit vulnerabilities to disable or control enhanced soldiers.

Societal impact and ethical implications

The societal impacts of human enhancement technologies are profound, carrying both transformative potential and significant risks. Public perception plays a pivotal role in shaping the adoption of these technologies. Resistance to human enhancement may arise from ethical opposition, fears of unintended consequences or concerns about violating fundamental human values. Such backlash could disrupt military recruitment, lower morale among soldiers and spark societal debates about the acceptability of altering human capabilities for military purposes.[12]

Beyond public sentiment, these technologies threaten to exacerbate economic and social inequalities. Enhanced individuals could outperform non-enhanced individuals in both military and civilian sectors, disrupting labour markets and creating new hierarchies of capability. Such disparities risk fostering economic divides and social tensions, particularly if access to enhancements is restricted by cost, nationality or organisational affiliation.

Emerging technologies, including brain-machine interfaces, genetic modifications and advanced pharmaceuticals, introduce further risks. Brain-machine interfaces, while enhancing cognitive and operational efficiency, could be vulnerable to hacking or misuse, raising concerns about privacy and the potential manipulation of thoughts or actions. Genetic modifications, while offering long-term benefits, might lead to unintended genetic disorders or health complications that extend to future generations. Similarly, advanced

[12] Mello, Patrick: Zeitenwende: German Foreign Policy Change in the Wake of Russia's War Against Ukraine. POLITICS AND GOVERNANCE, Vol. 12. 2024, p. 7346. https://doi.org/10.17645.

pharmaceuticals designed to boost cognitive and physical abilities may have unknown side effects or long-term health consequences, posing risks that remain poorly understood.

The ethical and political challenges surrounding unequal access to these technologies are equally pressing. The unequal distribution of human enhancements could reinforce global inequities, with technologically advanced nations gaining disproportionate power and influence. Enhanced soldiers may become symbols of national superiority, intensifying geopolitical rivalries and deepening divides between countries with varying levels of technological advancement. This inequality raises questions of sovereignty and autonomy, as nations with fewer resources may be pressured into adopting enhancements to maintain strategic parity.

Moreover, the integration of these technologies challenges existing international legal frameworks. Current conventions governing warfare and human rights struggle to account for the blurred lines between soldier and weapon. Enhanced individuals could be considered both combatants and technological assets, creating ambiguities in the application of humanitarian laws. The lack of clear guidelines or enforcement mechanisms risks creating a legal and ethical vacuum that could undermine global security and stability.

In conclusion, while human enhancement technologies hold the promise of revolutionising military capabilities,[13] their societal and ethical implications cannot be overlooked. These include moral dilemmas surrounding the essence of humanity, legal challenges in regulating new forms of warfare, operational risks stemming from technological dependency and broader social disruptions. Addressing these issues requires a comprehensive approach. This includes developing robust ethical guidelines, establishing international legal frameworks, implementing rigorous training and logistics systems and fostering public engagement to ensure informed decision-making and responsible deployment.

[13] Fordham, Benjamin: A very sharp sword - The influence of military capabilities on American decisions to use force. JOURNAL OF CONFLICT RESOLUTION 48(5), 2004, pp. 632-656. https://doi.org/10.1177/0022002704267935.

Key areas for further consideration:

- **Public perception and acceptance**: how to balance public trust with the strategic necessity of enhancements.
- **Potential civilian applications and implications**: the spillover effects of military enhancements on civilian sectors, including healthcare and industry, is non-neglectable.
- **Socioeconomic impacts**: the risk of new divides between enhanced and non-enhanced individuals, both within and across societies, could lead to a social divide.
- **Moral implications of human capability enhancement**: the philosophical questions about altering human nature and creating "superhumans" are particularly relevant to the military sector.
- **Informed consent in the military**: the ethical imperative of ensuring voluntary participation in enhancement programmes is not solved, yet.
- **Equality and accessibility**: the challenge of ensuring fair and equitable access to enhancement technologies to prevent deepening inequalities could be a challenge for society and for soldiers.

By addressing these challenges, societies can strike a balance between harnessing the transformative potential of human enhancement and mitigating the risks to human dignity, global equity and social cohesion.

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Conclusion

Who is Danny/Adobe Stock

Conclusion and derivations

Anton Dengg

Human Enhancement (HE) technology has many facets – both positive and negative. For example, if it leads to the promotion of social equality, increased acceptance in society can be expected. A further advantage would be the offsetting of diverging performance capability. To this regard philosophical considerations should be made at an early stage, so that all resulting concerns can be taken into account in further decision-making processes - including the influence of HE on armed forces.

What remains unresolved in the case of HE technology is the energy supply required for it. A comparison of the relatively low energy requirement of highly efficient human brain performance against the hunger for energy of contemporary microchips makes certain forms of HE appear unfeasible at this moment in time. In addition, neither the necessary storage capacities nor the microprocessors for the complex computing power are foreseeable. The challenges of HE technology are also intensified by AI-supported applications and the high energy capacity which they require. Achievements such as those that use of this technology to isolate toxins from the body can generally be considered as advances in terms of improving general health. However, they also pose a risk of carelessly exposing people to greater risks without providing prior protective measures.

Although Thomas Wagner predicts that the Robocrat will be a "super robot" with better abilities than humans, a robot-soldier surpassing a regular soldier's military performance seems unrealistic for the time being. E.g., a territory can be occupied by machines, but not taken over by them. Only human beings can do that. It is therefore more likely that robots will be used to fight for the territory, and that human soldiers will take over the conquered area following the victory of the robotic army. This may not reflect the status quo, but it illustrates a potential future in which robots surpass soldiers as combatants. From a strategic military perspective, securing terrain is only meaningful through the occupation of a defined area, which constitutes the primary objective of any armed conflict.

It remains to be seen how HE will develop. One thing is certain: the increasing technological advancement of the armed forces requires an ability to react to military operations with ever-increasing speed. In the future, it will no longer be possible for soldiers to cope with the increasingly complex information that they receive without having to multitask. This is particularly true if a "human-in-the-loop" or "human-on-the-loop" is required for AI-controlled weapon systems, which can only be achieved with HE functionality. Whether this can be achieved by using invasive or non-invasive means depends on social, legal and ethical conditions. If HE prevails, sufficient cyber security measures must be planned to prevent malicious access by hostile parties. However, progress in the HE research area will depend largely on both public and private investment resources.

A look at countries where research into HE technology is already being carried out gives rise to concerns that such products are highly unlikely to be beneficial to European countries.

Derivations for the EU,
Austria and the Austrian Armed Forces

- There is a great interest in research in the field of HE, for example in China, the USA and Great Britain. Therefore, the trend in HE development will continue rapidly in the interests of power politics.
- Research in this area is essential – it is imperative that rationality remains paramount when it comes to dealing with HE. A meta-level must be adopted when assessing the advantages and disadvantages of it. Pragmatic solutions in harmony with technical, medical, ethical-legal and military possibilities must be researched holistically and thoroughly discussed.
- If a significant breakthrough in HE research is achieved, a race for the best technology can be expected – similar to the nuclear arms race during the Cold War. It is important to counteract this in a timely manner by means of political and legal guidelines.
- Military needs will be informed by civilian research in the field of HE. This will enable global research results in the field of HE to be analysed and evaluated.

- The following must be noted: Research and development in the field of HE must be monitored – and advanced, if necessary – in order to keep up to date with technological developments. Failure to do so will result in loss of sovereignty.
- Due to the high costs, appropriate research can only be carried out in collaboration with the EU and/or NATO.
- Social acceptance of HE will increasingly be accompanied by medical successes in the treatment of patients. The desire to restore or expand human capabilities (including possible economic gains) will drive the spirit of research. A race in the field of HE is to be expected in the medium term. European countries must observe and analyse trends that go beyond this.
- Potential side effects on health – particularly long-term consequences – must be investigated thoroughly.
- Long-term results can be expected in several areas, even if the HE endeavours still appear to be uneconomical from a surgical perspective. Europe needs to steel itself. Simply playing a passive role will result in negative consequences.
- Due to the unresolved technical and medical challenges posed by HE, increased automation of the battlefield using machines can be expected in the medium term.
- The dynamics of armed conflicts will be revolutionised. This will change the strategy, operation and tactics in military operations. The armed forces must be prepared for this.
- Political, legal and ethical regulations and security standards are needed to counteract social upheaval and negative undemocratic tendencies. Europe can play a crucial role in this regard, akin to its involvement in the EU AI Act.
- Even if the exact development of HE cannot be predicted, human rights and Western values must be taken into consideration from an early stage. Together with the UN, the EU could make a significant contribution to this.
- The armed forces in Austria and the rest of Europe must be increasingly devoted to emerging technological developments in the civilian sector, in order to be able to react to trends in a timely manner.

- It is important to address potential proliferation problems with HE technologies in good time, in order to prevent misuse. General rules and standards for the use and application of HE technologies must be established.
- Due to the increasing speed and complexity of future battlefields, optimisation efforts among soldiers are likely scenarios. Europe has to deal with this.
- Armies must always be prepared for worst-case scenarios, some of which may be revolutionary in nature. HE has a plan for the long term. Particular attention must be paid to countries where ethical standards in HE research do not have the same priority as they do in EU Member States. Adherence to values is of intrinsic importance for armed forces, especially in peacekeeping and conflict management missions, since this symbolises their credibility.
- Non-compliance with (or exploitation of) standards relating to HE technology development and its fields of application is likely in the case of less democratic states. For such cases, response options for Western countries must be planned in advance.
- The impact of attacks by potential aggressors equipped with HE fighters must be taken into consideration in perceiving long-term threats. This includes both negative and positive consequences for the individual soldiers – due to enemy forces being equipped with HE, and the use of HE by their own troops.
- The positive effects of HE, such as the expansion of capability criteria for soldiers and security forces, must be evaluated.
- If HE is associated with an enhancement of baseline human performance, its long-term use for this purpose can be anticipated.
- The hybrid threat of HE is strong on multiple levels. The Austrian Armed Forces (Österreichisches Bundesheer – ÖBH) could play a key role in HE research within the EU from an early stage, by developing appropriate counter-strategies.

Practical Example

Jackie Niam/Adobe Stock

Human enhancement with Chinese characteristics – AI as a factor for China's military modernisation with special consideration of human-machine teaming

Doris Vogl

Abstract

China offers a highly instructive practical example for a state-driven long-term strategy, when it comes to the topic of human enhancement. This essay explores the evolution of AI policy as a factor for military modernization of the People's Republic of China starting with the 13th Five-Year Plan (2016-2020) until the year 2023, focusing on human-machine teaming/human enhancement. Navigating between the two opposing narratives of the "yellow peril" and the one propagated by PR China officials, the vantage point of this contribution is the priority accorded to security as defined by the OSCE. Since the PR China considers development part and parcel of national security, any attempt at interfering with its developmental goals is seen as a security threat. The complexity of the issue is enhanced by the fact that geostrategic considerations have already been placed in the framework of a domestic normative framework.

Thus, we face a situation which adumbrates the challenge for the EU to find a suitable response to China's global AI governance ambitions.

Introduction

In July 2022, the first book-length study of China's domestic AI politics, written by Zeng Jinghan,[1] was published under the title *Artificial Intelligence with Chinese Characteristics – National Strategy, Security and Authoritarian Governance* with the aim "to advance understanding of AI with Chinese characteristics".[2] This essay follows, so to speak, in the thematic footsteps of Zeng Jinghan and aims at examining human enhancement (HE) with Chinese characteristics. More precisely, the focus of observation is one specific facet of human enhancement, i.e. cognitive human enhancement through human

1 Prof. Zeng is lecturing Chinese Studies and Intl. Relations at Lancaster University, UK.

2 Zeng, Jinghan: Artificial Intelligence with Chinese Characteristics – National Strategy, Security and Authoritarian Governance. Springer Nature Singapore, 2022, p.5.

brain-computer teaming. Beijing's current AI policy forms the overarching framework and meta-structure for the topic of this essay, since cognitive human enhancement is just one of the achieved outputs of the manifold applications of artificial intelligence.

In recent years, we have witnessed an intensified monitoring of the development of AI applications in the PRC. On the one hand, the global monitoring results from technological rivalry among innovative high-tech industries. On the other hand, the democratically oriented Western world is increasingly voicing concerned critique regarding the use of AI for governmental surveillance purposes. Both approaches, i.e. technological rivalry as well as system critique on the part of liberal democracies, are linked to security policy. To date, we can already draw on an abundant number of publications elaborating on the security aspect of AI. This essay is not intended as a contribution to the description of AI-guided autonomous weapon systems as developed and implemented in the PRC. The focus instead lies on presenting and analysing Chinese positions and debates on human enhancement as accessible in open sources.

As far as today's security analysis is concerned, we encounter a major dilemma: there is a fundamental disconnect between current security-related discursive approaches towards China. The rationale of the US-initiated narrative is reflected in the US National Defense Strategy 2022, indicating "the growing multi-domain threat posed by the PRC"[3] as the top national defence priority. In stark contrast, the Chinese narrative envisions a new world order, enabling emerging and developing countries to "catch up" with the global North. This essay aims at navigating between the two conflicting narratives. It will neither follow the subliminal or overtly apparent narrative of a "Digital Yellow Peril", nor leave unquestioned the official Chinese narratives with their strong propagandistic colouring.

When engaging in Chinese studies in the context of security issues, it quickly becomes clear that security does not just concern the military or policing. According to the Chinese perspective, the security factor permeates the en-

[3] US Department of Defense: NDS Fact Sheet, 28.03.2022. https://media.defense.gov/2022/Mar/28/2002964702/-1/-1/1/NDS-FACT-SHEET.PDF.

tire society, including issues related to human enhancement. In the author's opinion, it is the OSCE's concept of comprehensive security that appears most adequate in the security analysis of human enhancement. According to OSCE-diction, comprehensive security embodies the politico-military, the economic and environmental as well as the human security realm. Thus, this article follows a whole-of-nation approach, and starts with the current National Defense Strategy, the relevant Five-Year Plans and the strategic concept of Military-Civil Fusion.

