Redesigning Humans in the Nano-Age

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Abstract: The blurring boundaries between therapy and human enhancement raise a lot of ethical questions that need to be addressed. Therapy is healing and restoring the sick to health; enhancement is improving the normal functioning of the body. With nanomedicine, the boundary becomes even hazier. Nanomedicine refers to the application of nanotechnology to the prevention and treatment of diseases. The European Science Foundation defines it as the science and technology of diagnosing, treating, and preventing disease and traumatic injury, relieving pain, and preserving and improving human health using molecular tools and knowledge of the human body (ESF, 2005). While nanomedicine delivers numerous and unprecedented benefits to the health and general well-being of individuals, nano-enabled human enhancement technologies will be the gateway to the transhumanist vision of immortality. Transhumanism contends that through the advancements in science and technology, we can overcome our physical and cognitive limitations, extend human lifespan, and attain perpetual existence. The blurring boundaries between enhancement will have remarkable consequences on what it means to be a human being. The study will make use of New and Emerging Science and Technology (NEST) Ethics as a framework for addressing dichotomous approaches and polarizing perspectives on human enhancement.

Keywords: human enhancement, nanomedicine, NEST ethics, human enhancement-therapy distinction

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Introduction

In recent years nanomedicine has made astounding advances in the areas of diagnosis, treatment, and prevention of diseases. The medical benefits are derived from using structures and devices at the molecular level. The size advantage of nanoparticles makes them capable of highly innovative medical diagnosis (since they are undetected by the immune system, able to cross the blood-brain barrier), targeted drug delivery, and decentralization of patient care. Medical monitoring will move away from hospitals to private spaces like our homes. The Rathenau Institute of the Netherlands, an independent body dedicated to monitoring the societal significance of technological advances envisions nanomedicine to become predictive, preventive, personalized, and participatory.[1] Nanomedicine would enable us to analyze, repair, and restore the ailing part of the human body; it promises to bring an end to pain and suffering, aging, and death. Nanotechnology potentially artificializes nature and naturalizes artifacts. The thin demarcation line between nature and artifact distinction opens up the possibilities for a posthuman future.

This paper will explore the different perspectives related to the human enhancement debate. It will analyze the societal and ethical implications of human enhancement, using patterns of moral argumentation, and new and emerging science and technology (NEST) ethics.

New and Emerging Science and Technology (NEST) Ethics

NEST ethics was primarily articulated in an article by Arie Rip and Tsalling Swierstra, scholars from the Twente University of the Netherlands. NEST is an acronym for new and emerging science and technology. NEST-ethics refers to a hypothetical structure observed in ethical debates over novel science and technology. It is an inventory or a repertoire of arguments, motives, and patterns available for use in concrete debates. It covers the taxonomy or grammar of arguments and argumentative patterns and an account of how the NEST typically unfolds. It includes categorizing and classifying arguments according to leading moral theories such as consequentialism, deontology, virtue ethics, and justice ethics. This framework also embraces meta-ethical issues such as novelty, inevitability thesis, and mobilizing the past, involving considerations about developmental control and the relation between morality and society.

NEST ethics presents itself as a set of repetitive tropes and argumentative patterns. Tropes are understood as recurring motive or argument that is supposed

[1] Rathenau Instituut-Technology Assessment, Nanomedicine in the Netherlands: social and economic challenges, May 31, 2010, Accessed at http://www.etp-nanomedicine.eu/public/news-events/news/related-content/ Nanomedicine %20in%20The%20Netherlands%20-%20Rathenau%20Instituut.pdf.

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to have a particular force. On the other hand, argumentative patterns are two or more ethical arguments in the sense that they provoke each other into existence.[2] These tropes and narratives frame the perspective of actors that view issues and apply them in concrete debates. NEST ethics is interested in understanding meta-ethical concerns, namely, novelty, inevitability thesis, and mobilizing the past.

1. *Novelty.* NEST ethics debates are launched with a strong emphasis on novelty. This feature is crucial in the development stage, there is no clear indication of what concrete ethical issues the new technology will raise.

Man occupies a unique place in the order of creation; he transcends his limits. While he lacks the wings of the birds, the fur to protect his body from extreme cold and heat, the agility of the cheetah to escape predators, and the ferocity of the tiger to ensnare enemies, man alone possesses the intelligence to make his life secure and comfortable. Left to his own devices, man can make progress by enhancing himself by altering his environment on purpose to suit his needs. Technology has been his ally to make things work for him.

