

“The Body” – signification and controversy

WP1 Scoping paper – Research line 3 “The body” – TECHNOLIFE Project

0. Overview

The first part of this scoping paper surveys the extant academic literature concerning bodily modification and enhancement in order to identify the principal issues and controversies that are discussed in this literature. In addition to the academic literature relevant internet discussions are also briefly surveyed where the web discussions add to the academic discussions. The methodology is described in appendix A.

The second part of the scoping paper then surveys how issues of bodily modification and enhancement has been dealt with in the science fiction literature in order to identify the main imaginaries projected in that literature. The specific works that have been analysed are tabulated in Appendix B.

The third part briefly outlines possible communities and scenarios/imaginaries of potential value for WP2 and WP3 based on the scoping of the two literatures.



Part 1 Body enhancement as a topic of academic controversy

1.1 Introduction

The literature on the ethics of body enhancement and modification (BE&M) is very large and spans several decades. Many of the concerns and controversies identified below can, for instance already be identified in Paul Ramsey's 1970 book "Fabricated Man" (Ramsey 1970). The current analysis does not lay claim to providing a completely exhaustive classification of the controversies in that literature. However, it does provide an overview of the most important controversies as they play out in the literature in order to provide a solid basis for the work in WP2 and WP3, and later in WP5.

It is useful to divide these into two kinds of controversies, general and specific and to divide the discussion itself into two phases, an early phase and a late phase where the dividing line is drawn sometime in the early 2000s marked by the emergence of modern transhumanism as an organised and global social movement (see more below).

By surveying the literature as one body of literature it becomes apparent that the ethical issues relating to BE&M can to a large extent be divorced from the specific techniques by which the modification is supposed to take place. Surgery, genetic modification and nanotechnology are clearly different technologies, but they can all be used to achieve BE&M and have even in some cases been proposed to reach the same desired outcome; and the ethical issues the different modifications raise turn out to raise are very similar. In the following the focus will therefore be on the arguments and the distinctions employed in the arguments and not on the specific technologies. It should also be recognised that it is difficult to make a clear cut between BE&M and, for instance cognitive enhancement. Sensory enhancement may be achieved by peripheral bodily intervention, e.g. laser eye surgery or implantation of small magnets under the skin (i.e. to achieve a new sensory modality, the ability to detect fluctuating magnetic fields). It is unclear how such enhancements should be classified and this is often also of little relevance to the argument.

1.2 The general controversies

The general controversies in the debate can be classified as follows:

1. Controversies about the body
 - a. The body as normative / without normative significance
 - b. The body as stable or limiting / the body as infinitely malleable
 - c. The human body and its specificities as an underlying, unarticulated (i.e. enthymematic) premise in ethical argument
2. Controversies about the nature of enhancement
 - a. What should count as an enhancement?
3. Controversies about moral / political theory
 - a. Is liberalism / libertarianism the foundational principle for modern societies?

The first three general controversies all centre on the status of the human body. How should we conceive of the body in ethical argument? And, does the present state of the human body and its current limit have any relevance as a premise in such arguments? Is there, for instance any normative force in the human life span presently being limited to approximately 120 years?

The controversy concerning whether the body is normative or not is closely parallel to the even more general controversy in ethics around whether nature or the natural has any normative status.

The idea that nature is normative is often linked to a more general adherence to religious or secularised versions of natural law theory (Finnis 1980). A succinct Catholic account of this view can be found in Farley:

“At the heart of tradition, however, is a conviction that creation is itself revelatory, and knowledge of the requirements of respect for created beings is accessible at least in part to human reason. This is what is at stake in the tradition’s understanding of natural law. For most of its history, Catholic natural law theory has not assumed that morality can simply be “read off” of nature, not even with the important help of Scripture. Nonetheless, what natural law theory does is tell us where to look; that is, to the concrete reality of the world around us, the basic needs and possibilities of human persons in relation to one another, and to the world as a whole. Looking (to concrete reality) means a complex process of discernment and deliberation, a structuring of insights, a determination of meaning from the fullest vantage

point available, given a particular history that includes the illumination of Scripture and accumulated wisdom of the tradition. Hence, the intelligibility of “realities” is not such that their meaning is immediately obvious. What is given to our understanding through experience is not only always partial, but it must always be interpreted. The limits, yet necessity, of this process account for many disagreements about specific matters, even within the faith community” (Farley 2001, p. 114-115)

Within this tradition nature or the natural is seen as normative because nature, properly interrogated reveals an underlying and meaningful order. What we see in nature is not just a random result of meaningless biological processes, but a meaningful whole that can guide us in our thinking about how we ought to live and act.

On the other side of this debate it is denied, following Hume that nature, whether human or non-human nature can have any normative import. This point of view is for instance articulated forcefully by Harris and by Takala among many others (Harris 2007, Takala 2004). The main arguments on this side of the debate is first that nature is just a brute fact and that the so-called fact / value distinction or the is / ought gap entails that no ethical judgement can follow directly from such a brute fact. Second that even if we took nature as normative we ought to realise that much of what is natural is not good and that most of medical activity is directed at preventing the natural from taking place.

On the other hand it is obvious that much of the argument for enhancement (implicitly) assumes that features that are characteristic of current human bodies and beings will also be characteristic of future enhanced agents (Holm 2006 & 2007). It is, for instance assumed in almost all of the pro-enhancement argument that any future agents will have the same kind of interest in freedom as human beings have.