One crucial takeaway for readers should be a better understanding regarding the strategic perspective of China's decision - and policymakers in the field of AI development with a particular focus on the technological AI subcategory *human enhancement*. Therefore, this text follows the classical path of comparative politics by identifying relevant action lines in a complex Chinese "High-Tech Development"-system.

This essay examines in the first part the national security interests of the People's Republic of China regarding AI and related policy lines within the framework of relevant Five-Year Plans. In the second part, it analyses the public discourse in the People's Republic on aspects of human-machine teaming is analysed; in a separate chapter the culture and entertainment sector is scrutinised in search of discursive patterns within science fiction productions. The third part elaborates on Beijing's self-perceived role as a "responsible" major power in applying dual-use AI for the purpose of human enhancement. The former topic concerns various aspects of the People's Republic's national Defense strategy, ergo hard power issues. The latter relates to the official self-image of China's political leadership and the normative underpinning of China's security policy trajectories. Here we are moving into the realm of soft power.

The classical distinction between domestic security issues of the PRC on the one hand and foreign policy agendas on the other has become obsolete to some extent, as in a digitalised world both dimensions play into each other. Nevertheless, in most chapters domestic and foreign policies are dealt with separately.

The concluding part of the essay examines the status quo of European defence policy, coping with the necessity of accelerating technological innovation in the military sector. It further examines alternative scenarios for EU positioning vis-à-vis China regarding universal guidelines for human enhancement.

1. AI military application through the lens of China's national security interests

The starting point of this chapter is the question: "What are the national security interests that are paramount to the People's Republic regarding artificial intelligence?"

Respective security interests can best be gleaned from China's defence-related strategy white papers of the last decade. China's strategy white papers are supported in terms of content by the party and the government and cover the security domain not only in the military domain but also in a broader sense. In looking at the relevant white papers – released by China's State Council in 2014, 2017 and 2019[4] - the following national security interests are to be considered as paramount: "safeguard sovereignty and territorial integrity" and "support the sustainable development of the country". The close dovetailing of development and security interests is a common thread running through all of China's security considerations.

In this sense, any technology embargo that affects economic development is interpreted as a direct attack on security interests. This mindset was previously critical to Chinese security considerations several decades before the emergence of today's resilience debate. As a logical consequence, machine learning and human-machine teaming are seen by the PRC state leadership as tools for accelerated development. For decades, the grand strategy has been "to catch up with the industrialised West" without much distinction between the civilian and military sphere. This is also reflected in the *Military-*

4 PRC State Council: China's Military Strategy, 26 May 2015, https://english.www.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm; PRC State Council: China's Policies on Asia-Pacific Security Cooperation, 11 Jan 2017, https://english.www.gov.cn/archive/white_paper/2017/01/11/content_281475539078636.htm; PRC State Council: China's National Defense in a New Era, 24 July 2019, https://english.www.gov.cn/archive/whitepaper/201907/24/content_WS5d3941ddc6d08408f502283d.html.

Civil Fusion (junmin ronghe 军民融合) development strategy,[5] to be discussed in more detail in Chapter 1.2.1. It may therefore hardly come as a surprise that in the tech field, particularly in terms of AI, the promotion of "dual-use" technology and infrastructure is a supporting pillar of numerous national development policies.

1.1 China's National Defense Strategy 2019

Cyberspace and informatisation have already been repositioned and upgraded in the national risk perception in China's military strategy 2015.[6] After cyber warfare had already come into focus in the 2015 strategy, the July 2019 Defense Strategy assumes innovative technology directed against state structures via hybrid dissemination channels as major threats. In the context of artificial intelligence, "intelligent warfare" is predicted for the near future:

> Driven by the new round of technological and industrial revolution, the application of cutting-edge technologies such as artificial intelligence (AI), quantum information, big data, cloud computing and the Internet of Things is gathering pace in the military field. International military competition is undergoing historic changes.
> New and high-tech military technologies based on IT are developing rapidly. There is a prevailing trend to develop long-range precision, intelligent, stealthy or unmanned weaponry and equipment. War is evolving in form towards informationized warfare, and **intelligent warfare is on the horizon**.[7]

Even though the physical or cognitive enhancement of military personnel is not mentioned in the Defense Strategy 2019, the concept of *intelligent warfare* surely does include human enhancement in all its forms. It also refers to various AI applications, generally known as "smart" solutions. As concluded in the strategy document, the prediction of intelligent warfare triggers the necessity of modernisation efforts at the operational level, subdivided into several operation lines. The reader will notice that information and commu-

5 With the release of the 13th Five-Year Plan, the Military-Civil Fusion concept became a prominent issue within CPC and PLA structures. See: http://www.xinhuanet.com/english/2018-03/12/c_137034168_2.htm.

6 See: Buchas, Peter: Bedrohungswahrnehmungen und Sicherheitspolitische Konzepte Chinas. In: Sicherheit und Frieden 3/2016.

7 China's National Defense in the New Era, 24 July 2019, p. 6.

nication technology (ICT) needs are listed at the outset, without indicating concrete technological output: "*advance the integrated development of mechanization and informationization, speed up the development of intelligent military,…*"[8] The issue of human-machine cooperation under the condition of intelligent military remains unaddressed in the document.

Scientific technological innovation is assigned an essential role in the Defense Strategy 2019. The development of high-tech products for the use of the People's Liberation Army structures is underlined as a strategic priority regarding Science & Technology:

> China's armed forces are accelerating the implementation of the strategy to develop the military through S&T (Science & Technology, author's note) in a bid to maintain and enhance the strength of the areas where they lead, and intensify innovation in emerging areas. They have made great progress in independent innovation in some strategic, cutting-edge and disruptive technologies, and succeeded in developing strategic hi-tech products such as the Tianhe-2 supercomputer.[9]

The National Security Strategy indicates only two timelines within the framework of operational goals to "strengthen" the People's Liberation Army (PLA) in the new era: significantly enhance the level of informationisation by 2020 and complete the modernisation of national defence and the military by the year 2035.[10] By the time of writing this essay, the first timeline benchmark has already passed, two years ago; relevant PLA progress reports were presented at three consecutive National People's Congress sessions. Despite strong geopolitical dynamics during recent years, no actualised national security white paper has been published since 2019.

The Defense Strategy of July 2019 does not provide any hints regarding China's ethical positioning on intelligent warfare making use of artificial intelligence, despite the fact that the ICRC had published a paper on autonomous weapon systems in the problematic context of international humani-

8 Ibid., 10; additional operational PLA needs read as follows. Cit: […] *create a modernized military force structure with Chinese characteristics, improve and develop socialist military institutions with Chinese features, and constantly enhance the capabilities to fulfill the missions and tasks in the new era*. Cit. end.

9 Ibid., p. 25.

10 Ibid., p. 11.

tarian law in June 2019.[11] China's current National Defense Strategy was elaborated in accordance with the 13th Five-Year Plan (2016-2020), but was released during the final phase of the five-year governance period. Considering the close intertwining of civil and military spheres in the People's Republic of China, the following short excurse appears useful for a better understanding.

1.2 The 13th Five-Year Plan

Western readers are rarely aware of the complex fabric of Five-Year Plans. Despite its crisp and professional appeal, the term *Five-Year Plan* is burdened with the "musty smell" of ossified real socialism and does not invite more attentive monitoring. Today's visible outcomes of China's AI policy can only be understood by taking a closer look at the dynamics derived from several overlapping planning schemes.

Beijing's quest for innovation in military matters, as reflected in the National Security Strategy 2019, was already regulated at an earlier date in the so-called *Outline of the 13th Five-Year Plan for Military Construction and Development*. At the same time the contents of military development were in line with a number of additional planning documents, such as the "*Outline of the National Innovation-Driven Development Strategy*", the "*State Council and Central Military Commission 13th Five-Year Plan for Integrated Development of Economic Construction and National Defense Construction*" and the "*13th Five-Year National Science* & *Technology Innovation Plan".*

In its 13th Five-Year Plan timeframe (2016-2020), China had set the goal to develop into a science and technology leader, with several "Science & Technology Innovation 2030 Megaprojects", including "AI 2.0". The plan required immediate action in the public sector, but also encouraged companies to invest in AI hardware and software research and development (R&D), including in AI-based vision, voice and biometric recognition, human-machine interfaces and smart controls.

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11 ICRC, June 2019, Artificial intelligence and machine learning in armed conflict: A human-centred approach. Cit.: *Any new technology of warfare must be used, and must be capable of being used, in compliance with existing rules of international humanitarian law. This is a minimum requirement.* Cit. end.

Shortly after adopting the 13th Five-Year Plan in May 2016, a three-year *National Artificial Intelligence Plan,* formulated by the National Development and Reform Commission in collaboration with the Ministry of Science and Technology, the Ministry of Industry and Information Technology and the Cyberspace Administration of China was released by the Chinese government. Known as the *Internet Plus initiative*, established in 2015 as a national strategy, it also contained a strong AI component to spur economic growth driven by innovative, internet-related technologies in the period 2016-2018. It focused on developing comprehensive platform ecosystems, accelerating AI hardware capacity and applying AI in socio-economic key areas.

In 2017, the State Council published the planning document *Guideline on Next Generation AI Development Plan*, which was aimed at providing industrial development goals on the basis of strong AI components. The plan presents China's mid-term as well as long-term objectives, offering three specific timelines:

1. AI-driven national economic growth by 2020,
2. major breakthroughs in basic theories by 2025,
3. building an "intelligent society",
4. to be a global AI innovation centre by 2030.

Similar to the term *intelligent warfare*, as envisaged in the Defense Strategy 2019, the concept of *intelligent society* embodies the increasing use of AI applications in all aspects of daily life, generally known as "smart" solutions in Europe. From the perspective of Chinese state authorities, the application of "intelligent surveillance technology" in the near future, part and parcel in all sectors of society, is considered necessary.

The plan's implementation advanced throughout government structures and private company dynamism. Actually, private companies' attention to AI predated government support. Chinese companies Alibaba, Baidu and Tencent made significant AI investments during the period 2016-2020. The rigorous control measures over the past two years, taken by state authorities against the above-mentioned high-tech giants, must be seen in the context of securitisation of AI policies.[12] According to the ideological view of China's political leadership, the development of an "intelligent society" must by no means be left to the industrial or service sector, but has to be managed in a top-down manner.

As for the first timeline, the *AI Development Plan* defined new-generation information technology as a strategic industry, which was supposed to generate 15% of the gross domestic product by 2020. The industry sector focused on applications and data integration, while the central government's priorities mainly targeted basic algorithms, open data and intelligent surveillance systems.

The establishment of a National AI Standardization Group and a National AI Expert Advisory Panel in January 2018 served the development of normative "basic theories", as targeted in the *AI Development Plan* by 2025. At the same time, the National Standardization Management Committee released a white paper on AI standardisation, supported by the Ministry of Industry & Information Technology.

1.2.1 Military-Civil Fusion (MCF)

In recent years, China watchers in the field of security policy research[13] have paid particular attention to a national PRC strategy adopted in 2017, calling

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[12] In Nov. 2020, the China State Administration for Market Regulation released a draft law to combat monopolies and anti-competitive practice of online commerce companies like Alibaba, Meituan, Tencent, etc.; see Hong, Shen: Shifting Sands for Tech Governance in China, *Digital Asia Hub*, 23 March 2021, https://www.digitalasiahub.org/2021/03/23/platform-futures-conversation-shifting-sands-for-tech-governance-in-china/.

[13] Laskai, Lorand: In Drive for Tech Independence, Xi Doubles Down on Civil-Military Fusion, Jamestown Foundation China Brief, 9 May 2018. https://jamestown.org/progr am/in-drive-for-tech-independence-xi-doubles-down-on-civil-military-fusion/; Kania, Elsa et al.: Myths and Realities of China's Military-Civil Fusion Strategy. CNAS, 28 Jan. 2021. https://www.cnas.org/publications/reports/myths-and-realities; Stone, Alex /Wood, Peter: China's Military-Civil Fusion Strategy. China Aerospace Studies Institute. https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Other-Topics/ CASI_China_Military_Civil_Fusion_Strategy.pdf; Singh*, MP:* Military – Civil Fusion Strategy of China, I*ndian Defence Review.* Jan.-Mar. 2022. 27 Apr. 2022. http://www.indiandefencereview.com/news/military-civil-fusion-strategy-of-china/; Evron, Yoram: China's Military-Civil Fusion and Military Procurement. Asia Policy 16/1, Jan. 2021. https://www.academia.edu/45004366/Chinas_Military_Civil_Fusion_and_ Military_Procurement; Jash, Amrita: China's Military-Civil Fusion Strategy: Building a Strong Nation with a Strong Military. CLAWS Journal 2020, pp. 42-62; https://www.researchgate.net/publication/346969971.

for increased cooperation between the civilian and military sectors, i.e. *Military-Civil Fusion* or MCF (junmin ronghe军民融合). In principle, the concept of this strategy is nothing new in the history of the People's Republic. In the 60s of the last century, Mao Zedong followed a costly policy, where a considerable proportion of civilian capacity was diverted to military research and innovation, such as laser beams and the atomic bomb.[14] During the Hu Jintao era (2002-2012), the concept of state-sponsored initiatives to share resources between the civilian industry and military structures was called Military-Civil Integration (*junmin jiehe* 军民结合).

Even though the declared aim to broaden the spectrum for dual-use technologies follows decades of tradition, the intensity of campaigning and implementation of Military-Civil Fusion (MCF) at various fronts of society is impressive. The MCF concept was propagated with outstanding vigour within all cadre ranks of the CPC and at the level of scientific and higher education institutions, not to forget the domestic industrial sector as a major addressee. In March 2017, the PLA declassified more than 3,000 dual-use technology patents and released 2,346 patents to the public with the purpose of adding to MCF.[15] As a side note, it should be taken into account that about 650 dual-use patents remained classified technology. In the course of the 13th National People's Congress in March 2018, the public campaign on the MCF concept reached its climax in Chinese state media.