A common perspective among those in favor of human enhancement is that it is not new to us since human beings have been enhancing themselves from the moment of their existence—tools, and implements were used to enhance their limited physical capabilities for survival. However, the unprecedented advancements in GNR technologies[3] and computer and information technologies such as artificial intelligence, smart and wearable devices, implants, the Internet of Things (IoTs), and cloud computing have raised ethical concerns. Man should set limits to what he can do. Can does not always imply ought.

2. *Inevitability thesis.* NEST ethics raises the question of whether technological development is inevitable or not. Dichotomous approaches to new technologies create polarizations. At the outset, proponents of technology exaggerate claims announcing all sorts of benefits (technology as a panacea or cure-all). In response, the critics downplay novelty since similar technologies in the past brought unwanted consequences. Promoters now choose to ease people's worries by presenting new technologies as a continuation of the old and should be opted since it does things better and faster. This narrative shifts the focus from novelty to business as usual.

3. *Mobilizing the past.* NEST ethics argues that previous technologies can

[2] Swierstra, Tsjalling and Arie Rip. "Nano- ethics as NEST ethics: Patterns of Moral Argumentation About New and Emerging Science and Technology," *NanoEthics* 1:3-20 (2007) DOI 10.1007/s11569-007-0005-8.

[3] GNR stands for genetics, nanotechnology, and robotics. These are transformative technologies that have the potential to impact human life.

be mobilized either to support new technological developments which were beneficial in the past or cast suspicion because similar previous technologies have brought unintended or unwanted consequences.

Mobilizing the past is often accompanied by mythological invocations:

1. *Promethean project.* Prometheus is invoked as the promoter of technology that boldly reaches for the goods to uplift the human condition.
2. *Faustian bargain.* Faust makes a pact with the devil in return for knowledge that could cost us our flourishing humanity.
3. *King Midas.* The Greek King wanted to turn everything he touched into gold, only to realize he was starving to death. It speaks about ill desires, getting it, and realizing it is not what was wanted.

A study by Nordmann and Macnaghten on the content of lay ethics concerns lists 5 archetypal narratives which underpin the nanotechnology talk.[4]

1. *The rich get richer, and the poor get poorer.* This argument emphasizes equal access to the benefits of nanotechnology. The critique against its potential development centers on justice, fairness, and equality.
2. *Kept in the dark.* This argument expresses powerlessness shared by participants in the face of human enhancement's troubling but inevitable development. It weaves ideas around control and power as well as modern alienation in the face of institutions (government, military, corporations) viewed as driven by dubious motives.
3. *Opening Pandora's box* cautions us of a temptingly closed box, that releases the gamut of human evils when opened. It incorporates ideas of potential and uncertainty, of hubris and meddling with things that should be left alone, and of danger, ultimately, disaster. It is also concerned about technology's unforeseen risks, uncertainty, and danger-arising from science that is hubristic and arrogant in meddling with what it doesn't fully understand.
4. *Messing with nature.* This argument summarizes concerns around the disruption of nature, the natural and the human. It implies that orders and boundaries, which should generally be left alone, are being blurred and transformed, and therefore it encodes an ethical judgment that nature should not be messed with. Flashpoints for these concerns for

[4] Alfred Nordmann & , Phil Macnaghten."Engaging Narratives and the Limits of Lay Ethics: Introduction," *NanoEthics*. 4. (2010) DOI 133-140. 10.1007/s11569-010-0095-6. The authors used the term lay ethics to signify ethical reflection of lay publics and the ways in which they are informed by experience and technological innovation, technology governance, and the (broken) promises of visionary science and technology.

unnatural enhancement to man's native talents were troubling notions of enabling actors to be God or to create, make, fabricate, or engineer life and the future.

5. *Be careful what you wish for*. This narrative draws together ideas about perfectibility, desirability, and the ethically troubling character of an extreme sort of human enhancement's seductive promises, as expressed in the notion that getting what you want may not be good for you.

NEST Ethics and the Patterns of Moral Argumentation

Current literature on NEST ethics may be limited and may justify further research. There are a few studies that focus on this subject. One important contribution related to this research area is Niculescu-Dinca's *NEST-Ethics in Convergence: Testing NEST Ethics in the Debate On Converging Technologies for Improving Human Performance*.[5] Another study worth mentioning is the article of Oerlemans, A.J.M., et al., *Towards a Richer Debate on Tissue Engineering: A Consideration on the Basis of NEST Ethics*.[6] These works largely draw from Swierstra,[7] and Swierstra and Rip.[8] The goal of this paper is to use NEST ethics as a framework for addressing dichotomous approaches and polarizing perspectives surrounding the human enhancement debate.

