Cyborg identities and contemporary techno-utopias: adaptations and transformations of the body in the age of nanotechnology

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SUMMARY

The possibility of improving the human body through a closer relationship with technology in order to overcome the human species toward new stages of evolution is a constant element of techno-utopian visions, among other transhumanism. This projection to a radical transformation of the body – and mind – as a result of technological action is based on the concepts of adaptation, or non adaptation, of a human being to a world constantly changed by techno-science.

The belief is that not only the body has to change, but that identity is not a stable concept. This mobility in the relationship between body and identity is typical of the post human thought, which inherits from the informational model the conviction that the biological embodiment of human is to be regarded as an accident of history rather than as an essential condition of life.

Hybridization is therefore valued by the post human thought as a condition which has "made" the human as he is today, and it appears as a fundamental topic in any discourse on nanotechnology, biotechnology and development of human-machine interfaces.

Key-words: Nanotechnology, Science, Technology, Human enhancement, Social control over science, Future of mankind, Transhumanism, Progress, Mythology, Historical aspects, Theory of evolution, Ethno-anthropology, Human body.

RÉSUMÉ

L'IDENTITÉ DES CYBORGS ET LES TECHNO-UTOPIES CONTEMPORAINES : ADAPTATIONS ET TRANSFORMATIONS DU CORPS À L'ÂGE DE LA NANOTECHNOLOGIE

La possibilité d'améliorer le corps humain grâce à une relation plus étroite avec la technologie afin de permettre de dépasser le stade de l'espèce humaine pour atteindre de nouvelles étapes dans l'évolution est une constante des visions techno-utopistes et notamment du transhumanisme. Cette perspective de transformation radicale du

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corps – et de l'esprit – comme conséquence de la technologie découle de la notion d'adaptation – ou de non-adaptation – de l'être humain à un monde constamment transformé par la science.

L'idée est que non seulement le corps va changer mais que l'identité n'est pas un concept stable. Cette variation dans la relation entre le corps et l'identité est typique de la pensée post-humaniste qui est l'héritière d'un modèle international de croyance que la corporalité biologique de l'homme doit être perçue comme un accident de l'histoire plutôt que comme une condition essentielle de la vie.

L'hybridation est dès lors considérée par la pensée post-humaniste comme une condition qui « a fait » de l'homme ce qu'il est aujourd'hui et cela apparaît comme un sujet fondamental dans tous les discours sur les nanotechnologies, les biotechnologies et le développement d'interfaces entre l'homme et la machine.

Mots-clés : *Nanotechnologie, Science, Technologie, Amélioration, Contrôle social de la science, Devenir de l'humanité, Transhumanisme, Progrès, Mythologie, Aspect historique, Théorie de l'évolution, Ethno-anthropologie, Corps humain.*

Humanity must not stagnate […] Humanity is a temporary stage along the evolutionary pathway. We are not the zenith of nature's development. It is time for us to consciously take charge of ourselves and to accelerate our transhuman progress.

Max More, *On Becoming Posthuman*[1]

The human desire to acquire new capacities is as ancient as our species itself. We have always sought to expand the boundaries of our existence, be it socially, geographically, or mentally. There is a tendency in at least some individuals always to search for a way around every obstacle and limitation to human life and happiness.[2]

Nick Bostrom, *A History of Transhumanist Thought*

Humanity is "always" eager to improve and has "always" wanted to exceed the limits holding up the fulfillment of happiness. To Nick Bostrom, this is precisely what justifies the will to enhance defining his movement, transhumanism. The idea of enhancing physical abilities, the need to cross limits and reach a new stage of human evolution is a constant element in transhumanist thought, particularly in the establishment of close body/technology relationships. Significantly transforming the human body – and mind, especially the intellect – using technology, implies relying on the notion of human adaptation and inadequacy abilities, in a world changing as a consequence of technological developments. These perspectives are extreme. Nonetheless, they can shape the conceptual and ideological framework of research projects in the nanotechnology field, often converging with biology and physics.

The concept of human adaptation and inadequacy abilities in times of technological evolution is developed within a specific stance on the natural-artificial relationship, where the acceleration of technological evolution is opposed to the tardiness of the organic one. It would thus seem that machines has more chances and opportunities of imposing its evolutionary model than living organisms and human in particular do. Several theories will be presented before we proceed to the identification of models of bodies used to substantiate the discourse regarding human beings' inadequacy in a technological environment, increasingly considered as a "doubled nature."

For the most part, the examples will be derived from transhumanist literature, omnipresent in "metaphysics" inherent to the hypothesis on converging technologies (nano-bio-info-cogno, NBIC Convergence) which aspires to enhance human abilities and increase their power. It should be pointed out that this literature is essentially of American origin. Yet, more and more

1. http://www.maxmore.com/becoming.htm.
2. Nick Bostrom, "A History of Transhumanist Thought", in *Journal of Evolution & Technology*, vol.14, n. 1, 2005.

transhumanist stances are present among the European academic world, especially in England, and not completely rejected by the "weak" European version of convergence, suggested in the report *Converging Technologies: Shaping the Future of European Societies* in 2004[3]. A model of unifying bodies seems to emerge from this analysis: the idea that bodies can be conceived, built, modified and laid out like a personal project as well as a collective one.