Since the very beginning of the MCF campaign, the Science & Technology Commission (STC) – a functional organ of the Central Military Commission – has been tasked with promoting Military-Civil Fusion and the strategic management of national defence S&T. In the same vein, the Science & Technology Commission introduced a monthly one-day event in 2020 to screen ideas from the civilian sector under the topic of military technological innovation.[16] With regard to future warfare analysis, the S&T Commission of the Central Military Commission has even been organising public hearings to

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14 See Chang, Jung/Halliday, Jon: Mao. Jonathan Cape Publ. London 2005, Chap. 45.

15 See Singh: Military – Civil Fusion Strategy of China, *Indian Defence Review,* 1/2022, 27 Apr. 2022, http://www.indiandefencereview.com/news/military-civil-fusion-strategy-of-china/.

16 Xinhua network: China invites public contributions to military technological innovation, 13 Sep. 2020, http://eng.chinamil.com.cn/view/2020-09/13/content_9901968.htm.

collect warfare scenario ideas.[17] This high level of outreach to the Chinese public seems remarkable, even if the collection of "valuable input from the people" was limited in substance to a PR campaign. It should also not go unmentioned that the US Defense Advanced Research Projects Agency (DARPA) appears to have copied some measures from the opposing Science & Technology Commission in the PRC by initiating very similar outreach events with some time delay.[18]

1.3 The 14th Five-Year Plan

Since 2021, military innovation agendas - and thus AI development - have been enshrined in the 14th Five-Year Plan. In the current Five-Year Plan (2021-2025), no more literal reference to the previously intensively propagated term *Military-Civil Fusion* (MCF) can be found. Yet, the strategic trajectory remains the same. It goes without saying that the development of human-machine interfaces and AI applications for PLA structures continues to be closely linked to civilian research institutions and private companies.

One section of the 14th Five-Year Plan is dedicated to defence and military issues. The stated objectives define the path for further priority setting within the PLA, complementing the Defense Strategy 2019. One outstanding feature of the planning outline is the emphasis placed on the necessity and urgency of further accelerating digitisation and smart systems. A new terminological creation, not yet existent in the Defense Strategy 2019, is introduced: intelligentisation (zhinenghua智能化). This terminology - rather clumsy sounding to Western ears – refers to the application of AI and supplements the key term of the 13th Five-Year Plan, i.e. informatisation (xinxihua信息化).

17 China Military Online: Chinese Military solicits future warfare concepts and scenario ideas, 24 May 2021, http://eng.chinamil.com.cn/view/2021-05/24/content_10039039.htm, cit.: *Since the public announcement of the solicitation in August last year, more than 1,000 people have signed up and submitted creative ideas. After being reviewed, some outstanding works with future warfare foresight, cognition and scientific innovation have been commended and rewarded.* Cit. end.

18 See DARPA website, 5 May 2022, DARPA Launches Event Series to Connect with Talented Innovators Nationwide, *DARPA Forward Conference Series*, running Aug. to Dec. 2022, https://www.darpa.mil/news-events/2022-05-12.

In December 2021, the National Development & Reform Commission released an explanatory note on the Five-Year Plan Outline *Accelerate the modernization of national defense and military*, underlining the laggard position of the People's Republic in military matters on a global scale:

> The major military powers are accelerating the construction of intelligent military systems, seeking new advantages in military competition, and exerting enormous strategic pressure on us. We must enhance scientific & technological insight and warfare insight, adhere to mechanisation as a basis, information technology as a leading element **and intelligentisation as direction**, …[19] *(emphasis added)*

According to the official discourse pattern as reflected in the above citation, the application of AI by other major military powers puts Beijing under "strategic pressure". Therefore, the People's Republic has no alternative other than to engage in an AI technology race in order to "catch up" with AI front-runners in the military sector. Artificial intelligence used in an armed conflict is even going to aggravate existing global imbalances, according to mainstream reasoning in Chinese publications:

> The intervention of these new technologies on the battlefield will further magnify the existing imbalance in conventional military force, making it much more difficult to offset disadvantages in conventional force with better tactics and strategies.[20]

It does not come as a surprise that this argument is perfectly in line with the strategic concept of the PRC *Global Security Initiative (GSI)*, which denounces unnamed major powers as the main source of instability and insecurity in the

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[19] Explanatory Article No. 41 with regard to the 14th Five-Year Plan Outline - Accelerate the modernization of national defense and military (Shísìwǔ" guīhuà "gāngyào" jiědú wénzhāng zhī 41 jiākuài guófáng hé jūnduì xiàndàihuà十四五"规划《纲要》解读文章之41|加快国防和军队现代化), 25 Dec. 2021, author's translation, https://www.ndrc.gov.cn/fggz/fzzlgh/gjfzgh/202112/t20211225_1309729.html.

[20] Feng, Shuai: Toward a Transformed and Unequal World – The AI Revolution and the New International System. In: *China Quarterly of International Strategic Studies*, Shanghai Institutes for International Studies, 2019/5, p.277. https://www.worldscientific.com/doi/abs/10.1142/S2377740019500118; see also Feng, Shuai: A Strategic Posture Review of International Cyberspace. In: *International Strategic Relations and China's National Security* (Vol.3). National Defense University of PLA, 2018.

world. From a Chinese perspective, the "unbalanced" status quo causes the inadequate representation of the legitimate interests of rising powers and the developing South. The close interrelationship between development and security is reflected in the *Global Security Initiative* by the declared goal to build a "balanced, effective and sustainable security architecture",[21] thus complementing China's *Global Development Initiative*. The GSI narrative leaves no doubt that Beijing's official vision of a "balanced" security architecture is aimed at breaking "US hegemony" in global security alliances and technological leadership.

The Western narrative paints an entirely different picture. In particular, US researchers and national security advisors argue that the PRC has in some respects already gained a leading position in the AI technology field. Numerous publications are elaborating on technological innovation the PLA already has or is believed to have at its disposal.[22] One frequently read argument is that the PRC knows how to exploit the advantage of the "second mover" in the military AI field and is – also regarding human enhancement – pursuing a "leapfrog" strategy.[23] The basic tenor of the US-American publications in-

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[21] Xinhua network, 21 Apr. 2022, Full Text: President Xi Jinping's keynote speech at the opening ceremony of BFA annual conference 2022, https://english.www.gov.cn/news/topnews/202204/21/content_WS62616c3bc6d02e5335329c22.html. Both initiatives were first presented by China to the UN General Assembly in Sep. 2021.

[22] Kania, Elsa B.: Chinese Military Innovation in Artificial Intelligence, Center for a New American Security, 7 June 2019. https://www.cnas.org/publications/congressional-testimony/chinese-military-innovation-in-artificial-intelligence; Kania, Elsa B: AI Weapons. China's Military Innovation. Apr 2020. CSET. https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_ai_weapons_kania_v2.pdf; Ding, Jeffrey: China's Current Capabilities, Policies, and Industrial Ecosystem in AI, 7 June 2019. Testimony before the U.S.-China Economic & Security Review Commission. https://cset.georgetown.edu/publication/chinas-current-capabilities-policies-and-industrial-ecosystem-in-ai/; Sullivan, Ryan: The U.S., China and Artificial Intelligence Competition Factors, China Aerospace Studies Institute. 4 Oct. 2021. https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Cyber/2021-10-04_US_China_AI_Competition_Factors.pdf; see also issue archive of bi-weekly newsletter *The China AI and Autonomy Report*, published by CNA, https://www.cna.org/our-media/newsletters/china-ai-and-autonomy-report/.

[23] Allen, Gregory C.: Understanding China's AI Strategy – Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security, Center for a New American Security, 6 Feb. 2019. https://www.cnas.org/publications/reports/understanding-chinas-ai-strategy; Vaddell, Kaveh: China is playing next-generation leapfrog with the West. Axios. 9 Feb. 2019. https://www.axios.com/2019/02/09/china-ai-leapfrog.

dicated in the above footnotes reflects the concern of being "left behind" in the AI field. We therefore see a setting in which both major powers perceive "strategic pressure" or at least disseminate such a perception.

In addition to the Five-Year Plan on the modernisation of national defence and military, the *14th Five-Year Plan for National Informatization* should be mentioned as a second major state-planning document crucial in AI application in the PRC. It is the latest major strategy document, released by Chinese central authorities for the innovation sector, and covers a wide range of technological areas, including "*neuromorphic computing, neural chips, DNA storage,* ***brain-machine interfaces****, digital twinning, novel non-volatile storage, silicon electrons, non-silicon semiconductors, etc.*"[24] (emphasis added)

2. Human enhancement – the challenge of a broadly defined term

In view of the overwhelming fanning of AI applications across Chinese society, it makes little sense to embark on an examination of China's dual-use application of human enhancement tools in a comprehensive way. As a matter of fact, the different forms of human enhancement vary too much.

For the research purpose of this essay, the topic of brain-machine interface (nao-ji jiekou 脑机接口) – also referred to as human-machine teaming or cooperation (ren-ji xietong 人机协同) – was selected as a thematic focus from the vast application field of human enhancement. In the author's opinion, it is the merging of human thinking with electronic systems that is going to play the most significant role in the HE development of the PRC. The annual NIDS China Security Report 2022, a monitoring tool of PLA modernisation trends published by Japanese security policy scholars, starts from a similar perspective and even lists the topic of human-machine teaming in first place:

[24] Translation: 14th Five-Year Plan for National Informatization, Stanford Cyber Policy Center, 25 Jan. 2022, https://digichina.stanford.edu/work/translation-14th-five-year-plan-for-national-informatization-dec-2021/; the Chinese version original was published on 28 Dec. 2022, http://www.gov.cn/xinwen/2021-12/28/5664873/files/1760823a103e4d75ac681564fe481af4.pdf.

The characteristics of intelligentized warfare as noted by scholars include:

(1) C2 through **joint decision-making by humans and machines using AI and cloud control**;
(2) the building of a weapons and equipment system featuring unmanned vehicles, and the realization of "swarm attack"; and
(3) further integration and fusion of traditional und new security domains as well as physical (land, sea, air and space) and non-physical (e.g. cognitive, social, cyber) security spaces, and the need to seize the initiative and control in confrontation operations in cognitive space.[25] *(emphasis added)*

Before taking a closer look at China's approach to human enhancement, its various forms need to be briefly outlined. To date, there exists no uniform categorisation. The relevant literature draws on different categorisation patterns.[26] The SIENNA project commissioned by the European Union on human enhancement – to be introduced in more detail in Chapter 4.2 – draws a basic line between "low tech" human enhancement and HE using emerging "high tech".[27] Another way of categorising HE differentiates between various applied technologies, such as biotechnology, neuroscience, robotics and

[25] Yasuyuki, Sugiura: The PLA's Pursuit of Enhanced Joint Operations Capabilities. NIDS China Security Report 2022. National Institute for Defense Studies of Japan, 28. http://www.nids.mod.go.jp/publication/chinareport/pdf/china_report_EN_web_2022_A01.pdf.

[26] For different categorization pattern see Daniels, Norman: Normal Functioning and the Treatment-Enhancement Distinction, in Cambridge Quarterly of Healthcare Ethics, 2000/3, pp. 309-322. https://www.cambridge.org/core/journals/cambridge-quarterly-of-healthcare-ethics/article/abs/normal-functioning-and-the-treatmentenhancement-distinction/; Hogle. Linda F.: Enhancement Technologies and the Body. In: Annual Review of Anthropology 34, 2005, pp. 695-716. https://www.researchgate.net/publication/234147840_Enhancement_Technologies_and_the_Body; Tennison, Michael/ Moreno, Jonathan: Neuroscience, Ethics and National Security: The State of the Art, Public Library of Science. Biology 10/3, 2012. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3308927/.

[27] SIENNA (Stakeholder-Informed Ethics for New technologies with high socio-ecoNomic and human rights impAct) project website, Cit.: *In addition, there are a variety of "low tech" forms of human enhancement technologies, including education, selected nutrition, as well as various activities that are assumed to result in enhanced cognitive performance or moods, like meditation, practicing music, or dancing.* Cit. end, https://www.sienna-project.eu/enhancement/facts/.

nanotechnology.[28] For the sake of simplicity, we use the following three categories:

1. cognitive enhancement,
2. physical enhancement, and
3. emotive enhancement.

Ad 1) Cognitive enhancement (CE) is aimed at improving human cognition, such as enhanced memory, creativity and learning capabilities. It can be achieved in various ways, e.g. brain-machine interfaces, brain imaging or pharmaceuticals. The technology of brain-machine interfaces (BMI) or brain-computer interfaces (BCI) provides direct communication between the brain and a digital device. It not only allows nonverbal direct control and command of unmanned vehicles, aircrafts or drones, but would also be an option for nonverbal soldier-to-soldier communication in combat. For this very reason, current BMI technology research is focused on relaying neural messages such as sounds or images between soldiers on the battlefield. Another typical tool of cognitive enhancement in the military sector is a headband that stimulates certain brain areas for more focus and concentration and guards against fatigue.

Ad 2) One of the most commonly used examples for physical enhancement (PE) are bionic exoskeletons, e.g. in the lower leg region to be able to run faster or jump higher. Physical improvement by adding or expanding body functions with help from technological means is also referred to as *human augmentation*. Human-machine cooperation and brain-computer interfaces play an essential role in the application of PE. Current global research is also going into genetically engineering soldiers to increase their strength, refine anabolic steroids to promote muscle growth, boost immune systems and block pain receptors so that soldiers can continue to fight in battle after being wounded. Furthermore, there are ongoing test series for the generation of artificial blood.[29] There is the view that vaccines should be assigned to the

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[28] See Lin, Patrick/Mehlman, Maxwell et al.: Enhanced Warfighters: Risks, Ethics and Policy, Greenwall Foundation. 2013, p.22-26. http://ethics.calpoly.edu/greenwall_report.pdf.

[29] See video: Cambridge University Research News, First ever clinical trial of lab-grown red blood cell transfusion, 7 Nov. 2022, https://www.cam.ac.uk/research/news/first-ever-clinical-trial-underway-of-laboratory-grown-red-blood-cells-being-transfused-into-another.

category of physical enhancement technologies by reducing the possibility of disease. Yet, the predominant opinion assumes that vaccines belong to the therapeutic category.