The second general controversy is about how to cash out the notion of an enhancement. In a recent paper Holm and McNamee have argued that there are four principal ways in which this notion can be understood (Holm & McNamee *in print*). There are two intersecting accounts of improvement that are at play: one that makes a distinction between objective (or inter-subjective) and subjective improvements and a

second that makes a distinction between improvement in relation to a norm and improvement purely in relation to the *status quo ante*

The first distinction is concerned with who is to judge whether a certain change is an improvement. Thus we can ask of any purported enhancement whether it is determined objectively (or inter-subjectively at least) or whether it is exclusively a matter for personal judgment. The second distinction is concerned with what the proper baseline is for judging or measuring improvements. Is it, for instance a species-based norm, or is it the function of one specific individual.

These two intersecting distinctions give rise to the four different ways of (mis)understanding improvement and *a fortiori* enhancement. The most restrictive of these is the objective, norm-based account which usually underlies arguments making a distinction between therapy in the sense of bringing a person (or restoring them) to a normal level of functioning and enhancement in the sense of improving function above the normal (Daniels, 2007). The most expansive account is the subjective, status quo account which essentially entails that any physical change a person deems to be an improvement of his function is an improvement (Harris 2009).

The four options can be illustrated in the following way:

Improvement	Norm-based	Status quo based
Objective	Most restrictive Treatment / enhancement distinction	E.g. The sports “doping” account
Subjective	<i>Rarely held</i>	Least restrictive E.g. Often implied in trans-humanist writing

Each of the four basic accounts can be further refined. As noted above improvements can be specific or general in relation to function, but it is also possible to conceive of physical improvements which do not strictly improve any particular function yet still improves the welfare of the person.

Within the subjective accounts further distinctions can be made in relation to whether the subjective judgment is personal or social and whether it can be fallible or not.

The third general controversy which permeates the literature on BE&M is concerned with the master value or philosophy of modern society. Is modern society liberal or libertarian (or if not fully yet, should it be)? This scoping paper will not further consider this controversy except to note that if it is accepted that liberalism is, or should be the foundational value of modern society it becomes unproblematic to invoke John Stuart Mill's so-called 'harm principle' in aid of enhancements that do not harm others:

'The object of this Essay is to assert one very simple principle, as entitled to govern absolutely the dealings of society with the individual in the way of compulsion and control, whether the means used be physical force in the form of legal penalties, or the moral coercion of public opinion. That principle is *that the sole end for which mankind are warranted, individually or collectively, in interfering with the liberty of action of any of their number, is self-protection. That the only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others.* His own good, either physical or moral, is not a sufficient warrant. He cannot rightfully be compelled to do or forbear because it will be better for him to do so, because it will make him happier, because, in the opinions of others, to do so would be wise, or even right. These are good reasons for remonstrating with him, or reasoning with him, or persuading him, or entreating him, but not for compelling him, or visiting him with any evil, in case he do otherwise. To justify that, the conduct from which it is desired to deter him must be calculated to produce evil to some one else. The only part of the conduct of any one, for which he is amenable to society, is that which concerns others. In the part which merely concerns himself, his independence is, of right, absolute. Over himself, over his own body and mind, the individual is sovereign.' (Our emphasis)

1.3 The specific controversies

It is also possible to identify a number of more specific controversies in the literature. In the early phase of the debate these controversies were primarily focused on specific types of enhancement and on the validity of a possible distinction between treatment and enhancement. In the later ‘transhumanist’ phase of the debate the treatment/enhancement distinction is still being discussed but the focus has moved to a discussion of a future with widespread bodily and cognitive enhancement. The more specific controversies can be classified as follows:

1. Early phase
 - a. The treatment / enhancement distinction
 - i. Cosmetic surgery
 - ii. Doping in sport
 - iii. Cognitive enhancers
 - b. Justice issues in enhancement
2. Late phase
 - a. Transhumanists / bio-conservatives
 - i. Engineered immortality (or more precisely ‘abolished senescence’)
 - ii. The ‘Singularity’
3. Relevant for Technolife but mainly outside the academic BE&M debate
 - a. The limits of body modification (tattoos, piercings, implants etc.)
 - i. Morphological freedom a.m. Anders Sandberg

1.3.1 The Treatment / Enhancement distinction

The most prominent debate in the early phase centres on the issue of whether there is a morally relevant distinction between medical treatment on the one hand and enhancement using the same technologies or skills on the other hand. Is there, for instance a difference between the plastic surgeon correcting congenital defects or burn scars and the same surgeon enlarging breasts that are of normal size? (see for instance the papers in Beaufort et al 1996).

This debate can be found in the literatures on cosmetic surgery, doping in sports, genetic enhancement, cognitive enhancement etc. (Parens 1998, Murry 2006).

Those who claim that the distinction is valid and useful usually do so by arguing that treatment for *bona fide* disease states has a moral claim on us that is stronger than the

claim generated by enhancement that merely adds to a healthy individuals welfare. The *locus classicus* for this argument is the works of Norman Daniels. Daniels argues that the distinction is valid and useful because it reflects the basic principle of social justice that society should offer ‘equality of opportunity’ to all its members (e.g. Daniels 1985, 2007). Illness and disease prevent persons from achieving equality of opportunity and we therefore have a strong obligation (as a society) to prevent, treat and alleviate these conditions. Not being enhanced does not affect equality of opportunity in the same way (and there may even be an equality of opportunity based argument against enhancement if it is unequally distributed).