1. THE EVOLUTION OF MACHINES: A COMPETITIVE KIND OF NATURAL EVOLUTION

Describing humanity's artificial and natural dimension using definitions such as "technosphere" or "technonature" seems to result in the double process of naturalness' artificialization and the naturalization of the artificial, and a desire to abolish the dualism existing between nature and artifice. In this sense, certain authors talk about "the evolution of machines". George Dyson[4], for example, expresses an amenable outlook where the evolution of machines and natural evolution are in symbiosis. The reconstruction of humanity's artificial history, from the first bit of flint to silicon microchips[5], follows an adaptive continuity, far from opposing biochemistry to electronics, and founded on two presumed methodologies: a biological point of view on the evolution of machines and a mechanical point of view on life. The co-evolution of the organic and the mechanic is a constant, characterizing the past and predicting the future.

However, a breaking point is often considered for this common process. This is what Vernor Vinge and Ray Kurzweil describe as "singularity". Indeed, there is a difference between an increase in machines and networks' intelligence and the human biological evolution. The latter is deemed slower and less capable of being integrated in what Dyson calls "global electronic intelligence."

Singularity is possible only if human beings succeed in building a conscious machine whose intelligence is superior to theirs. This contingency was often discussed and discredited[6]. The creation of such a machine is still in question to this day. However, if an "intelligent" computer is developed as explains Vinge, the concerted action of computer networks and their human users could lead to the creation of super-intelligence capable of increasing the human intellect. In 1993, referring to the curve of computing progress during the last decades, Vinge predicted that such an event could happen between 2005 and 2030[7]. Singularity can be considered as the end of human civilization and the beginning of a new era.

The promise of this kind of accomplishment in the future is grounded on a law meant to govern progress and change it into a regular and necessary process. As far as computing and nanotechnology are concerned, Moore's law on miniaturization is the most relevant example. Gordon E. Moore, Intel's co-founder, noticed that the amount of transistor's per integrated circuits had double every 5-6 years since 1959 and announced in 1965[8] and 1971 that the components' power would double equally every 18 months. This law seemed to make this potential future necessary and inevitable but found its limit in the size of microchips and transistors that cannot be reduced indefinitely. Yet today, nano-dimensions make it possible to « tease » Moore's law, as some researchers like to say, and push miniaturization's limits.

3. European Commission, Converging Technologies: Shaping the Future of European Societies, 2004, reporter Alfred Nordmann, http://ec.europa.eu/research/conferences/2004/ntw/pdf/final_report_en.pdf.
4. G. Dyson, *Darwin Among the Machines*, New York, Addison-Wesley, 1997.
5. A continuity available in the model of the outline established by A. Leroi-Gourhan about the evolution of knives in his work *Gesture and Speech*, Cambridge, Massachusetts & London, MIT Press 1993 (particularly in section II, *Memory and Rhythms*). Leroi-Gourhan outlines a similar functional "technical trend" uniting the Australanthropes' irregular cutting edge to the present knife. Dyson suggests a more haphazard linearity going beyond any trace of technological trends.
6. R. Penrose, *The Emperor's New Mind. Concerning Computer, Minds, and The Laws of Physics*, Oxford University Press, 1989; John Royston Searle, "Minds, Brains, and Programs", *The Behavioral and Brain Sciences*, vol. 3, n. 13, 1980, pp. 417-424.
7. Concerning the debate about technological singularity, a number of participants created associations present on the Internet. *Singularity Institute for Artificial Intelligence* (SIAI, official website http://www.singinst.org) is the movement of Singularitarians' website. Michael Anissimov (http://www.acceleratingfuture.com/michael/blog/) animates the debate on the blog: the website gives links to many personal websites and to websites of other authorities related to transhumanist and immortal movements or merely praising radical nanotechnologies. Eliezer Yudkowsky, for example, is for a « friendly AI », an artificial intelligence capable of increasing the human intellect prior to neurotechnology or genetics. He is also the author of *Singularitarian Principles* (http://yudkowsky.net/sing/principles.html). The *Acceleration Studies Foundation* (ASF, official website http://www.accelerating.com) promotes *Accelerating Change*, a multidisciplinary conference at Stanford University on the acceleration of technological change and affiliated to the website *Acceleration Watch* (http://www.accelerationwatch.com).

Ray Kurzweil, inventor, scientist, futurist and specialist in applied computing, suggests in his essay *The Law of Accelerating Returns*[9] and his last work *The Singularity is Near*[10], to extend Moore's law in order to include other forms of calculations. He believes that the exponential growth of technological progress could be a pattern visible throughout humanity's history, even before the arrival of life on earth. According to the law of "accelerating returns", when sciences and technologies dispose of efficient and affordable computing means, they can achieve more discoveries requiring new calculation methods. Technology's role is not only about making tools; it is also about making things allowing for the conception of new tools. Moreover, progress is contagious. Indeed, progress in a field leads to progress in others. Technology generates technology, yet again according to an accelerated growth curve. Technology thus becomes the generating factor of evolution in the present phase.

Hence, it is possible to see how the constant complexification and the regular development of human-technology relationships converge towards a point of no return, a radical rupture, a "singularity" defining an entirely new stage in history. However, Kurzweil's interpretation of Moore's law has changed the meaning and the area of relevance of this law, since it could only be applied to semiconductor circuits. Kurzweil extrapolates boldly: from predictions on material components of information technology he proceeds to the spiritual performances of human mind[11].