Ad 3) Emotive enhancement (EE) is mainly brought about by pharmaceutical products. For years there has been ongoing discussion about what the basic distinguishing criteria are between conventional medical treatment and emotive enhancement.[30] As for the use in military structures, the well-known pharmaceutical Propranolol[31] can help prevent or minimise the symptoms of post-traumatic stress disorder (PTSD) if taken several hours before a likely traumatic event, such as a fierce combat scenario. The central nervous system may be supported – hence trigger emotive enhancement - through the use of pharmaceuticals like Ritalin, Paxil, Modafinil or Prozac. On the other hand, recent and ongoing discussion on human-machine interfaces in the workplace points at accompanying human factor risks and increased emotional strain, which in turn may lead to the use of enhancing medication.[32]

2.1 China's public discourse on human-machine teaming in the defence sector

This chapter relies exclusively on Chinese open sources the reading of which does not require membership of academic institutions or military structures in the PRC. Fortunately, certain questions pertaining to human enhancement

30 See Lin, Patrick/Mehlman, Maxwell et al.: Enhanced Warfighters: Risks, Ethics and Policy, Greenwall Foundation. 2013, pp.22-26, 62, Cit.: *The treatment-enhancement distinction draws a line between services or interventions meant to prevent or cure (or otherwise ameliorate) conditions that we view as diseases or disabilities and interventions that improve a condition that we view as a normal function or feature of members of our species.* Cit. end.

31 Consumption of *Propranolol* requires a risk-benefit analysis, since it may cause major side effects; for details on emotive enhancement in the US Army, see Taraska, Philip A.: How Can the Use of Human Enhancement (HE) Technologies in the Military be Ethically Assessed?, doctoral dissertation, Duquesne University, 2017, https://dsc.duq.edu/etd/148.

32 The human-machine interface as an emerging risk, report commissioned by the European Agency for Safety and Health at Work, authors collective, *European Risk Observatory – Literature Review*, 4 Oct. 2009, https://osha.europa.eu/en/publications/human-machine-interface-emerging-risk; see also Moore, Phoebe: Artificial Intelligence: Occupational Safety and Health and the Future of Work, prepared for EU-OSHA, 2018, https://www.stjornarradid.is/library/04-Raduneytin/ForsAetisraduneytid/.

have been debated by various Chinese stakeholders fairly openly over recent years, offering insight into controversial discourse within the People's Republic. The screening of the available sources revealed distinct discourse patterns regarding the civil and the military sphere: in the civilian sector, on the one hand, the warning voices of human science scholars are very loud. On the other hand, there is almost overwhelming enthusiasm for HE applications in finance, management, logistics or medical treatment. In the defence sector, the topic of human enhancement technology application for military purposes is less debated - whether intentionally or unintentionally.

Publications of military personnel or military-related institutions are hardly using the term *human enhancement* (renlei zengqiang 人类增强), but speak first and foremost of *human-machine cooperation* (ren-ji xietong 人机协同) or – in more general terms – of *artificial intelligence technology* (rengong zhineng jishu 人工智能技术).[33] In particular, the discussion on human-machine teaming in the process of military modernisation has resulted in a number of publications, while other possible aspects of human enhancement, i.e. physical enhancement and emotive enhancement (see Chap. 2.0) - such as bioengineering for military personnel or the development of further "enhancing" pharmaceutical products are barely addressed. This leads the author to the conclusion that research results and papers on the latter two forms of human enhancement application, i.e. PE and EE, are likely to be found in the range of classified documents. Against this background, the discourse analysis will focus on publications related to human-machine teaming.

The limited scope of open sources in the Chinese military sector creates a fundamental problem, which even well-established China watchers in the Asian region cannot avoid, in that there are only a handful of publications available. One has to resort to quoting from individual contributions by PLA experts on this sensitive topic:

> In order to maximize the efficacy of AI-led human-machine systems operations, the PLA Daily raised the need for bolder organizational reforms, con-

[33] A more precise term, even though less used in Chinese military publications, is **brain-machine interface** (nao-ji jiekou 脑机接口), facilitating human brain control over unmanned weapon systems or supporting the human brain with additional information via external decision support systems.

> tending that the traditional military unit structure model be abandoned, that the overemphasis on military service expertise and pursuit of single-service interests be eliminated, and that a new structure be established that closely integrates systems, such as reconnaissance and intelligence, C2, precision attack, mobile power projection, and support guarantee. **These concepts are the personal views of PLA scholars, and it is unknown whether they will be reflected in the actual joint operations concept**.[34] *(emphasis added)*

In the defence sector, public discourse on AI application in general and human-machine teaming in particular appears with less emotional pendulum swing than in the civilian sphere. Unlike the dissenting voices of social scientists in the civil sphere, reservations and warnings are expressed in a rather limited manner. Expectedly, PLA personnel's comments and analytical contributions are characterised by enthusiasm for a new technological era and the call for accelerated development. Even before the release of the National Defense Strategy 2019, members of the People's Liberation Army assessed the modernisation push by AI technology as very high. The driver function of AI in the development of human-machine teaming is emphasised as the most salient benefit for military purposes in a PLA publication, dated September 2018:

> At present, military AI technology has become an important driver for the development of the man-machine combination of forces, promoting its comprehensive application in military fields such as command decision-making, formation and deployment, equipment utilisation, combat support, military training and rear-end security. The human-machine combination based on military AI technology will strongly promote the army's combat power to significantly improve and give rise to new warfare styles, and change the intrinsic mechanism of war-making.[35]

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[34] Yasuyuki, Sugiura: The PLA's Pursuit of Enhanced Joint Operations Capabilities , NIDS China Security Report 2022, Japanese National Institute for Defense Study, 2022, pp. 29f. http://www.nids.mod.go.jp/publication/chinareport/pdf/china_report_EN_web_2022_A01.pdf.

[35] Zhou, Xiaocheng (周小程) et.al.: Military Artificial Intelligence: How long will it take until human-machine combination is singing the lead ? (junyong rengong zhineng: ren-ji zuhe changzhujiao li women hai you duo yuan? 军用人工智能:人机组合唱主角离我们还有多远, 21 Sep. 2018. China military network, author's translation, https://www.81.cn/jwgz/2018-09/21/content_9294943.htm.

In the PLA Daily of 17 Oct. 2018, it was pointed out that the "informatisation" phase had already expired and now entered the "intelligentisation" phase, emphasising the revolutionary effect of AI applications in the PLA Command & Control process:

> This *(AI technology, author's note)* will create a new situation, to a certain extent, overturning the traditional perception of the command & control mode, a transformation is under way from information systems assisting humans to intelligent systems partly replacing humans.[36]

Human-machine teaming supported by AI systems does not only find praise regarding Command & Control, but also concerning military training. The PLA Daily of 25 August 2020 notes in this context:

> The use of convenient wearable devices, the Internet of Things and intelligent terminals can record "every move" of officers and soldiers in the training process. These data, through analysis and collation, can guide the troops to improve training content and methods and a dynamic optimisation of training plans and processes can be realised through comprehensive analysis of training behaviour.[37]

This quote immediately raises the question of the legitimacy of total surveillance. Looking into this controversial subject more closely, the author screened the *PRC Law on the Protection of the Status, Rights and Interests of Military Personnel* of 10 June 2021 for possible relevant regulations. The law does not

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[36] Lu Zhicheng: The typical way of intelligentized operation mode: human-machine cooperation! (智能化作战的典型方式:人机协同！). PLA Daily (Jiefangjun bao). 17.10.2018, author's translation. http://www.81.cn/jwgz/2018-10/17/content_9315760.htm; see also Gui Zeyu/Dong Xiaohui (桂泽宇/ 董晓辉): Connotation, characteristics, main obstacles and policy recommendations for the dual transformation of AI technology in the military and civilian sector (rengong zhineng jishu jun-min shuangxiang zhuanhuade neihan tezheng, zhuyao zhangai he zhengce jianyi 人工智能技术军民双向 转化的 内涵 特征、主要障碍 和 政策 建议). In: *Defense Science & Technology* (Guofang kezhi). 2020/2. https://www.cnki.com.cn/Article/CJFDTOTAL-GFCK202002008.htm.

[37] Bai Chengshen/Shen Shulin (白承森/沈寿林): Big Data "adds wings" to military forecasting (da shuju wei junshi yuce "tian yi" 大数据为军事预测"添翼"). Xinhua network. Originally publ. in PLA Daily. 25 Aug. 2020. http://www.xinhuanet.com/mil/2020-08/25/c_1210768915.htm.

offer any direct reference to the use of AI tools, or more specifically to human-machine integration and the application of cognitive human enhancement technology at the workplace. In the event of permanent damage to health incurred during military service, the entitlements to state benefits are – among other rights – listed in every detail. However, the importance of fully motivated army members following the mission of a modernised PLA is emphasised in several sections of the document.[38] It should not come as a surprise that the risk military personnel is exposed to in the experimental stage of HE technologies is not discussed in open media. Nevertheless, the aspect of the personal safety of military members is linked to the question of social inequality, including the ethical responsibility of upholding the human dignity of soldiers.

PLA personnel of low military rank do not count among privileged societal strata but appear to belong to the socially vulnerable segments of China's population. This fact is also reflected in a press conference of the Attorney General's Office of the People's Supreme Court of the PRC, which was held exactly one year after the *PLA Military Personnel Law* came into force. In their annual report, the prosecutors were highlighting vis-à-vis the public multiple difficulties of enforcing the newly introduced legal rights of PLA personnel and their families at provincial and county level.[39]

As already mentioned, the author's media screening for the years 2018-2022 reveals that publications on the PLA military web are mostly voicing enthusiasm regarding human enhancement via human-machine teaming. Nevertheless, the community also includes voices urging caution and highlighting new problem areas. This is where scientists from the National University of Defense Technology[40] (NUDT), in particular, have their say.

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38 PRC Law on the Protection of the Status, Rights and Interests of Military Personnel of 10 June 2021, NPC website, http://www.npc.gov.cn/npc/c30834/202106/f094f95689 1d4eb3b8453447289b89f8.shtm.

39 PRC People's Supreme Court Prosecutor's Office, We cannot let soldiers "give their sweat and blood, but live in hardship" (Zuigao jian: Bu neng rang junren "liuhan liuxue you liulei" 最高检：不能 让 军人"流汗 流血 又流泪"), 1 Aug. 2022, China judiciary network (Zhonguo fa-an wang), https://www.faanw.com/jianchayuan/11125.html.

40 The National University of Defense Technology (Zhongguo Renmin Jiefanjun guofangjishu daxue中国人民解放军国防科技大学) was founded in 1953 and is located in Hunan Province, Changsha. The NUDT is under the authority of the Central Military Commission.

Zhu Qichao, an NUDT researcher, raises his warning that there is a need to be alert to security and legal issues which human-machine cooperation brings about. He points out that in a military confrontation environment, once an AI system is attacked through malicious code, or virus implantation, it will bring tactical defeat.[41] On the legal side, Qiang Li and Dan Xie, two outstanding military law experts, identify multiple problems in employing AI technology in accordance with the principles and rules of international humanitarian law (IHL):

> If humans are responsible for the employment of AI weapons, who, of these humans, holds responsibility? Is it the designers, the manufacturers, the programmers or the operators (end users)? In the view of many Chinese researchers, the end users must take primary responsibilities for the wrongful targeting of AI weapons. Such an argument derives from the Article 35(1) of AP I which provides 'in any armed conflict, the right of the Parties to the conflict to choose methods or means of warfare is not unlimited'.[42]

Another researcher from the National University of Defense Technology, who is not named, points out the immense importance of laboratory testing in the context of human-machine coordination:

> In the future, intelligent warfare will require more simulations in combat laboratories to test the effectiveness of actual combat and human-machine coordination, **so "war from the laboratory" will become the reality**.[43] *(emphasis added)*

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[41] Zhu, Qichao (朱启超)**:** Artificial Intelligence and Global Governance (rengong zhineng yu quanqiu zhili人工智能与全球治理), 2019, no link available; see also Pan, Di (潘娣) et al., AI in the field of National Defense is the general trend (rengong zhineng yunyong yu guofang lingyu shi dashi suoqu人工智能运用于国防领域是大势所趋), People network, 11 July 2018, http://military.people.com.cn/n1/2018/0711/c1011-30140196.html.

[42] Qiang, Li/Dan, Xie: Legal regulation of AI weapons under international humanitarian law: A Chinese perspective, 2 May 2019, blog post stemming from the workshop *Artificial Intelligence at the Frontiers of International Law concerning Armed Conflict* held at Harvard Law School in Dec. 2018, https://blogs.icrc.org/law-and-policy/2019/05/02/ai-weapon-ihl-legal-regulation-chinese-perspective/.

[43] National University of Defense Technology: Is human-machine cooperation supposed to be put into actual combat intelligent warfare, or will it start from the laboratory? (renji xietong shi touru shizhan zhineng hua zhanzheng huo zong shiyanshi daxiang人机协同 是 投入实战 智能化战争或从实验室打响), China News, 26 June 2019, https://m.chinanews.com/wap/detail/zw/mil/2019/06-26/8874977.shtml.

Regarding the above quote, it is interesting to note that the article was not launched online within the *China Military network* (Zhongguo junwang 中国军网), but on the civilian news platform *China People network* (Zhongguo renminwang 中国人网), which has considerable public outreach in the People's Republic.

A comprehensive essay in the PLA Daily – selected for re-publishing in *Qiushi*, the prestigious theoretical journal of the Chinese Communist Party – elaborates on human-machine teaming under intelligent warfare conditions. Going against the technology enthusiasm mainstream, the author team issues a warning against the dominance of autonomous weapon systems in combat and also addresses ethical considerations:

> However, intelligent combat systems are only tools to assist humans, and must stay under the control of humans. This is the core of intelligent warfare and the inherent requirement of warfare ethics. Therefore, human-machine teaming will always be the typical approach to intelligent warfare.[44]

One semantic detail should be pointed out at this point: in the publications of the *China Military network*, which are also accessible to other countries, the Western narrative that the PLA has not only caught up in some defence technologies but has already overtaken them is apparently not fed by success stories in the area of AI innovation. With particular regard to human-machine teaming in the defence sector, technical innovations are described in detail; however, bombastic patriotic slogans of triumph – as were widespread in the Mao era - are conspicuously omitted. It can be assumed that this restraint follows instructions from above.