Those who claim that the distinction is invalid or without normative importance argue 1) that the standard accounts of illness and disease, for instance in terms of deviation from species typical functioning are highly problematic and 2) that it is difficult to see why certain kinds of improvement in welfare (those we call treatment) are more important than other kinds (those we call enhancement) (Harris 2009). They further argue that even if the distinction is valid it provides no reason to ban enhancements, it only gives a reason to give them lower priority when we are distributing societal resources.

1.3.2 Issues of justice

The second major area of controversy in the early phase of the BE&M literature centres on the question of whether there are problematic justice implications of BE&M. It is generally accepted in the literature that BE&M technologies are likely to be used first by resource rich nations and/or resource rich persons and that when such technologies are introduced there will be a phase where they and their enhancing results are therefore unequally distributed. In the context of enhancement via genetic engineering Silver for instance predicts a future where some people are ‘gene rich’ and others are ‘gene poor’ (Silver 1998).

The questions such likely future BE&M scenarios raise are: 1) whether the unequal distribution of enhancements is likely to persist or perhaps even widen, and 2) whether the unequal distribution is a significant ethical problem. Although these two questions are distinct questions it is common in the literature that authors who see the inequalities as an ethical problem also think that they are likely to persist or widen, whereas those who think that the inequalities are acceptable or irrelevant also think

they are likely to be only temporary (e.g. because of a trickle down from the resource rich to the resource poor).

The view that there is a problem is, for instance expressed by Yoxen in an early contribution to the debate on genetic engineering:

"But at the end of the day, whom will all this activity help? Some people certainly, but, I suspect, they will only be that minority already well supplied with medical goods and services, and the costs of providing cures for the ills of this social stratum will not fall. Too much money is made from putting molecules into people at a profit for very much to change without major convulsions.

That, for me, tarnishes the gleaming image of biotechnology. It is not that most people in health-care companies don't care that their work never touches the lives of millions of people. It is just that they have different priorities: an adequate return on capital invested. Their view of medicine is based on the view that people must first accumulate wealth and then buy health; otherwise there is no deal. The public good may take too long to be a worthwhile business proposition. 'Pure' research is used to fill that gap, but it is being increasingly subject to commercial criteria." (Yoxen 1983, p. 141-142)

The line of argument employed to show that the inequalities are ethically problematic is usually along Rawlsian lines pointing out that changes in social policy ought to be to the benefit of the 'worst off' (Rawls 1972), and that increasing inequalities by allowing or promoting BE&M is therefore an unacceptable public policy (e.g. Holm 1993).

On the other side of this debate it is claimed that since we allow the resource rich to advance their interests and, for instance 'enhance' their children through non-biological means (better nutrition and private education are often given as examples) there is no reason to single out BE&M technologies as particularly bad or problematic and no reason not to allow their use. Or it is argued more directly that the libertarian critique of Rawls put forward by Nozick is decisive and that there is no reason to worry about inequalities along as they have been produced in legitimate ways (Nozick 1974).

1.3.3 The late phase – Transhumanists versus bio-conservatives

In the late 1990s and early 2000s a number of disparate pro-enhancement groupings coalesced into what is now known as the Transhumanist movement. The World Transhumanist Association (now Humanity+) was established in 1998 and has since provided the central focus for a movement which describes its guiding idea in the following way:

“Transhumanists view human nature as a work-in-progress, a half-baked beginning that we can learn to remold in desirable ways. Current humanity need not be the endpoint of evolution. Transhumanists hope that by responsible use of science, technology, and other rational means we shall eventually manage to become posthuman, beings with vastly greater capacities than present human beings have.” (Transhumanist Values

<http://humanityplus.org/learn/philosophy/transhumanist-values>)

The emergency of Transhumanism re-oriented the BE&M debate. Partly because the Transhumanists categorised everyone who disagreed with them as bio-conservatives and thus, at least in their own mind created a dichotomy in the literature¹; partly because the overarching nature and ambition of the Transhumanist program moved the focus of attention from individual types of BE&M to the possible effects of multiple technologies converging to produce radical enhancement.

In this later phase of the BE&M debate discussion of justice issues is still prominent, but the arguments do not differ much from those identified above in the early phase. Two new issues became prominent in the late phase: 1) engineered immortality and 2) the ‘Singularity’.

1.3.4 Engineered immortality

One of the enhancements projected by Transhumanists is that the human lifespan can be increased significantly through the use of a combination of technologies. As long as human beings continued to be biological they would still be destructible, so could not achieve “real immortality”, but a lifespan of more than 1000 years has been claimed as possible and it has even been claimed that the first person to live to a 1000 is already alive today (de Grey & Rae 2007).

¹ Those identified by Transhumanists as bio-conservatives rarely identify themselves in this way and are not organized in the same way as the Transhumanists are.

This has sparked a substantial literature concerning whether 1) immortality is desirable and 2) the engineering of immortality creates ethical problems. Many of the ethical problems discussed are variants of the justice discussions outlined above, but new issues are also raised concerning the population effects of engineered mortality for some or all (see for instance Overall 2003, Pijnenburg & Leget 2007).