Then what is humanity's future in the convergence of biochemistry and electronics? Dyson warns us in the preface of his work: "In the game of life and evolution, there are three players at the table: human beings, nature and machine. I am firmly on the side of nature, but nature, I suspect, is on the side of machines."[12]. This point of view is shared by the spokesmen of a "strong" interpretation of the development of artificial intelligence. Hans Moravec[13], for example, agrees with him and is convinced that man's chances of surviving in the case of an encounter with the superior specie of artificial beings are very small. The end of humanity stands for a lost battle walking down evolution's path.

2. THE HUMAN BODY AMID INADEQUACY AND HYBRIDIZATION

Some extreme points of view on the adaptation dynamics existing among the dimension of the artificial and man, express the belief that man is *maladjusted* for a/the technosphere, maladjusted to integrate himself in it. Several models of the human body are at the basis of this belief. An old model makes reference to the theory of human incompleteness according to which man is an imperfect being capable of improving by means of culture – in particular due to his "autopoietic capacity"[14], that is to partly build himself – going back to a long tradition in occidental thought. Indeed, this is recounted in the Prometheus myth, found in Hesiod's *Theogony* and Plato's *Protagoras*. The legend tells the story of Prometheus and his brother Epimetheus. During the creation of world, the gods assigned them the task of distributing qualities and physical abilities among all living beings. Epimetheus gives all animals a special virtue, until no good is left for man, no protective covering and no quality. To atone for his brother's mistake, Prometheus steels the secrets of fire and arts to Hephaestus and Athena, and gives them to mankind to compensate for their deficiencies. At the Renaissance, Giovanni Pico della Mirandola thematizes the link existing between natural deficiencies and the indeterminateness of the human condition, referring it on the one hand to the condition of animals and on the

8. Gordon E. Moore's first article about this is "Cramming more components onto integrated circuits", *Electronics*, vol. 38, n. 8, 1965. See also http://www.intel.com/research/silicon/moorespaper.pdf.
9. http://www.kurzweilai.net/articles/art0134.html?printable=1
10. Ray Kurzweil, *The Singularity is Near. When Humans Transcend Biology*, New York, Viking Penguin, 2005.
11. For a review of the technological determinism expressed by Moore's law and the inclination to apply principles of this law in fields different from the development of semiconductors' industry, see the article written by Ilkka Tuomi "The Lives and Death of Moore's Law", *First Monday*, vol. 7, n. 11, 2002. Computing publication, website http://www.firstmonday.org/issues/issue7_11/tuomi/. Tuomi's critics, later resumed by a text clearly against Kurzweil's interpretation of Moore's law (*Kurzweil, Moore, and Accelerating Change*, august 2003, http://www.meaningprocessing.com/personalPages/tuomi/articles/Kurzweil.pdf), lead Ray Kurzweil's to answer in the article *Exponential Growth an Illusion: Response to Ilkka Tuomi* published in September 2003 on his personal website, http://www.kurzweilai.net/meme/frame.html?main=/articles/art0593.html.
12. G. Dyson, *Darwin Among Machines*, cit., p. 86.
13. H. Moravec, Mind Children. *The Future of Robot and Human Intelligence*, Cambridge, Massachussets, Harvard University Press, 1988; Robot. Mere Machine to Transcendent Mind, New York, Oxford University Press, 1999.
14. F. Remotti, «De l'incomplétude», in *Figures de l'humain. Le représentations de l'anthropologie*, Paris, Editions de l'Ecole des Hautes Etudes en Sciences Sociales, 2003, p. 28

other to the individual potential for liberty and responsibility[15]. Descartes asserts that, unlike animals whose existence is entirely determined by laws of matter, the incomplete adhesion of the human body to these laws and the influence of the soul, allow for human emancipation and gives him means to know the world and himself. During modern times, Johan Gottfried Herder systematizes the canonic theory of incompleteness especially in his *deen zur Philosophie der Geschichte der Menschheit* in1784-1791[16]. He also defines man from a median perspective: an animal within the animals, bound to earth and material needs, characterized by transcendent capacities resulting from rationality, freedom of action and the desire for immortality in religion, which destines him to a superior form of existence. The continuity between mankind and the animal kingdom diverges when perfection is aimed as it takes on different aspects for both. Indeed, animals reach their full potential perfectly in their natural milieu whereas men can only do it imperfectly, being required by God to enjoy a kind of superior existence.

During the 20th century, Arnold Gehlen gives an anthropological point of view on the roles that culture and technology have to play to overcome human incompleteness. According to him, human biological deficiencies (lack of developed instincts, unadapted organs, lack of hair protection for the body) are compensated by technology, without which man could not live on earth. Therefore, his imperfection is compensated by his exceptional ability to find the necessary stimuli to create and act. The development of technological acts would have generated a "shift in bodily participation", favoring "superior" cognitive and symbolic activities. For Herder, this superior skill is particularly well expressed via language. Thus, highly capable learning abilities have eventually privileged the emancipation of intelligence as a factor using technology to ensure human existence[17].

The concept of incompleteness strengthened the idea that other capacities could retrieve human beings from their animal condition; make them more independent in respect to life's materiality, as a result of the development of technologies and the influence of culture. But how did we get to the point of declaring that the body, the biological support of human intelligence, is becoming obsolete?