Chinese military-related media outlets tend to contain lengthy inventories of AI policies or new technologies of other major military powers. In the AI context, the programme contents and achievements of the US Defense Advanced Research Projects Agency (DARPA) are regularly monitored, de-

[44] Wang, Yang (王 洋)/Zuo, Wentao (左文涛): Identifying key factors for a winning strategy in intelligent warfare (reqing zhinenghua zhanzheng de zhisheng yaosu认清智能化战争的制胜要素), author's translation, *Qiushi* Journal, 18 June 2020, http://www.qstheory.cn/llwx/2020-06/18/c_1126130211.htm.

scribed and commented on in great detail. This tactical line of "keeping a low profile" is obviously aimed at emphasising China's "laggard" position:

> The United States, Russia, Japan and other countries regard AI as a „game-changing" disruptive technology. They are advancing layouts, strengthening top-level design and planning and exploring the direction of military AI applications. (…) The US military is vigorously promoting the use of AI chips in existing weapon systems, giving weapons an "intelligent brain" that can think like a human and interact autonomously.
>
> (…) Russia has formed the Artificial Intelligence & Big Data Consortium, the National Center for Artificial Intelligence and the Research and Experimental Center for Robotics under the Ministry of Defence to conduct theoretical and applied research in the field of AI and information technology. France has established an innovative defence laboratory, the UK has set up an AI laboratory and India has formed a special working group on AI to explore related technologies.[45]

One semantic detail that stands out is the change in terminology over the years. To give an example, in the area of cognitive enhancement in combination with electronic devices, military-related publications mostly refer to *human-machine cooperation* (ren-ji xietong 人机协同) and brain-machine interfaces (nao-ji jiekou 脑机接口) until the year 2021; most recently, the terms *human-machine integration* (ren-ji yi ti 人机一体)[46] and *cloud-brain control* (yun-nao kongzhi云脑控制) are used more frequently in Chinese publications.[47] In the author's opinion, both new terms are reflecting a rather worrisome

[45] Wang, Jinzhi (王金志), ed.: Intelligent warfare is accelerating, AI will become a disruptive technology that "changes the rules of war" (zhinenghua zhanzheng jiasulai, rengong zhineng duocheng "gaibian zhanzheng youxi guanze" de sujiaxing jishu智能化战争加速到来， 人工智能将成"改变战争游戏规则"的颠覆性技术), Xinhua network, 18 March 2022, originally published in PLA Daily , author's translation, http://www.news.cn/mil/2022-03/18/c_1211612712.html.

[46] *Human-machine integration* is also translated in Chinese as ren-ji yitihua (人机一体化).

[47] Wang, Jinzhi (2022); see also Wei, Yuejiang (魏岳江): Conclusions with regard to AI supporting human-machine integrated operations (AI zhuli ren-ji yitihua zuozhan yunyong duanxiang AI 助力 人机一体化作战 运用 断 想), Military network - China Aviation News, 10 March 2021, http://www.81.cn/bq/2021-03/10/content_10000430.htm.

trend. As for the English translation of the former term, "yi ti 一体" literally means "one common body". In other words, individuals cooperating via computers or machines are transformed into one single entity, i.e. "one body". A similar trend is reflected by the term *cloud-brain control*. Here, the cloud (yun) is mentioned first, whereas the human brain (nao) is put in second place (yun-nao 云脑). Compared to the still widespread term *brain-machine interface*, the human intelligence factor is secondary.

This linguistic shift in Chinese publications can be interpreted to some extent as initial indicators for future problematic developments on a global scale, i.e. to prioritise machine capabilities over human expert knowledge in the context of cognitive human enhancement.

2.2 China's public discourse on human-machine teaming in the civil sphere

In the civil space, human enhancement is mainly discussed as a new civilisation phenomenon. The civilisation aspect is also emphasised by the standard Chinese translation of *human enhancement*, which reads "human mankind enhancement" (renlei zengqiang 人类增强). The conceptual focus is therefore not on the human individual (ren 人) but on the collective whole of humanity (renlei人类).

A considerable number of essays emphasising the civilisation aspect, written by scholars with social science or philosophy backgrounds in scientific journals, are republished on non-academic, popular online platforms.

While obvious care is taken not to confirm the narrative of a likely leading position in human enhancement in terms of military matters, this restraint does not apply to the finance or economic sector. The application of AI technology and human-machine teaming using big data analysis or other smart devices is openly praised as an opportunity to overtake the West. In this context, the associative image of a leaping frog – with reference to the "leapfrog" strategy – is far less popular among the Chinese public than the widely used traditional metaphor of a carriage that gains the lead by speeding up in the curve *(wandao chaoche*弯道超车):

> In the era of digital economy, the one who wins the platforms wins the world (…) fostering industrial digital platforms is an opportunity for my country to successfully "overtake other carriages in the curve".[48]

However, there is a limitation to the positive basic attitude when it comes to human enhancement with the support of AI technology. China's academic community of social scientists has been sceptical of cognitive human enhancement - ergo human-machine cooperation - from the very beginning of the public discourse:

> Scientists and engineers at the forefront of technological development paint a rosy picture of the future world, tending to downplay the risks. But no one knows where the emerging technologies will eventually lead us. Regardless of which path is taken, the public acceptance of emerging technologies will depend on the openness of scientific and engineering communities to the public. The field of human enhancement technologies requires multi-stakeholder collaboration and joint response.[49]

In the above quote, the call for discursive participation is unmistakable. What also resonates here is the hidden critique that the scientific communities at the centre of AI development are disregarding social science expertise. Of course, this demand for co-determination is about establishing ethical principles in scientific development projects. Xu Xiangdong, another social science representative, puts it very accurately:

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48 Chen, Wenhui (陈文辉): Digital Economy and the Fourth Industrial Revolution (shuzi jingji yu di sici gongye geming数字经济与第四次工业革命). *China Finance* (Zhongguo Jinrong中国金融), 13 Sep. 2020, https://dzrb.dzng.com/articleContent/3497_790803.html; author's translation, cit.: shuzi jingji shidai, de pingtaizhe de tianxia…peiyang gongye hulianwang pingtai shi wo guo shixian "wandao chaoche" de jihui 数字经济时代，得平台者得天下…培育工业互联网平台是我国实现"弯道超车"的机会; Chen Wenhui is a finance expert and Vice Chairman of the National Council for Social Security Fund of China (NCSSF).

49 Yang, Qiong (杨琼)/Gao, Xiaoyu (高晓雨): Putting a "tightening spell" on human enhancement technology (gei renlei zengqiang jishu daishang "jinguzhou" 给人类增强技术戴上"紧箍咒"), *Chinese Journal of Social Sciences*, 6/2019, author's translation, http://ex.cssn.cn/zx/bwyc/201903/t20190319_4849746.shtml.

> …, from an ethico-political point of view, we need to at least go through democratic consultation, and in principle set the goals of human development in a way that can be rationally agreed by all. On this basis, (we can) determine which forms of human enhancement are ethically acceptable.[50]

In order to sum up the reservations against human enhancement in the civilian sphere, one can roughly establish three lines of argument: in the very first place, the question of inequality and social injustice as a result of HE application is raised. The assumption is that already existing social inequalities are going to be reflected in disparities in access to human enhancement technologies. The discourse on increasing inequalities is followed by legal questions about the responsibility of human subjects being complemented by artificial intelligence, particularly in the context of invasive BCI. A third category of concern elaborates on possible negative consequences for the human organism, such as the risk of epilepsy caused by transcranial magnetic stimulation or blood thickening due to stimulating pharmaceuticals.

In one aspect, the cautionary voices are unanimous: the future of human enhancement is ultimately about the value choices of a society. This brings us back to the main concern of social inequality, which has a strong ideological underpinning in the People's Republic. Criticism in civilian public discourse is therefore oriented more towards core socialist values rather than towards individual rights.

Despite a dense censorship network, public discourse in China should not be seen as a closed loop. Chinese netizens are highly responsive to media news coming from outside their own system. This was demonstrated by the reactions to a tweet thread between Elon Musk, co-founder of the neurotech company *Neuralink (*nao-ji jiekou gongsi脑机接口公司*),* and Billy Markus, co-creator of the crypto currency *Dogecoin*, in the context of brain-computer

[50] Xu Xiangdong (徐向东): An Ethical Examination of Human Enhancement Technologies (Renlei zengqiang jishu de lunli shenshi人类增强技术的伦理审视), *Philosophy Analysis* (Zhexue fenxi哲学分析), 5/2019, author's translation, cit.: 从伦理—政治的角度来说, 我们至少需要通过民主协商, 用一种原则上可以得到所有人理性地认同的方式来提出人类发展的目标， 在此基础上确定哪些形式的人类增强是道德上可接受. Cit. end, https://www.sohu.com/a/376367915_488818.

interface (BCI).[51] The short and rather humorous communication between two non-Chinese innovative minds has apparently caused a considerable stir on the Chinese internet, to the effect that the *Global Times* – internationally known as a CPC media mouthpiece – saw reason enough to publish a comment:

> In response to a question tweeted by Dogecoin founder Billy Markus on Tuesday "If you could upload your brain to the cloud, and talk to a virtual version of yourself, would you be buddies?" Musk tweeted that he "already did it."
> The tweets later sparked discussion among netizens on Chinese social media platform Weibo. Some doubted the claim, saying that it could just be hype; while some said that without proper supervision and constraints, AI and biotechnology's development could be dangerous for human beings in the future.[52]

Here again, we see the argument that cognitive human enhancement requires control and constraint, being a potential danger to mankind. In the same breath, however, the *Global Times* commentary points out that the stock quotations of the Chinese neuro-tech companies *ENC Digital Technology* and *Innovative Medical* experienced a significant surge as an immediate result of Elon Musk's tweet.[53] The urge for state control is thus mixed with the hope for a booming domestic BCI industry.[54]

As for the public discourse on brain-computer interface (BCI) technology, discursive patterns have changed in recent years. Before 2022, Chinese media disseminated the general view that cognitive human enhancement requiring surgical implantation, such as the *Neuralink* BCI technology, should be re-

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51 On 19 July 2022, Billy Markus tweeted the question: "*If you could upload your brain to the cloud, and talk to a virtual version of yourself, would you be buddies?*" Elon Musk responded, "*already did it*", https://twitter.com/elonmusk/status/1549197098226171906.

52 Global Times, Related shares in Chinese A-share market surge after Elon Musk said he has already uploaded his brain to the cloud, 20 July 2022, https://www.globaltimes.cn/page/202207/1270970.shtml.

53 Ibid.

54 Chinese brain-computer interface (BCI) technology producers apart from *ENC Digital Technology* and *Innovative Medical* are *NeuroXess, Brainland Technology, Beijing Vision Technology, EEG Smart, Huayuan Data, Neural FLEX, Bo Rui Kang Technology,* etc.

jected.[55] At the same time, China's domestic BCI industry developed wearable headgear wired with a chip and sensing-electrodes. Those known as non-invasive neuro headsets were – according to producer information – supposed to enter the commercial market in healthcare and aerospace. Yet, it is highly probable that the use of this innovation first and foremost took place within PLA structures.[56]

In April 2021, at the 8th China International Technology Fair, China's first remote brain-computer interface chip was presented by a Shanghai producer, available at half the price of foreign suppliers. In parallel, China's state media started heralding a commercial breakthrough.[57] In 2022, the media-driven position to reject invasive BCI technology in China changed. State media began by publishing success stories about innovative surgery in the context of brain-computer interfaces. In June 2022, brain surgery on animals was reported, where BCI chips were implanted via a blood vessel in the neck and manoeuvred towards the brain;[58] another research innovation – made public

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[55] Shen, Xinmei: Elon Musk's Neuralink is exciting and terrifying to people in China, *South China Morning Post*, 18 July 2019, https://www.scmp.com/abacus/culture/article/3029489/elon-musks-neuralink-exciting-and-terrifying-people-china.

[56] For more technical details, see Xinhuanet: China unveils Brain-Computer Interface chip, 18 May 2019, http://www.xinhuanet.com/english/2019-05/18/c_138069590.htm; Devanesan, Joe: China self-develops brain-computer interface to bypass US tech sanctions, *TechWire Asia*, 24 May 2021, https://techwireasia.com/2021/05/china-self-develops-brain-computer-interface-to-bypass-us-tech-sanctions/; DARPA Outreach, 20 May 2019, https://www.darpa.mil/news-events/2019-05-20.

[57] Fudan University unveils self-developed remote BCI chip, *Global Times*, 18 Apr. 2021, https://www.globaltimes.cn/page/202104/1221323.html; China's first wireless brain-computer interface chip for animals goes on display in Shanghai, *Yicai Global*, 19 Apr. 2021, https://www.yicaiglobal.com/news/china-first-wireless-brain-computer-interface-chip-for-animals-goes-on-display-in-shanghai.

[58] Xie, Echo: Chinese team implants brain sensor without cracking skull, *South China Morning Post*, 30 June 2022, https://www.scmp.com/news/china/science/article/3183540/chinese-team-implants-brain-sensor-without-cracking-skull; Jin, Zhigang, BCI Debuts at World Artificial Intelligence Conference, NeuroXess (NaoHu) Technology Medical-grade BCI Products Released at WAIC 2022 (2022 shijie rengong zhineng dahui, nao-ji jiekou shoudeng WAIC, NaoHu kezhi yiyong ji BCI chanpin zhong bang fabu 2022 世界人工智能大会｜脑机接口首登 WAIC，脑虎科技医用级 BCI 产品重磅发布), *Xinmin Wanbao*, 2 Sep. 2022, https://news.xinmin.cn/2022/09/02/32225404.html; Shanghai Research Institute of Microsystems and Information Technology (ed.), Special Focus on Brain Machine Interfaces and Applications, Science *China Information Newsletter*, Vol. 65/ 4, 2022, http://scis.scichina.com/cn/2022/SSI-2022-0155.pdf.

by Chinese media – involves liquid metal, designed to work as a BCI electrode inside the brain of animals.[59]

One observation stands out here: despite the already far-reaching securitisation of China's public discourse on artificial intelligence, so far there has been no ongoing national security debate with regard to BCI applications.[60] In the civil sphere, the discourse on BCI technology is heavily focused on the medical field under the flagship theme *medical treatment + brain-computer interface* (yiliao + nao-ji jiekou医疗+ 脑机接口). Future options for the treatment of various diseases and disabilities are emphatically praised. Whereas security issues, such as the possible manipulation of human brain activity through BCI devices, are not addressed by the mainstream media.