1.3.5 The 'Singularity'

Another specific issue discussed in the later phase of the debate is the so-called 'Singularity', a future state or scenario that was first proposed by the early Transhumanist Vernor Vinge and defined as:

“The postulated point or short period in our future when our self-guided evolutionary development accelerates enormously (powered by nanotech, neuroscience, AI, and perhaps uploading) so that nothing beyond that time can reliably be conceived.” (Vernor Vinge 1986, quoted from <http://www.extropy.com/faq.htm>)

More recently the computer scientist Ray Kurzweil has described it in the following way:

“What, then, is the Singularity? It's a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed. Although neither utopian or dystopian, this epoch will transform the concepts that we rely on to give meaning to our lives, from our business models to the cycle of human life, including death itself.

Understanding the Singularity will alter our perspective on the significance of our past and the ramifications for our future. To truly understand it inherently changes one's view of life in general and one's own particular life.” Ray Kurzweil "The Singularity is Near", 2005

If the Singularity is taken seriously as a possible scenario it obviously limits the degree to which it is meaningful to discuss far future BE&M, since it is impossible to discuss the ethical or social implications of a state one cannot reliably conceive.

1.3.6 The limits of body modification

Primarily outside of the academic literature there is a lively internet discussion of body modification on web-sites such as www.bmezine.com, www.bodymod.org and

www.bodymods.org . The body modifications that are described, pictured and discussed on these sites and their associated blogs and forums are mainly sought as means of personal expression and include tattoos, piercings, surgical modification and implants, scarification etc. Given the nature of these sites discussions concerning limits of body modification mainly occur in response to particular instances of body modification that are displayed and often focus on issues of aesthetics and safety. There are, however instances where the question of limits is explored more directly. In the academic ethics literature discussion of this kind of body modification is almost absent, although the prominent Swedish Transhumanist Anders Sandberg has argued that a right of ‘morphological freedom’, i.e. a right to modify your body in any way you choose is a basic human right (Sandberg 2001).

Part 2 Body enhancement in the science fiction literature

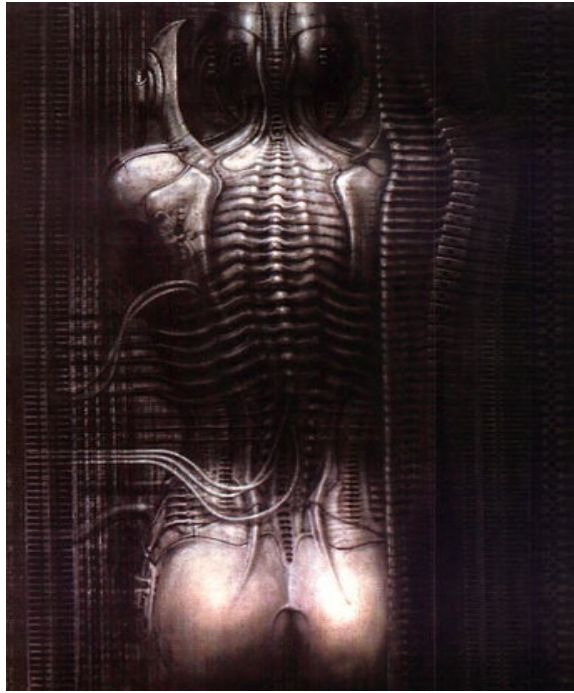
2.1 Introduction

In this part of the scoping paper, we will identify ethical concerns within the science fiction literature on body enhancement (research line 3). This identification of ethical concerns will facilitate the identification of imagined communities –which organise themselves around those concerns- in WP2.

The paper aims to be something more than just a mapping exercise. We intend to provide some insights on the following question: To what extent is science fiction literature a good channel to access, diffuse and discuss ethical concerns? (and perhaps even to inform policy making). The paper is organised in three sections. First, we will provide a short theoretical introduction on science fiction, imaginaries and ethical concerns. Second, we provide a brief description of a key ‘image’ of body enhancement in science fiction: the *cyborg*, as it relates to two general ethical frames: transhumanism and posthumanism. Next, we will provide an analysis of science fiction literature on body enhancement. We will do so by using two different approaches: a) a mapping approach. This will be an extensive analysis of the literature. The aim is to identify a number of key imaginaries/ethical concerns in relation to types of enhancement and technologies; b) an in-depth-interpretative approach. After selecting a novel, we will look at *how* imaginaries/ethical concerns are framed within them.

2.2 Science Fiction: Imaginaries and Ethical Concerns

Weingart and Pansegrau (2003) have characterized science fiction as the alter ego of science: Science and science fiction work is “about testing conceptions of the future” (Weingart and Pansegrau 2003: 227). They are built upon the same kind of ‘what if’ questions: what if nano-devices are implanted in the spine to enhance the nervous system? “How will this gene function if I combined it with this chemical substance?” (Weingart and Pansegrau 2003: 227); However, these authors argue, a fundamental difference is precisely that science fiction thematises the social consequences of science.