Indeed, today's technology seems to exceed environmental and physical constraints to the extent that some humans are no longer satisfied with their body. We own a body that we no longer desire. As the Australian artist Stelarc likes to say: "*The Body is Obsolete*"[18]:

> It is time to question whether a bipedal, breathing body with binocular vision and a 1400cc brain is an adequate biological form. It cannot cope with the quantity, complexity and quality of information it has accumulated; it is intimidated by the precision, speed and power of technology and it is biologically ill-equipped to cope with its new extraterrestrial environment.

The body is neither a very efficient nor very durable structure. It malfunctions often and fatigues quickly; its performance is determined by its age[19].

According to Stelarc, we are entering a postevolutionist era:

> In fact, I think that evolution ends when technology invades the human body [...] Nowadays, technology is ubiquitous, it is becoming a component of our body – including watches and artificial hearts; for me, it represents the end of Darwinist evolution as the organic development over millions of years, through natural selection. From now on, with nanotechnology, man can swallow technology. The body has to be comprehended as a "structure". It will only be possible to readjust our conscience of the world by modifying the body's architecture.[20]

15. Giovanni Pico della Mirandola, *De hominis dignitate, Discourse on the Dignity of Man* (1486), see *Pico Project* University of Bologna – Italy and Brown University, http://www.brown.edu/ Departments/Italian_Studies/pico/. Man, created lastly by God, does not receive any special virtue, but is placed at the center of the world and anything given personally to each individual will be come common to him, This is a reference to the famous speech given by God to Adam during the creation: a man who does not hold a defined nature is free to follow his judgment and define his own nature (§ 4).
16. Johann Gottfried Von Herder, *Outlines of a Philosophy of the History of Man*, Bergman, New York, 1966.
17. Arnold Gehlen, *Der Mensch: seine Natur und seine Stellung in der Welt*, (1940), Frankfurt am Main, V. Klosterman, 1993.
18. http://www.stelarc.va.com.au/parasite/index.htm.
19. http://www.stelarc.va.com.au/obsolete/obsolete.html. See also Stelarc, « Prothèses, robotique, existence à distance », Arts et cognition, Marc Partouche (edited by), Ed. Ecole d'Art d'Aix-en-Provence, 1994, p. 44.
20. Stelarc, « Portrait robot de l'homme-machine », interview with Jean-Yves Katelan, L'autre journal, n. 27, sept. 1992, pp. 24-41.

As Stéphan Barron[21] noticed, the human being described by Stelarc is almost like an object submitted to technology: an organic machine interacting with technological machines. For Stelarc, the body is one of technology's spin-offs, forced to adapt itself to technological needs and design: "I don't recommend to adapt space to our body but to restructure our body. So the question is: how can we restructure a human pan-planetary physiology [...] how can we restructure a body to enable it to exist in varied atmosphere, gravitation and electromagnetic field conditions?"[22]

The artist's words reveal posthuman and transhumanist principles where the body's model is obsolete, arbitrary and hybrid.

Jeffrey Deitch, the art critic who organized the interesting exhibit *Post Human* in the 90's about the relationship between body, identity and representation, goes back to an idea shared by the majority of technophile movements linked to posthuman circles. This idea asserts that human evolution is entering a new stage that Darwin could never have predicted. According to Deitch, "Social and scientific trends are converging to shape a new conception of a self, a new construction of what it means to be human being. The matter-of-fact acceptance of one's "natural" looks and one's "natural" personality is being replaced by a growing sense that is normal to reinvent oneself"[23].

Artists' actions – as well as writers' and philosophers' – focus on the transformation of the body, its disidentification and transmigration towards other configurations of expression, where genre and form no longer refer to human beings. This is the case in Orlan's *body art*, which modifies his features by means of live surgical interventions, Stelarc's declaration on the human body's final obsolescence where man-machine borders are redefined using prosthesis, implants, mechanical and technological interventions, and in Matthew Barney's appraisal of the human-animal boundary.

Of course, this concept of body-technology hybridization remains in the background. Cinema is also studying this desire to blend organic and artificial distinctions. Indeed, body-machine hybridization is present in David Cronenberg's work, and the *Alien* cycle, the cyborg figure in *Terminator 2: Jugement Day* (USA, 1991) by James Cameron and the virtuality theme discussed in the Wachowski brothers' trilogy *Matrix*, all discuss human/non-human hybridization.

Posthumans value hybridization as the condition that "made" humans what they are today. This concept is central in any discussion dealing with nanotechnology, biotechnology and the development of man-machine interfaces. 21st century technologies multiply contamination and hybridization situations: biotechnological practices (genetic engineering, creation of chimeras), the use of foreign tissues in xenografts, the use of synthetic organs and transgenesis. These technologies favor the horizontality of life's hierarchy. Moreover, the increasingly invasive use of miniaturized and advanced technologies – whose mechanism must rely on our biological substrate while conversing with it and sometimes managing its facilities – create new human performative possibilities. *Cyborgs* are *cybernetic organisms*, the hybridization of humans and machines, and are often regarded as the spokesman, the new subject of the posthuman era and both terms tend to become synonymous[24].

Katherine Hayles[25] covers all stages found between humans and posthumans by identifying the evaluation of the informational model – which regards biological incarnation as a historical accident rather then an essential condition of life – as the first step towards posthuman condition; the second step is to acknowledge that conscience results from evolution's process as an epiphenomenon, and no longer as the base of human identity. The body is ultimately regarded as a prosthesis that can be modified and controlled. This leads to the complete achievement of posthuman anthropology: the human-machine junction. New technologies and scientific progress have brought technology and body closer, to the extent of combining them.