Using the normative moral standards, we examine the plethora of questions that NEST ethics covers— consequentialist, rights, justice, and good life arguments.

Consequentialist Arguments

New and emerging science and technologies are often hyped technologies. They are heralded by arguments that point to consequences or benefits that will simultaneously allow us to increase our control of the world and promote wellbeing. Skeptics typically question these promises along four axes:

1. Is the promise possible, or is it just hype?

[5] V. Niculescu-Dinca. "NEST-Ethics in Convergence: Testing NEST Ethics in the Debate On Converging Technologies for Improving Human Performance," (2009). https://purl.utwente.nl/essays/59321.

[6] A.J.M Oerlemans, M.E.C. van Hoek, E.van Leeuwen et.al. "Towards a Richer Debate on Tissue. Engineering: A Consideration on the Basis of NEST Ethics." *Sci Eng Ethics* 19, 963-981 (2013). https://doi.org/10.1007/s11948-012-9419-y.

[7] Tsalling Swierstra. "Introduction to the Ethics of New and Emerging Science and Technology" in the *Handbook of Digital Games and Entertainment Technologies*, Nakatsu, R et.al, ed., Springer Science+Business Media Singapore (2015). DOI 10.1007/978-981-4560-52-8_33-1.

[8] Tsjalling Swierstra and Aric Rip. "Nano-ethics as NEST-ethics: Patterns of Moral Argumentation About New and Emerging Science and Technology." Springer Science+Business Media B.V. Singapore 2007. DOI 10.1007/s11569-007-0005-8.

2. What is the proportion between risk and benefit? In the final analysis, will the side effects outweigh the good effects?
3. Is there a better alternative to realize the envisioned good?
4. Is the envisioned good considered a real good?

Rights Arguments

The second category of arguments stresses fundamental principles, rights, and obligations-typically siding with the individual in danger of being sacrificed for the collective good. When rights and principles become the subject of ethical controversy, they are typically contested. They can be too abstract to be applied to the NEST in question.

Universal human rights form the basis of establishing and evaluating ethical standards within the social order and include rights to life, freedom, political participation, legal protections, and basic social and economic goods.

Justice Arguments

The question of how to distribute the cost and benefits of NEST figures in this discussion. Among the accepted criteria for distribution are equality, merit, need, and chance. NEST ethics are couched in egalitarian terms or need. This is a benefit to humankind and intended for human progress. It is immoral to stop this technological development because it will benefit the sick and the starving. Consequently, two conflicting positions emerged. 1) The trickle-down effect will ensure that benefits will reach the needy, and 2) The trickle-down effect will not happen without political help.

Good Life Arguments

Good life arguments are issues that are hard to categorize because the issue of the good life is very complex. Good life arguments project scenarios that describe visions of possible worlds in possible futures. NEST ethics identifies with Aldous Huxley's *Brave New World*, which plays prominently in technologies invading privacy. Good Life arguments are predisposed to lead the debates toward clashes between incommensurable world views (sometimes arguments are treated as private beliefs). Notably, the European and US reports lack such argumentation, suggesting that good life arguments do not easily find their place in public policy recommendations.

In evaluating human enhancement technologies, questions regarding how the technology is likely to serve the purposes of human excellence and thriving must be addressed. This will force us to consider our motives, intentions, values, and interests. The technology involves various processes such as concept utilization,

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funding, production, and application of technologies. These processes involve human interests at various levels—scientists, investors, funding agencies, technical review boards, policy-makers, and exporters. Manufacturers, consumers, and society as a whole shape the development of technology. Whose interests should prevail?

Ethical Questions on Human Enhancement

After examining the argument patterns concerning consequentialist, rights, justice, and good life arguments, I shall now focus on the issue of human enhancement. The following discussions will be devoted to the distinction between enhancement-therapy distinction and discussion of arguments for and against human enhancement. In this section, the views of Allhoff and Lin, and Wolbring will be presented. While Allhoff and Lin present counterarguments against human enhancement, Wolbring puts forth compelling reasons in support of human enhancement.

Nowadays, it is cumbersome to draw the line between medical and non-medical use of new medical technologies. A case in point is the application of surgical interventions for reconstructive and aesthetic purposes. Another example is the cosmetic industry's overlapping medical and non-medical concerns, dealing with allergies that are proper to the medical field. In the case of vaccines, polio vaccine may boost the immune system of the person (a form of enhancement), and at the same time, it can prevent the disease (therapy). Thus, it is plausible that neurological stimulation of the human brain could extend beyond the boundaries of diagnostic and therapeutic purposes.