As science, science fiction is projected towards the future. Because it focuses on the imagined consequences of science and technology, a number of authors have recommended using science fiction analysis as a method within future studies (Miles, 1993; Idier, 2000). Science fiction-based explorations of the future are particularly appealing in times in which the speed of the technological developments is so high that many times fictions become facts (Petersen et. al, 2005., Milburn, 2002), before ethics had time for reflection. Nanotechnology is a good example of the latter. While nanoethics is a very young field (less than 5 years old), images of nanotechnological developments and related ethical concerns have been the topic of science fiction novels since the mid 1980s². In this respect, it has been argued that science fiction is a valuable ethical ‘foresight tool’ (Idier, 2000). Furthermore, it has been argued that the advantage of science fiction above other foresight tools (as scenario building) is that it contributes to “exhibiting forces that economics and rationalization ignore” (Idier, 2000:). Because it is informed by the imagination, it enables access to shared values, motivations and meanings. Science fiction narratives evoke culturally embedded socio-technical imaginaries³ of the future (Kearnes et. al, 2006).

² See for instance “Blood Music” (1983) by Greg Bear.

³ Socio-technical imaginaries have been defined as: “collectively imagined forms of social life and social order” in relation to technoscientific developments (Jasanoff and Sang-Hyun, 2009:120). Jasanoff and Sang-Hyun highlight the national character of these imaginaries, an aspect that we introduce as a selection criteria in our mapping exercise.

In myths, tales and science fiction narratives moral messages come encoded within images and imaginaries. As those other products of popular culture, science fiction is informed by a kind of ‘speculative imagination’ (Warrick, 1982). Differing from myths, however, often the kind of images and imaginaries transmitted within science fiction narratives are more exploratory and future oriented. Through this kind of speculative and exploratory imagination, science fiction enables people to make sense of new technologies (Pertesen, et. al 2005). Appealing to this kind of imagination, Darko Suvin has pointed to ‘cognitive estrangement’ as the key feature of science fiction: "a literary genre whose necessary and sufficient conditions are the presence and **interaction of estrangement and cognition**, and whose main formal device is an **imaginative framework** alternative to the author's empirical environment"⁴. This ‘cognitive estrangement’ is defined by a fundamental tension between the unknown and the known. Science fiction imaginaries come articulated within that tension, combining alien and familiar (recognizable) features. Important in this sense, in science fiction novels, the technologies described by the author may not be real (yet) but they have to appear as plausible, their effects entailing some sort of uncertainty. In this regard, science fiction differs from ‘fantasy’ literature in that it takes science and technology seriously (Clute and Nicholls, 1993). Accordingly, science fiction novels manifest social concerns on specific technologies such as nanotechnology, biotechnology or cybernetics (and future developments/convergences of these technologies).

Science fiction novels talk about plausible futures. Through the ‘cognitive estrangement’, techno-scientific developments are situated within concrete and to some extent recognizable contexts. The ‘cognitive estrangement’ (the tension between the alien and the same) can be seen as having a two folded effect on the reader: creating a wish to make sense of the unknown –uncertain technologies- (opening-up effect), and providing the reader with elements to create emerging meanings of the new techno-scientific objects (constructive effect). Because of the ‘cognitive estrangement’, and the tension it entails, science fiction can be seen as a valuable channel to express, access and share ethical concerns, fears, anxieties, desires and critical views about the future (Parrinder, 1980). The *cognitive estrangement* produces a *distancing vision* (reflexive)

⁴ Encyclopaedia of Science Fiction pp. 311-314.

which: “not only facilitates an imaginative ‘escape’ from or transcendence of the given social environment, but sows the seeds of dissatisfaction with that environment, and of the determination and ability to change it {...} Science fiction considered as *cognitive estrangement* offers a series of analogies for, or perhaps imaginative rehearsals of, such possible changes” (Parrinder, 1980:73). Science fiction enables people to make sense of new technologies by bringing them into particular circumstances with recognizable elements. The *cognitive estrangement* can be seen as entailing a tension between the technically possible and the ethically acceptable.

In section 4, we will introduce and explore the image of the ‘cyborg’ as it is key within science fiction novels on human enhancement. This exploratory section aims at stating a number of provisional categories that we will use (and test) in the subsequent mapping exercise.

2.3 Imaging the Cyborg: Posthumanist and Transhumanist Concerns.

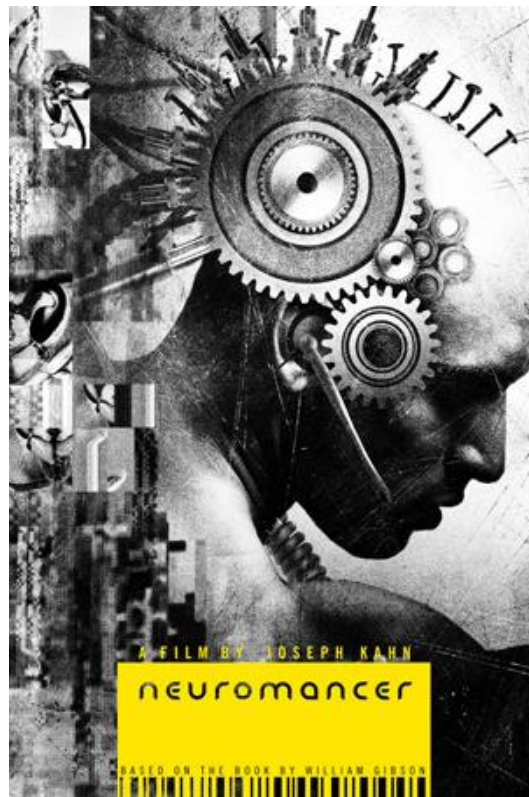
In this section, we explore the image of the ‘cyborg’ because it is the image *par excellence* of the science fiction novels on body enhancement. Our reflections are based on two sources: a key ‘cyborg’ novel: ‘Neuromancer’ and academic literature on the ‘cyborg’/body enhancement (mainly bioethics and sociological studies).