3. CONVERGING TECHNOLOGIES AND THE STAKE OF BODY ENHANCEMENT

This idea regarding the obsolescence and inferiority of the body in opposition to technosphere, is found at

21. http://stephan.barron.free.fr/technoromantisme/stelarc.html. See also Stephan Barron, Technoromantisme. Arts, esthétique, vie culturelle, communication, médias, science et techniques, Paris, l'Harmattan, 2003.
22. Stelarc, « Portrait robot de l'homme-machine », cit.
23. J. Deitch, *Post Human*, DAP, New York, 1992, p. 27. See also http://www.artic.edu/ ~pcarroll/PostHuman.html.
24. D. J. Haraway, *Simians, Cyborgs and Women: The Reinvention of Nature*, New York, Routledge, 1991.
25. N. K. Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Litterature, and Informatics*, Chicago, The University of Chicago Press, 1999.

the core of the concept of converging nano and biotechnologies. The most anticipating and utopist version of converging technologies, also known as "genetics, nanotechnology, robotics" (GNR) or "Nanotechnology, Biotechnology, Information technology and Cognitive science" (NBIC), questions the body's present state and its possible modification. Converging technologies refer to the synergetic combination of four major NBIC provinces of science and technology: nanotechnology, biotechnology and biomedicine, information technology, and cognitive science.

The report *Converging Technologies for Improving Human Performance*[26] edited by Mihail C. Roco and William Sims Bainbridge, brings together over 50 opinions of experts representing the government, the academic world and private sectors. It aspires to express major points of the development of convergent technologies. The concept of information is at the basis of the convergence of technologies. Yet convergence's keyword is "nano": human beings are made up of tiny elements and "The integration and synergy of the four technologies (nano-bio-info-cogno) originate from the nanoscale, where the building blocks of matter are established"[27]. Indeed, the ability to control bits, atoms, neurons and genes should enable the control of nearly everything, since it provides a comprehension of matter's informational code at all levels. The heroes of this development are the engineers, the only ones capable of understanding nature's laws and their mechanism in order to adapt them to requirements of design[28].

The prospect of convergence is an excellent argument of all discussions regarding the European nano-initiative and the American one (NNI, *National Nanotechnology Initiative*), launched in 2001 by the Clinton administration and supported by the actual Bush administration as a top-priority scientific and industrial development section.

In regards to the body, it is obvious that this new knowledge will need to be applied on human organisms. If, as Roco and Bainbridge concede, technological progress of the last decade allows for a better understanding of human biology, then the expectations of the development of nano-bio fields are more radical. A better understanding of human biology isn't enough anymore. We want to reach a new dimension and the ability to transform human biology[29]. The aim of control is obvious in the project of deciphering human beings' essential mechanisms[30]. This could be possible for the human body, if it is presumed that all human activities, both physical and cognitive, are entirely organized as a physical process (fig. 1).

Despite many promises, the prospect of convergence is regarded as very concrete and real. It seems to be confirmed and asserted as the best track to follow to accomplish a second Renaissance. As it is articulated in the title of the report *Converging Technologies for Improving Human Performance*, this new Renaissance is founded on the idea of human enhancement. The chapters' titles express it very clearly. The prospect of enhancement begins with taking the expansion of cognition and human communication into consideration, followed by the improvement of health and human physical abilities, in order to create a better relationship with other individuals and society in its entirety. The report's authors are convinced that converging technologies "could achieve a tremendous improvement in human abilities, societal outcomes, the nation's productivity, and the quality of life," in the interest of individuals, society and humanity, in the long term[31]. The problem then consists in giving a sense to the notion of "enhancement" or "increase." How do the experts of this report define these notions? James Canton of the *Institute for Global Future* defines human normal and enhanced performances as follows:

> For the physically-challenged the definition may entail gaining sight or mobility. For the aged, it may entail having access to one's memory. Even bolder, the definition of human enhancement may entail providing people with advanced capabilities of speed, language, skill, or strength beyond what humans can perform today. Just as plastic surgery and pharmacology have given new choices to human

26. M. C. Roco, W. S. Bainbridge (supervised by), *Converging Technologies for Improving Human Performance. Nanotechnology, Biotechnology, Information technology and Cognitive Science*, NSF/DOC, June 2002. http://wtec.org/ConvergingTechnologies/1/NBIC_report.pdf.
27. Ibid., p. vii.
28. Cfr. Michael J. Heller, "The Nano-Bio Connection and Its Implication for Human Performance" in Roco, Bainbridge, *Converging Technologies*, p. 191.
29. Ibid.
30. Roco, Bainbridge, *Converging Technologies*, p. 179.
31. Roco, Bainbridge, *Converging Technologies*, p. ix.