2.2.1 Discursive construction regarding human-machine teaming within the culture and entertainment sector

According to the view of Chinese political elites, the cultural sphere is definitely related to national security. Accordingly, discursive intervention at all levels of domestic cultural industry is assumed to be a necessary security measure:

> In particular, at a time when the cultural industry is increasingly becoming an important area of contention in international political, economic, and cultural competition and an important area for the comprehensive national strength of a country, the importance of the cultural industry to **national cultural security has come to the forefront**.[61] *(emphasis added)*

The People's Republic is confronted with a fundamental problem when it comes to increasing the overall level of social acceptance concerning human-machine teaming. The use of new technologies is supposed to be focused on

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[59] Zhang, Tong: Chinese scientists use liquid metal to create "X-rat" in the hope of treating humans with nerve damage, *South China Morning Post*, 24 Aug. 2022, https://www.scmp.com/news/china/science/article/3189975/chinese-scientists-use-liquid-metal-create-x-rat-hope-treating.

[60] For securitisation, see Zeng, Jinghan: Artificial Intelligence with Chinese Characteristics, 2022, pp. 35-59.

[61] Su, Yong: Strategic Vision for Promoting the Cultural Industry as a Pillar Industry: Sun, Guodong *(ed.), Chinese Culture and Its Impact on China's Development*, World Scientific Publishing 2022, p. 340.

innovation, but as a general lifestyle, China's political leadership blatantly advocates a neo-conservative attitude. The style of government that is classified as "authoritarian" by democratic Western systems is understood as "paternalistic" in the opinion of Chinese state authorities. Shan Wei, research fellow at the National University of Singapore, draws a direct analogy between traditional family values and the political system of the People's Republic:

> Traditional Chinese culture defines the relationship between individuals and the state as hierarchical, as an enlargement of the relationship between children and their parents within a family. Citizens should accept the state authority like children comply with their parents, regardless of the credibility of its actions.[62]

Clearly, cognitive human enhancement as the basis of human-machine teaming may shake traditional hierarchical structures. To avoid such a risk, adequate framing of human enhancement "for good" needs to be constructed for the broader public, including corresponding anti-hero narratives. Consequently, we witness a strong element of state-controlled discourse-construction in the culture and entertainment sector.

How are the popular cultural representations of artificial intelligence – in particular human-machine teaming – narrated in films, TV series and literature? First of all, the positive effects of digitalised life primarily need to be communicated in order to promote techno-scientific optimism in a society. With regard to possible negative consequences, one crucial topos is the struggle against radical capitalism and misuse of intelligent technology by corporations and criminal groups. The message is clear: human enhancement "for good" requires restrictive control by central authorities and the superiority of the human mind as the final result.

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[62] Shan, Wei: Value Changes and Regime Stability in Contemporary China, Series on Contemporary China, Vol. 48, World Scientific Publishing, 2021, p. 24; for neo-conservatism in the PRC, see also Vogl, Doris: Chinas Suche nach einer resilienten Gesellschaftsform, in Frank, Johann et al. (eds): *Internationales Konfliktmanagement in Zeiten einer Pandemie*, Schriftenreihe der Landesverteidigungsakademie, 1/2021, pp. 159-175, https://www.bundesheer.at/wissen-forschung/publikationen/beitrag.php?id=3432.

Liu Cixin, who was the first Chinese author to win the prestigious Hugo Award for science fiction in 2015,[63] puts the individual and human condition in the foreground. The younger, subsequent generation of sci-fi authors, however, already follows a new line. The thematic focus is now on the human-machine relationship, more precisely on the humanisation of AI or, conversely, the cognitive cyborg existence of individuals. Chen Qiufan tells the story of an AI identity – serving as a technical tool of a "flirt app" – that falls in love with a human female and therefore has to be removed from the system.

A recent joint publication project by Chen Qiufan and Lee Kai-Fu[64] – both bestseller authors and former IT technicians – has attracted considerable international attention. The book *AI 2041 – Ten Visions for our Future*, published in 2021, attempts to describe in ten short stories, in the spirit of so-called science fiction realism, how AI is going to be implemented in 20 years.

One of the ten stories elaborates on virtual technology, separate from the user's body. Contact lenses are transmitting content like 3D objects, text or video and providing the user with an additional "extrasensory" world. In the analysis chapter, Lee Kai-Fu foresees the future of Augmented Reality (AR) mostly likely assisted by glasses or contact lenses (e.g. a new generation of Microsoft HoloLens). With regard to the invasive brain-computer interface (BCI) of Elon Musk's *Neuralink* project, Lee remains highly sceptical.[65]

As for BCI technology, the short novel *The reversed Turing Test* of sci-fi author Sun Wanglu reveals a highly politically charged, discursive underpinning. According to the novel's plot, only hierarchical order and strict compliance with

63 See English translation, Liu Cixin: The Three-Body Problem Trilogy (San-ti三体), Head of Zeus Publ., 2015; Liu is also author of the short story *The Wandering Earth* (liulang diqiu流浪地球), made into a movie in 2019.

64 Both authors worked for Google China before starting a writing career; Chen Qiufan is internationally known for the bestseller *Waste Tide* (2013, German title: Die Siliziuminsel) and lives in Beijing; Lee Kai-Fu's New York Times bestseller *AI Superpowers* appeared in 2018; Lee was born in Taiwan, during childhood emigration to the US, founder of Sinovation Ventures, currently residing in Beijing with 50 million followers on the Chinese social network Weibo.

65 Lee, Kai-Fu/Chen, Qiufan: AI 2041 – Ten Visions for Our Future, WH Allen Publishers, 2021, pp.207f.

top-down rules allows “successful” cognitive human enhancement. An IT expert of a cyber defence unit dies by not complying with existing regulations:

> On that day, Li Hongbing died of cerebrovascular infarction just as he was using the neural network system access. Death in the line of duty, they said. (...) An unauthorised experiment, anyway, that was never officially investigated.[66]

The same choreography of self-destruction by unauthorised action can be found in Hao Jingfang’s novel *The Loneliest Ward*, where a nurse connects to a neural IT network on a coma patients’ ward without permission:

> “*Why shouldn’t I try it once?”* she thought. “*Just once”.* She lay down on the bed and attached a few electrodes to her forehead. (...)The neurotransducer hummed, scanning her thoughts. Then, she heard the hypnotic words streaming into her mind, like a dear friend trying to make her feel better, or perhaps like a trusted counselor trying to guide her with wisdom. (…), the gray hospital ward disappeared from her vision.[67]

Apart from literature, the film industry also proves an effective tool to disseminate discursive fabrics: *The Wandering Earth* (liulang diqiu流浪地球) was released in February 2019 and ranks as the first Chinese sci-fi blockbuster to be a worldwide success.[68] In the narrative plot, two discursive elements are easily combined. On the one hand, the theme of family reverence, on the other, the belief in technical innovation. The main heroes of the movie are depicted in a family of three generations that finds itself - despite misunderstanding and tensions - emotionally reconciled at the end. As for the technical aspect, mankind is saved from extinction by propelling the earth out of

[66] Sun Wanglu (孙望路): The reversed Turing Test (nixiang tuling逆向图灵), author’s translation, *Quantenträume – Erzählungen aus China über künstliche Intelligenz*, Heyne Verlag, 2020, p. 125.

[67] Hao, Jingfang (郝景芳): The Loneliest Ward (gudan bingfang孤单病房), *Clarkesworld Sci-Fi Magazine,* No. 143, Aug. 2018, https://clarkesworldmagazine.com/hao_08_18/; Hao received the Hugo Award in science fiction literature for her story *Beijing Folding* (Beijing zhedie 北京折叠) in 2016.

[68] Shackleton, Liz. n.d.: Netflix Acquires Chinese Sci-fi Hit ‘The Wandering Earth.’ Screen. 2019. https://www.screendaily.com/news/netflix-acquires-chinese-sci-fi-hit-the-wandering-earth/5137123.article.

its solar orbit using a manned space station and gigantic engines on the Earth's surface. With regard to the role of AI, the cosmonaut Liu Peiqiang succeeds in disabling the space station AI system after it starts to initiate destructive actions. In a final sequence, the willingness to self-sacrifice in the exercise of duty appears as an overarching theme, when cosmonaut Liu navigates the space station into doom to save the Earth from destruction.

In the latest, internationally much reviewed sci-fi film production *Warriors of Future* (Ming Ri Zhan Ji 明日戰記), released in August 2022, the factor of physical human enhancement plays a dominant role in the combat setting. The soldiers of a small air force team are wearing sophisticated armour suits (exoskeletons) in the confrontation with an alien plant invading Hong Kong in the year 2055. The futuristic element of human-machine teaming in the combat field is represented by assisting killer robots.

In China's culture and entertainment sector, online streaming services and social media platforms are playing a rapidly growing role in terms of social dissemination drivers. Literature as well as TV series and movies are reviewed and evaluated in the various netizen communities. Therefore, the online media sphere is increasingly targeted for stricter control by the central authorities of the People's Republic. In a regulation for algorithmic recommendation service providers, effective since March 2022, discursive construction is realised via the obligation to adhere to *"**mainstream value orientation**, optimise algorithm recommendation service mechanisms, actively **spread positive energy** and advance the application of **algorithms 'for good'**"* (emphasis and apostrophe by the author).[69] The vaguely worded request to "spread positive energy", in particular, is problematic. Any production with a dystopian impression, narrating a gloomy development of AI application or being

[69] Internet Information Service Algorithmic Recommendation Management Provisions, Chap. II, Art. 6, author's translation, cit.: *suanfa tuijian fuwu tigongzhe yingdang jianchi zhuliu jiazhi daoxiang, youhua suanfa tuijian fuwu jizhi, jiji chuanbo zheng nenglian, cujin suanfa yingyong xiangshang xiangshan*算法推荐服务提供者应当坚持主流价值导向，优化算法推荐服务机制, 积极传播正能量, 促进算法应用向上向善 cit. end, alternative translation and Chinese original text available at DigiChina, Stanford University, 10 Jan. 2022, https://digichina.stanford.edu/work/translation-internet-information-service-algorithmic-recommendation-management-provisions-effective-march-1-2022/.

sharply critical of cognitive human enhancement and brain-computer teaming, is likely to become a target for censorship.[70]

3. China's understanding of global responsibility with regard to AI application

While previous chapters examined strategic planning, policy and discursive patterns with a domestic scope of impact, Chapter 3.0 deals with Beijing's outward-looking initiatives regarding military applications of AI, including human enhancement. The title of this essay *Human enhancement with Chinese characteristics* commits to a holistic approach that also includes China's self-image on the international stage. How does Beijing articulate and frame its self-perceived "responsibility" in the dual use of AI serving the purpose of human enhancement? What is the declared ethical underpinning of China's international AI-policy trajectory? The answer to these questions should always take into account one consideration: the political leadership of the People's Republic cares immensely about gaining global influence in the normative arena. And in the field of transnational AI governance, in particular, the accumulation of soft power is regarded by Chinese political elites as a crucial strategic driver.

With regard to developing "AI governance with Chinese characteristics", the year 2021 is definitely outstanding. During the *Year of the Ox*,[71] the People's Republic took two major steps to play a pioneering role in co-shaping global AI governance: first, at a domestic level so-called *Ethical Norms for the New Generation Artificial Intelligence*[72] were announced in September 2021, followed by a UN-level initiative towards the end of the year.

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[70] The Algorithmic Recommendation Management Provisions are administered by the National Cybersecurity & Informatization Department of the Cyberspace Administration of China (CAC) as a coordinating agency, the Ministry of Industry and Information Technology, the Ministry of Public Security and State Administration for Market Regulation.

[71] 11 Feb. 2021 – 31 Jan. 2022, the most recent Chinese Year of the Ox.

[72] Xinyidai rengong zhineng lunli guifan 新一代人工智能伦理规范, PRC Ministry of Science & Technology (kexue jishu bu), 25 Sep. 2022, http://www.most.gov.cn/kjbgz/202109/t20210926_177063.html.

Obviously, the introduction of ethical norms within Chinese state territory was deemed by the political leadership as a necessary precondition for further initiatives at international level. As a matter of fact, the *Ethical Norms for the New Generation Artificial Intelligence* were preceded by year-long discussions between academia, policymakers and the corporate sector on how to contribute "lessons learned by China" for future global governance challenges inflicted by AI.[73] The warnings of Chinese social science and philosophy scholars – as reflected in the public discourse of recent years (see Chap. 2.1.2.) – were, for the most part, taken into account regarding the interests of corporate actors.

Although tangible issues of human-machine teaming with AI components are not directly addressed in the document, some elementary points were set for future normative action. In the framework of so-called *fundamental ethical norms* (jiben lunli guifan基本伦理规范[74]), the following passage defines the fundamental norm *Ensuring Controllability and Trustworthiness* (quebao ke kong ke xin确保可控可信):

> Ensure that humans have the full power for decision-making, the rights to choose whether to accept the services provided by AI, the rights to withdraw from the interaction with AI at any time, and the rights to suspend the operation of AI systems at any time, and ensure that AI is always under meaningful human control.[75]

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73 In July 2021, two leading think tanks, China Academy of Information & Communications Technology (CAICT) linked to the PRC Ministry of Industry & Information Technology and JD Explore Academy financed by the e-commerce company JD had published the preparatory document *White Paper on Trustworthy Artificial Intelligence* (ke xin rengong zhineng baipi shu 可信人工智能白皮书); for a comprehensive study, see also Arcesati, Rebecca: Lofty Principles, Conflicting Interest – AI ethics and governance in China, MERICS China Monitor, 24 June 2021, https://merics.org/sites/default/files/2021-06/MERICSChinaMonitor69AIEthics2.pdf.