The cyborg is the central image of the first “cyberpunk” novel, “Neuromancer”. This novel has had an important impact on the Western popular culture since the 1980s and 1990s, being the first inspiration of the cyberculture and particularly of the cyberpunk movement (which combines high tech and low life standards). The German band Atari Teenage Riot is a good example of cyberpunk music⁵. Other examples can be found in urbanism (such as the famous Times Square in New York), architecture (the Sony Center in Potsdamer Platz in Berlin), films (i.e. The Matrix and Blade Runner), and plastic arts as well as in the academic literature. In Neuromancer, the image of the ‘cyborg’ (a hybrid of human and machine⁶), articulates ethical concerns on identity

⁵ <http://www.youtube.com/watch?v=-rfih2MkFvk&feature=fvwm>

⁶ Cyborg stands for cybernetic organisms (organisms that combine artificial and natural systems). It includes enhanced humans and human-like organism created on a biological basis (androids). That enhancement may be produced through biological modification, genetic engineering, artificial

and privacy. As we will argue in this section, later on so-called ‘cyborg’ novels have emphasized other ethical themes (such as immortality).



During the 1990s, the image of the ‘cyborg’ had also an important impact on the narratives and approaches of the social sciences. In her famous essay: " A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century", Donna Haraway (1995) pointed to *hybridity* as the defining feature of the cyborg. Defined by hybridity, the 'cyborg' has had an impact on the social sciences, including the social studies of science and technology⁷. It has been used not only as a concept but also as a broad interpretative frame which has proved to be fruitful in providing explanations of the complexities of the technology-society interplays in contemporary globalised societies. Furthermore, the image of the ‘cyborg’ can be easily recognized within the discourse of bioethics. Within the bioethics literature on body enhancement, an important discussion focuses on the distinction between

intelligence implants, i.e.

⁷ The influence of this image on ANT (Actor Network Theory) approaches is well acknowledged. Furthermore, the use of the ‘cyborg’ as a metaphor has been particularly fruitful in the field of gender studies, but also in other fields such as urban studies. See for instance concepts such as “Cyborg urbanization” (Chatzis, 2001) or “cyborg anthropology”.

‘enhancement’ and ‘treatment’. Treatment can be seen as something radically different from enhancement or as a particular type of enhancement targeted to ‘cure’. Notably, the enhancement/treatment discussion is often articulated in functional terms, by focusing on the function/purpose of particular body modifications.

Interestingly enough, within the science fiction literature both, hybridity and functionality appear as important features related to the image of the cyborg. Attending to these two features, we propose a provisional typology of body enhancements (table 1).

Hybridity (materiality)	<ul style="list-style-type: none"> • Human/machine (nanotechnology/cognitive sciences) • Human/animal/plant (biotechnology)
Function	<ul style="list-style-type: none"> • Medical • Cosmetic

Table 1.

Table 1 shows a provisional typology of body enhancements in relation to function and type of ‘hybridisation’/technology. While nanotechnology and cybernetics (informatics) include human/machines combinations, biotechnology entails bio-based combinations (human/animal/plant). In addition, inspired by the literature of bioethics, we have proposed two types of enhancements attending to function: medical and cosmetic. In the next section, we will use -and test- this typology to map ethical concerns within the science fiction literature.

Indicated by our introductory section, we presume that the image of the ‘cyborg’, as it is articulated in science fiction narratives, brings encoded ethical messages. The hybridity of the cyborg can be seen in connection to the ‘cognitive estrangement’ that characterizes science fiction as a genre: the image of the cyborg is the image of a disturbing ‘otherness’, at the same time, the reader of science fiction can recognize an analogy with the cyborg (its human side or resemblance). This tension, between

estrangement and identification, can be seen as making of the image of the cyborg and related imaginaries, relevant sites to access/express ethical concerns.

The image of the cyborg can be seen as closely related to two general ethical frames: transhumanism and posthumanism. Although, both frames refer to a condition 'beyond the human' which is often presented as the unavoidable future, different aspects of that condition are emphasized. In subsequent sections, we will use this difference as an analytical distinction. It will enable us to identify and classify ethical concerns⁸.

- 1) Posthumanism can be seen as referring to an ontological condition. Generally, humanist ethical frames focus on freedom, dignity and autonomy as defining principles of the human condition (Nayar, 2008). Post-humanism frames problematise how these principles apply if humans become 'cyborgs' and 'cyborgs' become citizens of high-tech societies. 'Rights' is a key issue of post-humanism (Nayar, 2008). Science fiction novels can be seen as concerned with post-humanist ethical issues when narratives and stories refer to social identity, social control, equality and justice.
- 2) Differing from the latter, trans-humanism can be seen as referring to an existential condition. Transhumanists aim at 'transcending' the human nature, determined by limitation, imperfection, pain and suffering. Personal and/or societal salvation is a key issue of transhumanism (Schummer, 2004). Prolonging life-span and even achieving immortality are main transhumanist ethical concerns (Drexler, 1985; Bostrom, 2005).