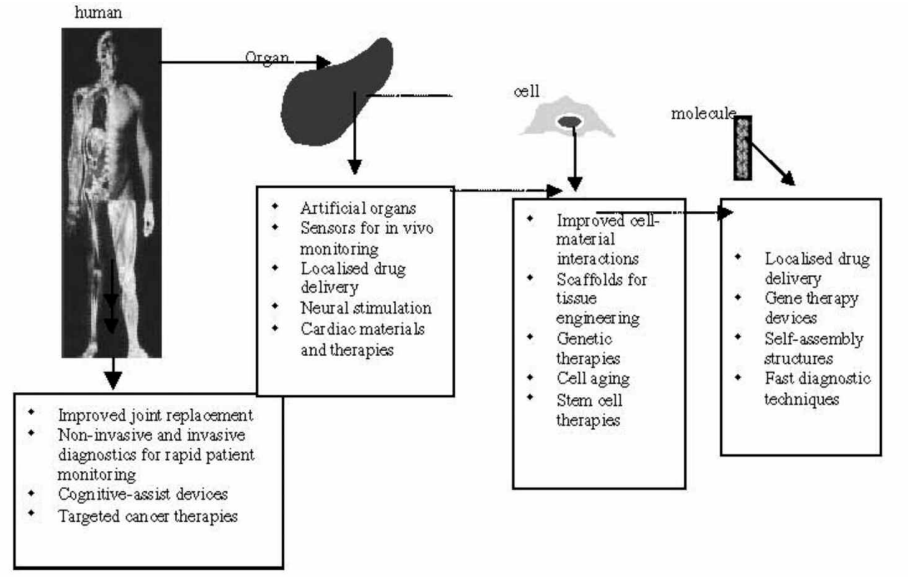

Figure 1. Examples of levels for intervention of nanobiotechnology in human life extention. Roco, Bainbridge, *Converging Technologies*, p. 185.

beings today, enhancement treatments will no doubt shape tomorrow.[32]

The military has a great need for human body enhancement. According to the DARPA (*Defence Advanced Research Projects Agency*): "With the infusion of technology into the modern theater of war, the human has become the weakest link, both physiologically and cognitively. Recognizing this vulnerability, DARPA has recently begun to explore augmenting human performance to increase the lethality and effectiveness of the warfighter by providing for super physiological and cognitive capabilities"[33] (fig. 2). Regarding nations and the world's welfare, human enhancement seems to be the main challenge.

Notions of health and health care remain central in these discussions and emblematic of the nano and bio convergence. Thereby, nanomedecine presents itself as a different and revolutionary outlook on health care. The significance of economical investments and political strategies mobilized for the support of nanotechnology development demonstrates the extent to which the convergence of biological, medical and physicochemical research has become a priority for all industrialized countries, from both a social and scientific point of view. The public seems to become increasingly familiar with terms like "nanomedicine" and "nanobiotechnologies", promising research fields whose effectuation and expectations are so numerous and varied that it seems difficult to predict their social, technological and industrial impact.

Generally, the inclination to miniaturize devices likely to interact with the human body was welcomed as a possible improvement of preciseness in health care. Over a short period of time, developments in biological research, on the one hand, and nanotechnologies on the other, seem to offer significant solutions capable of solving certain medical issues. However, on the long run, these developments could lead to an entirely different outlook on medicine. Expectations are high, as is often the case when new technological horizons appear. For instance, the American *National Cancer Institute* regards nanomedicine as an investment of utmost importance to eradicate by 2015 the pain and mortality generated by cancer. Europe has established a technological platform to support initiatives in the nanomedicine field hoping to offer decisive solutions to serious pathologies such as cancer, diabetes, Alzheimer's and Parkinson.

32. James Canton, "The Impact of Convergent technologies and the Future of Businnes and the Economy", in Roco, Bainbridge, *Converging Technologies*, p. 78.
33. Michael Goldblatt, "DARPA's Programs in Enhancing Human Performance", in Roco, Bainbridge, *Converging Technologies*, p. 337.

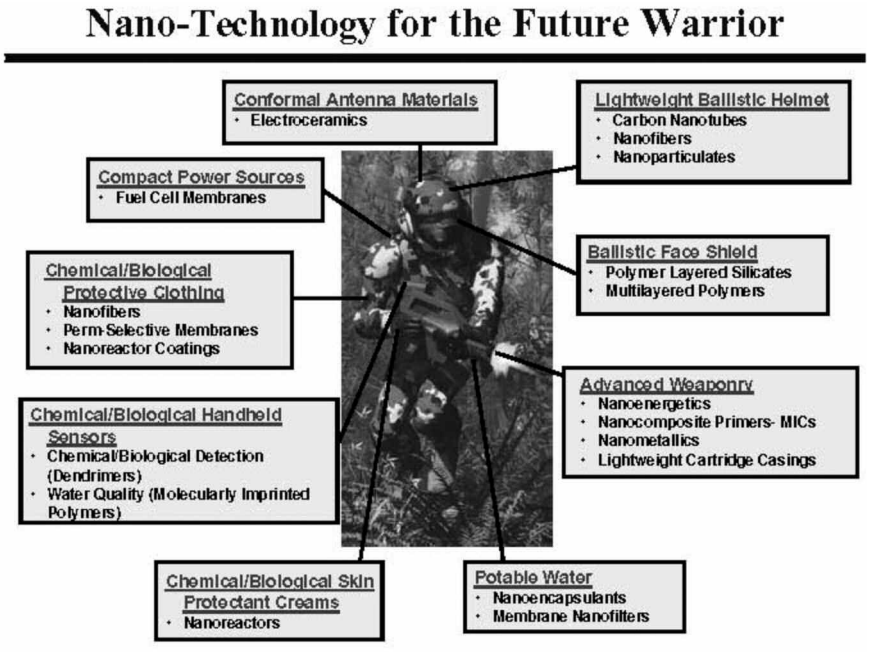

Figure 2. Soldier system of the future. Roco, Bainbridge, *Converging Technologies*, p. 354.