According to Allhoff and Lin, human enhancement is about boosting our capabilities beyond the species-typical level of the statistically normal range of functioning for an individual. Therapy, on the other hand, is treatment aimed at pathologies that compromise health or reduce one's level of functioning below this species-typical or statistically normal level.[9] While therapy restores the normal structure of the body, enhancement alters the original structure beyond the species-level of functioning. For instance, the use of corrective eyeglasses is considered therapy; night vision goggles are a form of enhancement. It gives one the ability to see beyond the range of unassisted vision. Beta-blockers, when use to control high blood pressure, is therapy; but when they are used to gain an advantage in sports, such as an archer, to better control the release of the arrow, it becomes a form of enhancement. With nanotechnologies, a sharp distinction between the two cannot be made since many therapies have aspects of enhancements, just as there are aspects of enhancements that may be considered therapeutic.

[9] Fritz Allhoff and Patrick Lin. "Untangling the Debate: The Ethics of Human Enhancement," *NanoEthics* (2008) 2:251-264, DOI 10:.1007/s11569-0008-0046-7.

Gregor Wolbring advanced arguments in favor of human enhancement.[10] (1) He stated that humans have been enhancing themselves since the beginning of time to protect themselves and enhance their physical limitations. (2) Humans should enhance themselves because the playing field is not leveled in the first place. Not everyone has the same gifts or talents. Variations in biological and physical traits introduce inequalities in man. Some of us are taller, faster, and smarter than others. (3) Enhancement favors business productivity. The advantage of superior memory, intelligence, speed, and endurance will boost the economy. (4) Pro-enhancement advocates contend that enhancement is a conscious choice to transcend our feeble nature; we are aware that we are already changing what it means to be human. (5) Enhancement is an exercise of our freedom; it is a personal choice. (6) There is a hazy boundary between enhancement and therapy. In most cases, the two overlap. (7) Enhancement cannot be dealt with in a straitjacket manner but must be considered on a case-to-case basis.

Allhoff and Lin stood against enhancement and raised the following ethical and societal concerns. (1) Both argue that while self-enhancement is a personal choice, it is a freedom that is situated within limits to guard against the conflict with the rights of others. Some forms of enhancement, such as neural implants, may compromise man's deliberative capacity. He may not be truly acting freely as he should. (2) Human enhancement also poses risks to health and safety. Its long-term effects may be detrimental to the aggregate. There are still knowledge gaps regarding its possible effect on the germline. (3) Human enhancement magnifies the issue of inequality since not everybody has equal access to enhancement technologies. A job gained by an enhanced person is the loss of the person who is not enhanced. (4) Human enhancement will cause social and economic disruptions. Non-enhanced workers will be laid-off due to the company's preference for the enhanced workforce. Individuals with super hearing abilities may outwit privacy protections. (5) Allhoff contends that human dignity is the hardline stance of those against human enhancement. Mortality and fallibility add a dimension of meaning to human life.

The contrasting views of Allhoff & Lin, and Wolbring invite us to investigate the matter further. The following questions categorized under normative ethics may be explored to provide us with deeper insights concerning human enhancement:

Consequentialist Ethics

1. Is the cost of human enhancement proportionate to the number of people likely to benefit from it?

[10] Gregor Wolbring. "Therapy vs. Enhancement: not as simple as it sounds," (2006) http://www.innovationwatch-archive.com/choiceisyours/-choiceisyours.2006.06.15.htm.

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2. What are the most likely outcomes- positive, negative, or neutral?
3. What is the level of risk that can be anticipated?

Rights-based Ethics

1. Do we have the right to protect the interests of current and future generations to develop an enhanced population of human beings?
2. Do we have the right to be enhanced by new technologies, and to what extent?
3. Do vulnerable populations, such as children, the elderly, the sick, etc., have the right to refuse enhancement technologies?

Justice Ethics

1. Will human enhancement reduce inequalities or widen disparities?
2. How will those communities harmed be compensated by human enhancement technologies?
3. Will the limited availability of medical nanotechnologies due to the cost and access increase existing social barriers and injustices?

Virtue Ethics

1. Will nanotechnology's promise of life extension and immortality through human enhancements be an ideal goal?
2. Will human enhancement and control over man's physical limits be ultimately desirable for men?
3. Can further medicalization of society be considered a positive development?