In this section, we have stated a set of analytical categories regarding the *type of technology, enhancement and ethical concern*. In the next section, we present a mapping of the main science fiction novels on human enhancement. Our analysis builds upon (but also tests) the provisional categories presented up to this point.

2.4 Scoping ethical concerns in science fiction/body enhancement literature.

⁸ Of course this distinction is problematic and many would not accept it. Here, we use it just with an analytical purpose, particularly, for the sake of bringing order to our subsequent mapping.

2.4.1. Literature mapping

In this section we present a number of ethical concerns identified within the science fiction literature on body enhancement. In order to perform our mapping we have analysed over 45 novels (See Appendix B). In selecting these novels, we have applied 3 criteria: scope and recognition, reception (audience) and cultural difference. Therefore, we have included awarded novels and authors, novels that repeatedly appear in internet science fiction forums as well as novels from the EU (mainly UK) and US.

Appendix B provides a detailed overview of our mapping exercise. All science fiction novels presented in our mapping bring encoded moral messages. However, there is a significant variation in relation to the degree in which particular ethical concerns are explicitly/implicitly presented. In some cases, the narratives are highly open to interpretation. While the motivations of the writer remain ‘absent’, the reader has to commit her/himself to active interpretative work for the moral meanings to emerge. It could be questioned if the more implicit and open to interpretation the message is, the less normative effect the narrative has.

On the basis of our mapping, we have identified three general issues structuring the imaginaries/narratives of the novels that we have analysed: social order, identity and immortality. Related to these issues, we have identified a number of ethical concerns. Table 2 shows the most frequent issue/concern relations as we found them in our mapping (Appendix B). These relations are not exclusive. Of course, some of those concerns can be related to more than one issue. For instance freedom and colonization could be seen as both social control and identity. Overpopulation can be related to social control (or the lost of it) or immortality. Furthermore, within one novel, differing ethical concerns appear mixed and interwoven in rather innovative and speculative ways (differing from how these concerns usually appear in the everyday life). For instance questions of colonization may converge with questions of ‘splitting personalities’ (the original human-being living in Earth, while its clone lives in the starts or in virtual worlds). It can be said that this type of convergences facilitate the emergence of new ways of defining problems, questions and meanings. In addition, in most of the analysed novels, ethical issues are framed in the form of personal narratives: a protagonist (or a group of protagonists) lives in a high-tech world and

has to make a choice (normally related to technology) which entails ethical implications and dilemmas. Presented in this way, ethical issues appear as embedded in everyday life situations. Ethical issues are, therefore, framed as fictions and as everyday-life facts.

Issues	Ethical concerns
Social	Control: Maintenance of status quo and order, violence, surveillance, society vs individuals, xenophobia, security, cheating, lost of autonomy/freedom, colonization, eugenic selection
	Distinctions/inequality: Gender, class, marginalization of modified/non-modified humans
Identity (individual)	Identity lost (memory lost), the borders of the ‘human’, splitting personality, body/soul connections, human/non-human rights (animals, androids), individualism, privacy, moral enhancement, loyalty, safety, freedom
Immortality (life-span)	Overpopulation/depopulation, intergenerational disorders, extinction (loss of adaptability), evolutionary transcendence/disorders, religion/dogmatism

Table 2.

A crosscutting theme within the analysed literature is technological risk/control. Some novels present utopian futures in which technologies are under control and enable the development of humanity, social justice and equality. Others present dystopian futures in which technologies are misused or have gone out of control. Within a number of the analysed novels, ethical concerns appear as elements of general utopian or dystopian frames. Nevertheless, science fiction narratives are often ambiguous, presenting mixed utopian/dystopian images of the future.

Some of the ethical concerns identified in table 2 can be seen as related to more general trans-humanist or post-humanist frames. Indeed, there are clearly ‘post-humanist’ novels (such as ‘Neuromancer’) which focus on identity problems. Others (such as ‘Kethani’) are clearly ‘transhumanist’ novels, thematically centred on immortality. However, what we have identified as post-humanist and transhumanist

issues/concerns may appear simultaneously (related and overlapping) in a number of novels (see Appendix B).

The ethical concerns presented above often appear as related to specific types of body enhancement and technology (see Appendix B). Inspired by the bioethics literature, we suggested two categories attending to the function/purpose of the enhancement: medical and cosmetic. In the course of our analysis, however, we felt that the selected categories were neither suitable nor sufficient. The ‘cosmetic’ category did not appear in our mapping. Furthermore, we found a number of enhancements that were not covered by our categorization. For instance, in the novel “the Player of games”, humans have enhanced glandules which enable them to produce drugs when they feel sad or depressed. Enhanced humans can also produce substances that will help them to improve their concentration, and then be better game players. What we found in our mapping is a kind of enhancement which does not have a specific medical or cosmetic purpose, but it enables a modification/improvement of social roles/relations. In addition, police and soldier cyborgs are quite common images within the science fiction literature. These images often entail a type of enhancement targeted to issues such as violence control and colonization. We have classified it as ‘political’ enhancement.