In the 90's, Robert Freitas, an American researcher active in promoting and developing nanotechnologies applicable to human health, puts forward a new concept of "nanomedicine". The latter is founded on the visionary project aiming to create and realize nanorobots – or nanobots – capable of traveling in the human body and step in on cells at a molecular level.

According to Freitas, it will be possible in 10 or 20 years, to create « real » molecular machines, nanorobots capable of keeping the human body healthy and alive more efficiently then "natural" cells. Robots of nanometric dimensions will circulate in our veins and arteries to purify our blood (*respirocytes*), find awry or missing elements and eliminate toxins and pathogenic agents (*microbivores*).

Ray Kurzweil pushes the expectation even further: nanorobots will be connected to biological neurons allowing them to control our senses and feelings, create a total immersion in virtual reality and above all increase our memory abilities and form our non-biological intelligence. Connected online, our brains will be capable of exchanging new knowledge and abilities.

The shift from a healthcare notion to a notion of enhancement is achieved by the possible application of nanotechnologies and the miniaturization of chips. In his latest work *The Singularity is Near,* and in *Fantastic Voyage : Live Long Enough to Live Forever*[34], Kurzweil introduces an external transformation of the body using alimentary hygiene, as well as an inner transformation using nanotechnology. His works give a meaningful idea of the visionary predictions regarding the effects converging technologies would have on the human body and the general notion of humans, with nanotechnologies placed in the foreground. His vision is close to that of transhumanists, who regard Kurzweil as a point of reference, and insist on the need of transforming the body using any available means.

Following a movement comparable to the one responsible for the independence of sexuality from reproduction by encouraging its communicative and sensual aspect – at least in the industrialized world –, it could be possible, according to Kurzweil, to predict a similar emancipation process for other biological activities linked to sociality and sensual pleasures. Food

34. R. Kurzweil, *The Singularity is Near*, New York, Viking, 2005 ; R. Kurzweil, T. Grossman, *Fantastic Voyage : Live Long Enough to Live Forever*, Rodale Books, 2004.

is a good example of that. Our digestive system and metabolism have evolved with time but do not correspond to our present situation: obesity is a symptom of this dysfunction. Our body was essentially chosen to ensure reproduction, its aim not being longevity. Yet, the partial abundance of goods, technoscientific progress and knowledge on the organ system have enabled life extension by questioning the human status in version 1.0, as Kurzweil says using computing language.

In an upper technological level, "traditional" food could become a cultural and sensory experience by avoiding the absorption of nutritious elements and having nanobots eliminate excess substances.

Nanobots will be able to come in and out of our body easily and find nourishing substances in the environment. Version 2.0 of mankind will therefore be more independent and resistant. According to Kurzweil's prediction, most of our organs and cells should have been eliminated by 2030. Only the skeleton, skin, sexual organs, mouth and upper part of the esophagus and the brain would be left. Everything could be improved or transformed by nanotechnology and new materials: the skeleton would be stronger, more resistant and self-maintained; skin would become a solid material capable of resisting coldness and heat; treating the brain like a circuit would enable the establishment of direct communication with nerve cells, the recovery of vulnerable functions and the delivery of medicine at specific locations. Version 2.0 of mankind would be the result of a longstanding evolution during which we were increasingly in touch with technology. At first, computers were big machines in air-conditioned rooms. Then, by dint of miniaturization, they came closer to our desks, our bags and today our pockets. Kurzweil claims that they will soon be in our brains and bodies. As of 2030, we will be more nonbiological then biological and by 2040 nonbiological intelligences will be much more powerful then biological ones.

The main argument used to justify this shift towards the artificial is that biological evolution will always be limited by the use of a finished range of materials (proteins and amino acids). But this is a slow building movement. However, it created a species that thinks and manipulates its environment and is capable of accessing its *design* and improves it: biological principles could be reviewed and changed. Version 3.0 of mankind, expected by Kurzweil for 2030 or 2040, will correspond to a total revision of the human project.

4. THE BODY AS PROJECT: THE CONTINUITY OF THE MODERN CHALLENGE

All of these different models – obsolete, arbitrary, hybrid, modifiable – seem to be attached by one in particular: the body as "project."

In itself, the notion of project implies the idea of carrying "outside" (from Latin *projectus* and *proicere*, throw ahead), bringing something to attention. A project can therefore utterly be connected to the notion of "product" (latin *productus*, past participle of *producere*, to carry outside, impel, then bring, cause) in the sense that it predicts and sets things in a way that enables their accomplishment. The idea of project implies the act of anticipating a concrete accomplishment, the idea of an aim often deemed achieved. This is true for technological projects, relying on a type of determinism ensuring their future achievement. In the technological field projects essentially belong to engineers, thus any intervention on the body is studied with an engineering outlook. *Biodesign*[35], for example, is introduced as a new field bordering bioengineering, biomedical sciences and health technologies. A kind of ergonomics; a technological project of the body based on biorobotic engineering designs, applied to medicine and in synergy with biological sciences until the point of reaching nano dimensions.