74 The *Ethical Norms* define six fundamental ethical norms: advancement of human welfare, promotion of fairness and justice, protection of privacy and security, assurance of controllability and trustworthiness, strengthening of accountability and improvements to the cultivation of ethics. It also specifies 18 ethical requirements concerning AI management, research and development (R&D), supply, use and other specific activities.

75 English translation by the International Research Center for AI Ethics and Governance: The Ethical Norms for the New Generation Artificial Intelligence, China, 27 Sep. 2021, https://ai-ethics-and-governance.institute/2021/09/27/the-ethical-norms-for-the-new-generation-artificial-intelligence-china/.

However, to date these ethics guidelines do not have the effective force of a law, nor is it specified how the defined norms will be enforced in the case of non-compliance. Another question that arises is whether it is that simple "to withdraw from the interaction with AI at any time"[76] in a working situation with a brain-computer interface.

3.1 China's AI governance approach at the global level

Several months after the release of the *Ethical Norms for the New Generation AI* at national level, the Chinese UN Ambassador for Disarmament Affairs submitted in December 2021 a position paper to the Sixth Review Conference of the UN Convention on Certain Conventional Weapons to regulate the military applications of AI.[77] In the paper, the topic of human-machine teaming is indirectly addressed; in the foreground stands the demand for universal accountability rules:

> …, countries need to enhance self-restraint on AI research and development activities, and **implement necessary human-machine interaction across the entire life cycle of weapons** after taking into full consideration of the combat environment and the characteristics of weapons. Countries need to adhere to the principle of regarding human as the final subject of responsibility, establish accountability mechanism for AI and conduct necessary training for operators.[78] *(emphasis added)*

A closer look into the document reveals that the Chinese UN initiative in military matters is basically in line with the ethical norms formulated for the domestic civil sector, enshrined in the *Ethical Norms for the New Generation AI* of September 2021:

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[76] See footnote 69.

[77] In an earlier position paper of April 2018, China's UN delegation advocated a new protocol for the Convention on Certain Conventional Weapons "to ban the use of fully autonomous lethal weapons systems"; the first relevant position paper was put forward in Dec. 2016, requesting "the development of a legally binding protocol on issues related to the use of LAWS".

[78] Position Paper of the PRC on Regulating Military Applications of Artificial Intelligence, 14 Dec. 2021, https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/wjzcs/202112/t20211214_10469512.html.

1. uphold human beings as the ultimate liable subjects,
2. clarify the responsibilities of all relevant stakeholders, and
3. establish an accountability mechanism in AI-related activities.[79]

It can therefore be concluded that Beijing's position regarding global AI governance in military matters is not exclusively derived from geostrategic considerations, but draws to a considerable extent on the Chinese domestic framework of "whole-of-society" AI governance. Nevertheless, China's AI governance approach at global level is highly ambitious. Beijing's security-related geostrategic vision of AI governance is well mapped in an academic essay, published shortly before the submission of the UN position paper:

> As existing rules and policies regarding technology development and governance that have been made by a handful of Western powers have proven to be largely ineffective, **a new, more inclusive platform should be put in place** that reflects the broadest possible consensus on risk management and mitigation.
> With this platform, thorough and detailed discussions and debates of the impact of technological advances on international security could be conducted to **work out better institutional solutions** and mobilize more international political, economic, and social resources for technology governance.[80] *(emphasis added)*

What exactly is meant by requesting a more inclusive platform? Briefly summarised, China's understanding of "better institutional solutions" for future AI global governance within UN structures is shaped by the following considerations:

- The Global South is lagging behind in terms of science and technology development, therefore the security interests of developing countries should be better accommodated in new institutional formats.

[79] See footnote 70, basic norm V *Strengthening accountability* (qianghua zeren dandang强化责任担当).

[80] Sun, Haiyong: Global Science and Technology Governance: Impetus, Challenges and Prospects, *China Quarterly of International Strategic Studies*, 1/2021, Vol. 7, p. 73, https://www.worldscientific.com/doi/10.1142/S2377740020500244.

- UN platforms for security debate should force the inclusion of non-governmental organisations, since the most vocal advocates for restricting the use of AI-driven weapon systems are NGOs.
- Technologically leading UN member states should initiate multi-party consultation networks between national governments and corporate actors under the UN framework.
- Trust-building measures centred on increased dialogue between technologically leading nations – in particular, between the USA and the PRC – are declared as necessary prerequisites for achieving institutional solutions at UN level.
- Last but not least, Beijing's search for "better institutional solutions" also follows image-building reasoning, by putting emphasis onto an entirely new UN action field. According to the Chinese position, relevant UN institutions should not be "revised" but need to be created from scratch. Hence, China's wide-spread labelling as a "revisionist" power is difficult to uphold in the context of AI governance.

Apart from United Nations channels to exert influence, China's options for contributing to global AI governance have remained rather limited. At the G20 Summit of June 2019 in Osaka, the PRC was a signatory to the joint declaration to adopt a "human-centred AI approach". The joint statement of the G20 Summit 2019 committed to a human-centred approach to AI, and presented those known as G20 AI Principles based on recommendations from the Organization for Economic Co-operation and Development (OECD).

The G20 AI Principles do only include indirect references to human enhancement, by stating that trustworthy AI should pursue *beneficial outcomes for people and the planet, such as* ***augmenting human capabilities and enhancing creativity***[81] (emphasis added). The non-binding G20 AI Principles maintain a clear focus on economic matters and do not relate to the security policy sphere. Under section 1.4, the declaration simply includes a short passage stating that AI systems should "*in conditions of normal use, foreseeable use or*

[81] See G20 AI Principles, Ministerial Statement on Trade and Digital Economy (Annex), 9 June 2019, https://www.g20-insights.org/wp-content/uploads/2019/07/G20-Japan-AI-Principles.pdf.

misuse, or other adverse conditions, […] function appropriately and do not pose unreasonable safety risks."[82]

As a matter of fact, in recent years Chinese expectations that the G20 may become a leading forum for global AI governance have not materialised. Quite on the contrary, the chances of a China-inclusive governance framework of global relevance appear to have rapidly diminished since 2019. The aforementioned AI expert Zeng Jinghan[83] and his team provide the following status quo diagnosis:

> The emphasis on democratic values and selective Western membership under the geopolitical influence in particular has let most existing influential global AI governance initiatives either exclude or directly counter China.(…) The aforementioned 'value competition' over different governance approaches towards AI, for example, has put the most important AI ethics debate – the role and value of human in the AI-enabled world – into shadow.[84]

4. The European response – status quo and alternative outlook

This essay neither serves as a policy paper or as a strategy recommendation in terms of how to respond to China's global AI governance and human enhancement ambitions. Against this backdrop, the chapter starts from the European perception of recent Chinese UN initiatives on the restricted military use of AI technology, followed by a description of concerted European action in response to emerging war technology, including new forms of human-machine teaming, such as brain-machine interfaces. In the concluding part, alternative options for an EU approach vis-à-vis China's AI discourse pattern and global initiatives are briefly outlined. It is left to the reader to opt for one or the other European approach to AI governance with "Chinese characteristics".

Similar to the PRC, European global AI governance initiatives show sharp contours. The *Global Partnership on Artificial Intelligence* (GPAI) was initiated

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[82] Ibid.

[83] See footnote 1 and 2.

[84] Cheng, Jing/Zeng, Jinghan: Shaping AI´s Future? China in Global AI Governance, *Journal of Contemporary China*, 8 Aug. 2022, pp. 17f, https://doi.org/10.1080/10670564.2022.2107391.

by France and Canada in 2017 and eventually launched in June 2020. Currently, the GPAI includes a total 12 EU Member States[85] and the European Union as a separate member.

The GPAI considers itself a global reference point for the adoption of "responsible AI"; human rights are first cited as core principles for all GPAI activities. Against the democratically oriented, normative background of the international partnership, China has no chance of being included in the GPAI community. Added to this is the increasingly tense human rights debate on Chinese national policies of recent years.

To date, six EU Member States[86] joined the *AI Partnership for Defense*, initiated by the US Department of Defense in September 2020 shortly after the launch of the GPAI.[87] The declared objective of the AI partnership under US lead lies in defining norms for ongoing and future weaponisation of AI technology. The envisaged norms for the defence sector are preferably elaborated beyond the scope of UN structures.

4.1 European perceptions of China's stance on regulating AI military applications

Most security-related publications on China's recent UN initiatives on global AI governance in military use, published in the European Union, draw a direct comparison line between the Chinese "no first use" principle for nuclear

85 Belgium, Czech Republic, Denmark, France, Germany, Ireland, Italy, the Netherlands, Poland, Slovenia, Spain, Sweden; the UK joined as a non-EU member. The GPAI Lead Council is currently chaired by France and co-chaired by Japan. With 25 member states, the GPAI includes 11 non-European countries, see also Global Partnership on Artificial Intelligence - GPAI. n.d. https://www.gpai.ai/.

86 The Partnership consists of military and defence delegations from 16 nations, including the six EU Member States France, Germany, the Netherlands, Finland, Sweden and Estonia.

87 Initially, Washington refused to join the GPAI with the argument that multiple regulative mechanisms would hamper US innovation. Eventually the USA joined the alliance in June 2020, for details see: https://www.globalgovernmentforum.com/us-abandons-boycott-of-global-ai-partnership/, https://www.politico.eu/article/artificial-intelligence-wary-of-china-the-west-closes-ranks-to-set-rules/.

weapons and the suggested prohibition of AI-driven lethal weapons.[88] At the same time, it is criticised that China's diplomatic commitment to limit the application of "fully autonomous lethal weapons systems" does not hinder Beijing from developing and building their own.[89] An additional range of comments suggests that Beijing's ethical normative initiatives are perceived to be nothing more than smoke screens[90] and attributes the attempts at UN level to the sole objective of expanding communist power.

Another category of AI-related China studies is simply eclipsing Beijing's recent and current efforts to achieve universally valid UN regulations on the use of AI in warfare. This kind of "one eye open, one eye closed" perception may appear convenient in the short term, but eventually narrows down the options for proper foresight analysis. In particular, the working field of China-related analysis requires nuanced monitoring in all directions. In the same vein, the renowned AI-monitoring journal *Analytics India Magazine (AIM)* gives a clear warning:

> It is unhelpful to reduce China's rapid AI development into a simplistic narrative about China as a threat or as a villain. Observers outside China need to engage in the debate and **take more steps to understand – and learn from – the nuances** of what's really going on.[91] *(emphasis added)*

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[88] See Roberts, Huw et.al.: The Chinese Approach to Artificial Intelligence: An Analysis of Policy, Ethics, and Regulation, University of Oxford, ResearchGate, Nov. 2021, https://www.researchgate.net/publication/355883283_The_Chinese_Approach_to_Artificial_Intelligence_An_Analysis_of_Policy_Ethics_and_Regulation.

[89] Jochheim, Ulrich: China's ambitions in artificial intelligence, European Parliamentary Research Service (EPRS), Sep. 2021, https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA(2021)69620; cit.: *One example of an initiative seeking to promote such norm-setting in AI is the 'Campaign to Stop Killer Robots', co-founded by Human Rights Watch. In this framework, China has only agreed not to use these robots (but does not oppose their production).* Cit. end.; see also Meier, Oliver/Staak, Michael, China's Role in Multilateral Arms Control, Friedrich Ebert Stiftung, June 2022, https://library.fes.de/pdf-files/iez/19484.pdf.

[90] Briant, Raphael: La synergie home-machine et l'avenir des operations aériennes, *Focus stratégique*, No. 106, IFRI, Sep. 2021; cit.: *Certaines grandes puissances (Chine, Russie) s'orientent vers la substitution de la machine à l'homme dans une perspective d'autonomisation des systèmes, via un recours aux algorithmes et à un traitement automatisé des données. La France et de nombreux autres États restent pour leurs parts vigilants sur les risques de perte de contrôle.* Cit. end.

[91] Das, Sohini: Misuse of artificial intelligence in China, *Analytics India Magazine*, 28 Dec. 2021, https://analyticsindiamag.com/misuse-of-artificial-intelligence-in-china/; see also: Naik, Amit: Absurd happenings in the world of AI in China, *Analytics India Magazine*, 12 Jan 2022, https://analyticsindiamag.com/absurd-happenings-in-the-world-of-ai-in-china/.

In fact, the Indian data science magazine has never been too shy to criticise AI policies in China, a certainly unloved neighbour. Yet, a sharpened eye in all directions is kept open in order "*to understand the nuances*".

4.2 EU responses to AI and human enhancement in the defence sector

The *EU White Paper on Artificial Intelligence* of February 2020 draws on the already existing G20 and OECD guidelines. The document is focused on commercial issues, excluding the military sector. Yet, in consideration of various security challenges in the civilian sector, the category of "high risk" AI application is introduced. The question of human-machine teaming is addressed rather vaguely:

> AI can perform many functions that previously could only be done by humans. As a result, citizens and legal entities will increasingly be subject to actions and decisions taken by or with the assistance of AI systems, which may sometimes be difficult to understand and to effectively challenge where necessary.[92]

Several years before the release of the *EU White Paper on Artificial Intelligence,* Brussels authorities had already implemented working steps to address human enhancement and human-machine teaming. Under the umbrella of the Horizon 2020 research and innovation funding programme (2014-2020) the European Commission initiated what is known as the SIENNA project (*Stakeholder-Informed Ethics for New technologies with high socio-ecoNomic and human rights impAct*).

The SIENNA project was not tailored to the defence sector; the reports were aimed at delivering recommendations regarding the legal regulation and introduction of operational tools for the ethical management of human enhancement, AI & robotics (human-machine teaming) and human genomics in all realms of society. The defence aspect is touched upon in the chapter

[92] European Commission: White Paper on Artificial Intelligence – a European approach to excellence and trust, 19 Feb. 2022, https://ec.europa.eu/info/sites/default/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf.