The enumerated ethical quandaries will have an impact on the choices that we have to make collectively as a community of individuals, and the answers to these questions will determine the common future of humanity. The ethical stakes are high; the existing debates require our participation and firm resolve for action.

Drawing upon the preceding discussions, it becomes evident that technological advancements at a breakneck pace lead to confounding issues of boundaries of human enhancement. Reflecting on the notion of limits, we may raise some important questions: What may be considered acceptable and non-acceptable forms of enhancements? (Allowing enhancements may be viewed as an act of participation in the creative powers of the Creator. However, it may be used for wrong motives, such as facilitating criminal activities, undermining personal relationships

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and human values, and exacerbating inequalities.) Are current regulatory and policy guidelines adequate? Do current oversight mechanisms meet the challenges of privately funded human enhancement technologies? What if we reach the point of no return? Can we reverse the modifications made to our enhanced selves? In the age of nanotechnology and artificial intelligence, does it matter if human experiences are virtual or real? Would it make any difference at all? In an effort to bring about human wellbeing, how will these enhancements bear upon the human spirit?[11] Will they diminish the value of human life? Will they erode the value of the human spirit and distort our sense of purpose and meaning? Will there be a space for thoughtful attention to things important to spiritual and moral growth? These are crucial questions that cannot be answered by the paper, but may open up new lines of inquiry in NEST ethics.

The real issue we need to address should gravitate toward the purpose of human enhancement technologies since purpose shapes our values and guides our decisions in pursuing enhancement technologies. This inquiry will usher us into an ethical investigation about two fundamental questions: 1) the kind of life we want, and 2) the concept of perfection. Human enhancement is driven by our values, desires, and ability to take risks and it is closely related to the kind of life we want. Integrating technologies with the human body, improving our physical and cognitive abilities, prolonging or extending lifespan, etc., will open the floodgates of possibilities that will raise societal and ethical concerns. The transformative nature of these technologies can have profound implications on our understanding of what it means to be human. Perfection is a subjective concept. Different societies may prioritize certain traits or capacities in pursuit of perfection. Aristotle views perfection as the ultimate achievement of our rational nature. It is the summit of excellence and fulfillment and a concept that is closely linked to eudaimonia or human flourishing. However, this view may be different from the ideal of Nick Bostrom and other futurists and transhumanists, who identify the concept of perfection with overcoming our defect, weaknesses and limitations through technology.

Overall, human enhancement technologies vis-à-vis the developments in nanomedicine will broach ethical and societal issues, as it holds the promise of advancing human capabilities and improving general wellbeing through nanoscale drug delivery systems, brain-machine interfaces, tissue engineering, etc. NEST ethics may serve as a useful map in navigating the discourses on human enhancement. As ethics and technology co-evolve, NEST ethics will be an ongoing conversation. New technologies will continue to emerge but the patterns of moral argumentation

[11] St. John Paul II declares that human wellbeing flows from human dignity. He asserts: "The dignity of the human person transcends their biological condition. See *The Dangers of Genetic Manipulation*. http://www. Ewtn.com/library/ PAPALNUC/JP2GENMP. HTM.

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will provide useful guidance in evaluating the broader implications of emerging technologies. At the same time, NEST ethics will continue to interrogate our ethical theories and beliefs that are often simplistic and ambiguous. This reflective exercise will lead to richer and more robust ethical discussions. As far as nanotechnology is concerned, it has introduced in the foreground of ethical debates the talk about the Precautionary Principle (PP), and Responsible Research and Innovation (RRI). NEST ethics attempts to provide a comprehensive framework for evaluating the ethics of human enhancements. It encourages a nuanced reflection on the role of technology in shaping our understanding of what it means to be human.

Conclusion

The question of nano-enabled human enhancement as NEST ethics added flavor to existing debates in NEST due to the size property of nanomaterials and nanoparticles and their quantum effects. Nanotechnology is ethically different from other techno-scientific enterprises; it operates at the nanoscale, where materials and devices exhibit unique properties and behaviors. Ethics and technology co-evolve; it is not a finished project. Moral arguments are reformulated and enriched. Therefore, the repertoire of NEST ethics is continuously modified and expanded. As the debate on human enhancement develops, we see the nature of the arguments that actors play. NEST ethics provides a methodical framework to give us new insights into technologies.

With new technologies like nanotechnology, we take good chances as we make difficult choices. In the words of American philosopher Ronald Dworkin: the crucial boundary between choice and chance is the spine of our ethics and morality, and any serious shift in that boundary is seriously dislocating. Human enhancement technologies will test our commitments to freedom and responsibility for our life and future.PS

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