This project can also be interpreted as one of identity construction, a theme developed in art, feminism and *transgender* movements. To be a project, the body must be privatized: the individual is responsible for its construction, reconstruction and daily redefining. According to Anthony Giddens[36], bodies are the visible carriers of individual identities; hence each individual is responsible for the design of his own body. This duty of body cultivation, assumed by its owner, meets all the products on the market, tools and handbooks required for this care[37]. Society provides the tools and models but the undertaking of the task is the body owner's responsibility. Thus the individual becomes transformation material as well as the active subject of

35. See the multidisciplinary project of Stanford University, http://www.stanford.edu/ group/biodesign/index.html.
36. A. Giddens, *Modernité and Self-Identity. Self and Society in the Late Modern Age*, Stanford University Press, Stanford, 1991.
37. Z. Bauman, *Mortality, Immortality and Other Life Strategies*, Polity Press, Cambridge, 1992.

this transformation. He is free to pursue his project but is also defined by the sociocultural constraints, somehow suggested/imposed on him. This idea of body plasticity and freedom refers to a *culture-body*, a body entirely considered within its cultural elements, slowly growing more distant from its biological features to assume the ones characterizing it as a cultural, unnatural and worked up object. This vision of the body given by Kurzweil, is freed of all the human psychological, emotional and relational aspects of its physiological functionalities. Yet this body remains subject to a standardized social and cultural perspective, in which adaptations to ancient and new, individual and general, cultural and social body ideals are expected. This definition of the body as project agrees with the postuman vision of the body suggested by Kurzweil and transhumanist movements, and with the discussion on converging technologies. Technology has been interiorized[38] and is an integral part of identity construction, refusing any material or bodily boundaries and human or codified limits. It lives through gender, animal and human forms, what is considered normal or pathological, in both natural and artificial realms.

According to the German philosopher Peter Sloterdijk, mankind's will to act on its own nature goes back to a component of human condition: the ability to tame the world and tame oneself[39]. In the long process of "domestication of Being" attended by the movement of hominisation, technology is an essential tool allowing for human's build-up and which will continue using technologies increasingly embedded in living structures. This "anthropotechnique"[40], enabling man to be his own *artifex* up to the most ultimate and problematic point of genetic manipulations of the genome, is stigmatized by Günter Anders[41] who denounces the qualitative and quantitative double transformation of the intervention of modern man on nature. According to Hannah Arendt *homo creator* is destined to succeed to *homo faber* and is now capable of generating an entirely artificial "double nature" while having an effect on *homo materia*, that is humanity transformed into raw material, tamed, educated, transformed, conditioned, manipulated and eventually *created*. So despite their heavy projection towards the future, trans- and postshumanism seem to be the extension of the modern project: the conquest of death. Indeed, modernity has led to the denial of accepting death as life's ultimate outcome and to the idea that life isn't formed as a curve with an end to it. Modern times are portrayed as an arrow pointing to a single direction. Present and past are of no value: future is the source of value in modernity's build-up. The complete achievement of rationality is a utopia giving value to the present as the next step towards times to come. Modern life is therefore considered as a process with a commencement – birth –, but continually projected in the future as "endless potentiality"[42] for change and creation.

Within an individual, collective and life project[43], the individual has a long-term aim, a work to achieve, talents to express, a world to build or change. Death is interpreted as the absurd interruption of these projects. It forces mankind to remain in the incompletion of their project and conveys the upsetting feeling of unfinished work. Thus, death in modernity is understood as "waste", an absurd loss of potentialities forever never to be expressed[44].

Thinking of life as the creation of a project implies negating death as its necessary end. This outlook on death is in itself the result of a long process of changes and modifications of the individual's status in society, his relationship with the world and accordingly his viewpoint on death.

Transhumanism's great endeavor to adapt the human body to the evolution of machines can thus be explained as a renewed attempt to oppose the utmost offense made to the human almightiness, a will to take up reason's challenge – mortality – using extreme self-technologisation. ■

38. A set of devices is meants to to live close to our body one day: nanorobots, or nanobots, that Kurzweil mentions are an example of that.
39. See especially P. Sloterdijk, *La domestication de l'Être,* Paris, Editions Mille et une nuits, 2000 and *Regeln für den Menschenpark. Ein Antwortschreiben zu Heidegger „Brief über Humanismus",* Surkamp Verlag, Frankfurt am Main, 1999.
40. Some authors prefer the term "anthropotechnie", see Jérôme Goffette, *Naissance de l'antropotechnie. De la médecine au modelage de l'humain,* Paris, Vrin, 2006. Goffette associates this notion to "bricolage", that is man's ability to manipulate himself, without knowing the outcomes or implications of it, but always applied for change.
41. G. Anders, *Die Antiquiertheit des Menchen. Über die Seele im Zeitalter der zweiten industriellen Revolution*, C.H. Beck Verlag, Munich, 1956.
42. E. Bloch, *Das Prinzip Hoffnung*, Suhrkamp Verlag, Frankfurt am Main, 1959.
43. The notion of modern project corresponds to Jean-François Lyotard's definition of "metarécits": great stories that impressed modernity – the emancipation of reason, work, the notion of human and social progress due to technological progress, and the universalistic Christian discourse. Unlike myths, these stories find their legitimacy in their will to be universally achieved in the future without looking for original foundations in the past. This is what is called "modern project".
44. L.-V. Thomas, *Mélanges thanatiques*, L'Harmattan, Paris, 1993, pp. 230-232.