"Weaponisation of enhancement"[93] in one of the reports together with the question of enhanced military personnel:

> The existence of states with enhanced soldiers requires rethinking of international laws of war and human ethics, as they present risks to security of non-enhanced states as well as populaces, and, furthermore, ethically challenge notions of human nature.[94]

On the sidelines, the SIENNA project also analysed the debate on HE technology in selected non-European countries (i.e. Brazil, China and South Africa). As for China-related monitoring, the summary of the ethical discourse contains the following statement:

> The state of ELSI of HET *(**E**thical, **L**egal, **S**ocial **I**ssues of human enhancement technology, author's note)* in China is well developed. In particular, Chinese experts and scholars tend to focus on cognitive enhancement, emotional enhancement and moral enhancement. (…) They pay special attention to the ethical issues caused by cognitive enhancement technology, mainly including health and safety issues, technology risks, side effects, addiction, justice and equality issues, and issues of self and autonomy.
> (…) **There are not themes that are surprising to find nor interesting gaps compared to international debates**.[95] *(emphasis added)*

Drawing on the above SIENNA project findings, it may be concluded that the Chinese discourse on human enhancement is no "blind spot" for Brussels authorities. Moreover, it is noteworthy that the HE debate in China is assessed as lacking any "*interesting gaps compared to international debates*".

A few years after the SIENNA project report, the political climate in Brussels regarding China's technological advancement has taken a significant turn: the growing value-based divide between democracies and illiberal systems has changed the way China's global initiatives are viewed and discussed. In its role as a pillar of European democratic structures and human rights con-

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[93] SIENNA D3.4, deliverable report, Ethical Analysis of Human Enhancement Technologies, 2019, p. 107; cit.: *Furthermore, if weaponized enhancement development accelerates, there may be an arms-race that could prompt militaries to cut corners in development to receive immediate advantages*. Cit. end, see also: http://siennaproject.eu/.

[94] Ibid., p. 107.

[95] Ibid., pp. 29-30.

cerns, the European Parliament's recent criticism of the PRC is the most articulate.

The comprehensive supporting study *Artificial Intelligence diplomacy / AI governance as a new European Union external policy tool*,[96] requested by the European Parliament Special Committee on Artificial Intelligence in a Digital Age (AIDA), covers various security and defence aspects. The document suggests that the EU should not stay out of the geopolitical power struggle over AI between the US and China and suggests a proper plan for "European AI diplomacy". Reflecting on the question of a looming Sino-European decoupling, the author argues with diplomatic prudence:

> While the US is the EU's most important and closest ally, and China a systemic rival, China also is a cooperation partner on some topics, and an important partner in trade. Europe, therefore, has to look in two directions at once.[97]

It remains to be added that the above quoted study neither addresses human enhancement nor human-machine teaming; brain-computer interface technology is consequently not mentioned.

The European Parliament Research Service (EPRS) fact sheet *China's ambitions in artificial intelligence*, released a few months after the comprehensive AI study, already takes a rather different view by quoting mainly US Defense Community sources relating to the AI security debate.[98]

The European Defence Agency (EDA) is the leading actor in developing and coordinating common European defence policies among the Member States. The Strategic Compass, published in March 2022, refers to the global secu-

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[96] Franke, Ulrike: Artificial Intelligence diplomacy I Artificial Intelligence governance as a new European Union external policy tool, June 2021, Study for the Special Committee on Artificial Intelligence in a Digital Age (AIDA), Policy Department for Economic, Scientific and Quality of Life Policies, EP, Luxembourg, https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662926/IPOL_STU(2021)662926_EN.pdf.

[97] Ibid., p. 16.

[98] Jochheim, Ulrich: China's ambitions in artificial intelligence, EPRS Fact Sheet, Sep. 2021, https://www.europarl.europa.eu/RegData/etudes/ATAG/2021/696206/EPRS_ATA(2021)696206_EN.pdf.

rity setting in view of an emerging PRC by underlining the protection of European interests and values.[99]

In the context of proliferation of weapons of mass destruction, China is named together with Russia as "*developing new weapon systems*"[100] without further specification. Subsequently, the Strategic Compass does not offer any specific link between the PRC and artificial intelligence, which is dealt with in the strategy regarding critical dependencies and defence innovation.[101] The document also does not contain any mention of human enhancement technologies.

The urgent challenge of concerted EU action on emerging and disruptive technologies has led to the establishment of the *Hub for EU Defence Innovation* (HEDI).[102] Since May 2022, HEDI is entrusted within EDA with the task to adapt current strategic defence concepts to nascent technology trends.

So far, no specific policy paper on human enhancement has been released for the European defence sector. Yet, following the necessity of strengthening innovative resilience, in 2021 the EDA conducted what is known as a *Technology Foresight Exercise,*[103] where, among other trends, the strategic implications of **hybrid human-machine teaming** (EDA Foresight, scenario 05) and **cognitive enhanced soldier** (EDA Foresight, scenario 07) were examined. Scenario 05 deals with the topic *Soldier – Unmanned system integration,* whereas scenario 07 outlines among other enhancements the impacts of *In-*

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[99] European External Action Service: A Strategic Compass for Security and Defence, June 2022, p. 18, cit.: *China's development and integration into its region, and the world at large, will mark the rest of the century. We need to ensure that this happens in a way that will contribute to uphold global security and not contradict the rules-based international order and our interests and values*. Cit. end, https://www.eeas.europa.eu/sites/default/files/documents/strategic_compass_en3_web.pdf.

[100] Ibid., p. 22.

[101] Ibid., pp. 47- 48.

[102] The Strategic Compass for Security and Defence, which was approved in March 2022, called for the creation of an Innovation Hub.

[103] The Technology Foresight Exercise 2021 was aimed at providing a strategic vision of the possible impact of emerging technologies in defence in 2040+; exercise outcomes were fed into the revision of the EU's Capability Development Plan (CDP) to be finalised by 2023, https://eda.europa.eu/what-we-do/all-activities/activities-search/technology-watch-foresight#techsight, for interim results, see footnote below, ISDEFE report.

tegrated brain-computer interfaces. In the exercise summary, it is emphasised that advances in brain-machine interfaces in combination with the rapid development in AI and robotics provide a potential enhancement of tomorrow's soldier.

The conclusion on human enhancement innovation in military matters once again refers to the ethical aspect:

> This potential *(of enhancement, author's note)* will pose a great challenge on defining and enforcing the regulatory and ethical framework for the new possibilities, both at European and global scale.[104]

Coming back again to the status quo of EU responses to emerging AI technology in the defence sector, one specific policy trend should not remain unmentioned: the discussion concerns the currently promoted "open innovation" concept. Engaging in open innovation policy invokes the fact that a majority of emerging and disruptive defence applications are mainly produced and marketed in the private sector. Consequently, close cooperation with civil high-tech enterprises appears indispensable for European military innovation. In this context, public financial support for innovative SMEs, producing technology for dual use, is discussed:

> Setting up accelerators by networking innovation stakeholders from different backgrounds, university laboratories, companies and public funding bodies on a given programme may enable these SMEs and start-ups to grow and become part of a network of innovation for the defence community.[105] *(emphasis added)*

In reference to Chapter 1.2.1, the reader will note that the above idea of financial state support and close innovation networking between the civil and the military sector addressed borrows the Chinese strategy of *Military-Civil Fusion (MCF)*, promoted as *Military Civil Integration* before the beginning of the Xi Jinping era.

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[104] ISDEFE (Ingenieria de Sistemas para la Defensa de Espana) commissioned by the European Defence Agency, EDA Technology Foresight Exercise 2021, 1st Event Results – Publishable Summary, Aug. 2021, p. 9, https://eda.europa.eu/docs/default-source/documents/eda-technology-foresight-exercise-(2021)---1st-event-results---publishable-summary72ffba3fa4d264cfa776ff000087ef0f.pdf.

[105] Interview with Jean-Pierre Maulny (ARES), EU should become a full stakeholder in defence innovation, *European Defence Matters* (EDM), 2021, No. 22, p. 15, https://eda.europa.eu/docs/default-source/eda-magazine/edm22singleweb.pdf.

4.3 Alternative outlook

The question of what strategic steps Europe or the EU can pursue with regard to China's AI ambitions has already been discussed. The outlook of this essay, however, focuses on human-machine teaming with a specific interest in cognitive human enhancement via brain-computer interfaces, one of the manifold technological subcategories of AI.

First, it must be noted that "European AI diplomacy" vis-à-vis China on a bilateral basis will have little effect on already existing AI standards with "Chinese characteristics".

If the EU is aiming for separate permanent agreements with Beijing on ethical principles for human enhancement technology, these need to be negotiated in an international framework, be it UN organisations, the *Global Partnership on Artificial Intelligence* or platforms not yet established.

Two alternative scenarios put themselves forward for the coming years:

- In the first scenario, the GPAI community, where European countries play a major role, is evolving into an anti-China alliance in terms of normative technology standards. The currently existing working groups within the GPAI, i.e. "Responsible AI", "Future of work", "Data governance", "Innovation and commercialisation" and "AI and pandemic response" already show a strict orientation against illiberal state systems. Under the assumption of all European GPAI members insisting on obligatory democratic values of human enhancement technology, dialogue with China appears out of the question. Any future governance model for human enhancement with Chinese characteristics will be embedded in a fundamentally different understanding of citizen-state relationships, as described in part 2.0 of this essay. As an additional consequence of increased value competition, a further economic North-South decoupling process is predictable: to date, Chinese producers are already offering products with AI technology components at lower prices than Western suppliers for both the civilian and military sector, and therefore find their markets primarily in the global South. This will also most likely be the case for "cognitive human enhancement" products such as non-invasive brain-computer interfaces, augmented reality headsets or other devices.

- As for the second scenario, the European Union – for whatever reasons – comes to the conclusion that the PRC should be allowed to play a certain role in setting standards for the global governance of "cognitive human enhancement" technology.

Of course, only a policy of small steps would be conceivable here, such as the creation of a new GPAI working group with a more inclusive orientation, such as "Fair Human Enhancement" or "Human Enhancement for All". As for these topoi, the developing world would also feel addressed and China – as the declared advocate of developing countries – would be ideologically obliged to participate in the debate. Collaborative efforts in tandem with China may also be considered to define international standards for brain-computer interface (BCI) technology in less safety-related industries, such as the medical field.

The looming security issue of the weaponisation of human enhancement is likely to be subject to Chinese initiatives or requests at UN level in the near future. In this context, the EU may demonstrate moderately supportive voting behaviour. Of course, all of the above assumptions of the second scenario presuppose an open exchange of conflicting discourses. Hence, no "rose garden" but fierce controversies are to be expected.

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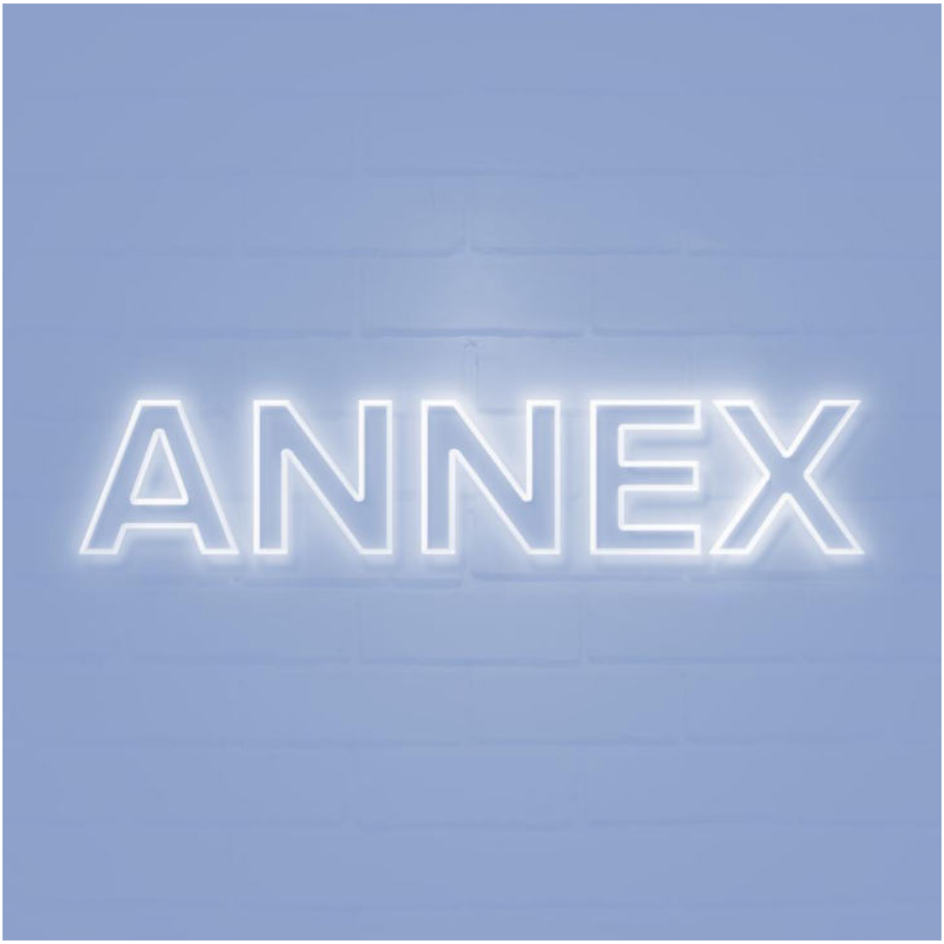
Annex



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Civilian achievements – including medical ones – often end up being used in military applications. The armed forces are always striving for optimisation potential in order to emerge victorious in a conflict thanks to strategic, operational or tactical advantages. Successful research in the field of human enhancement (HE) could generate such an advantage in optimising human abilities. New technologies in combination with artificial intelligence (AI), applied to and within the human body, should lead to improved performance. This could be achieved through invasive and non-invasive procedures. But despite such high ambitions, technological advances do not always necessarily benefit mankind. In this publication, experts from the scientific fields of technology, medicine, society, law, ethics and the military outline the current and future challenges of HE technology, as well as the potential limits and threats for the European Union and Austria.

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