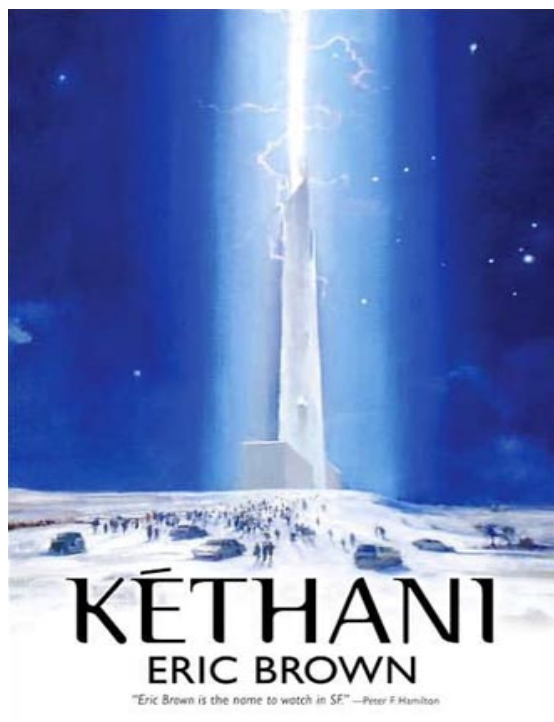
Remarkably, our analysis suggests that the science fiction literature presents and prioritizes types of enhancements (political and social) which are not central in the academic literature of bioethics, while this academic literature highlights a type of enhancement (cosmetic) which is no relevant in science fiction. This contrast between academic and popular literature is interesting, as it indicates that they could be use as complementary means for a comprehensive analysis of socio-ethical concerns on emerging technologies.

2.4.2. Imaginaries and ethical concerns on body enhancement in a novel: ‘Kéthani’

While in previous sections we have provided an overview of ethical concerns on body enhancement in science fiction literature, here we present an in-depth analysis of ‘Kéthani’. We are interested in exploring how particular ethical concerns are problematised within this novel. It has been selected attending to the ethical issue it deals with. As our map indicates, novels on life-span extension and immortality have become increasingly popular. ‘Kéthani’'s main theme is immortality. It can be

qualified as a transhumanist novel. Our analysis will be structured around these questions: Which are the imaginaries encoded in this novel? Do these stories and narratives describe the body enhancement in a positive or a negative way? Why is enhancement acceptable -or not-? If enhancement is described in a negative way, what are the problems and how are they framed? How are ethical concerns presented? Related to this, in the concluding section of this paper we will reflect on how is science fiction an appropriate channel for the diffusion and discussion of ethical issues.

The *Kèthani*, an alien civilization, is colonizing stars and planets using advanced technology. Particularly, they control the secret of immortality. The narrative of the novel evokes powerful images of the *Kèthani* towers landing on the Earth and of how they spread all along the surface of the planet. The author describes the towers as white, sharp, metallic, powerful and of a non-human beauty to which humans feel magically attracted. On the inside, the towers are ordered, spotless, hygienic and transmitting a feeling of lifelessness. The towers are the place where the dead people are brought for resurrection. The image of the towers transmits a marked tension between life and death. The novel is articulated around this tension.



Another key image of the novel are the *Kèthani* nanotechnology implants. The *Kèthani* offer to humans the choice of been implanted, then becoming immortal. Resurrected people may become *Kèthani* ambassadors, sent to colonize other planets and stars. However, while being on Earth, humans never see the *Kèthani* as they remain mysteriously absent, only delivering their implants. The *Kèthani* devices are implanted in people's temples. Conserving personal memories and DNA, these devices became the mark of immortality. When implanted people die, their transplants emit vibrations indicating that the person is still alive and entering in a state of hibernation. The corpses are brought to the *Kèthani* towers where they are enhanced both physically and morally. Resurrected people are given healthy and young bodies and they are trained in '*Kèthani-Zen*' ethics so that they become free from all their previous bad moral habits and desires. The image of 'the returnees' is that of more 'neutral', 'calm', 'better' as well as 'less human' people. The *Kèthani* people hardly appear in the novel, and just once a member of that alien civilization is seen by a human. Interestingly enough, the images of the '*Kèthani*' (architecture, technology, practices and people) always evoke a feeling of emptiness and lack of feelings, a sort of an existential vacuum. At the same time, this image appears as related to positive attributes such as calm, purity and peace. The imaginaries of the novel bring implicit a relation between 'immortality' and 'lack of humanity'. The latter is in tension with the overall positive view of 'immortality' that the novel transmits. Immortality is always portrayed as a 'gift'. Immortality is presented in an ambiguous way, as both a limitation of the humankind and as a *sine qua non* condition of humanity (the limit and possibility of freedom).

This combination of positive and negative images makes up an overall ambiguous imaginary, corresponding with an ambiguous way of valuing and trusting the new technology and 'expert institution' (physically located in the '*Kèthani*' towers). Although this is mainly a utopian novel, it includes important dystopian elements. In the beginning of the novel, humans are sceptical and contesting. There are riots and public protests against the '*Kèthani*'. However, years pass and humans start to trust the '*Kèthani*' and to see the goodness of immortality as they listen to the stories told by the 'returnees' (the resurrected). Most people believe the gift of 'immortality' makes them happier, releasing them from the unbearable burdens of death (for instance the death of loved people). In addition, 'immortality' is seen as bringing

about important and positive social changes. For instance, violence and criminality decreases, almost disappearing. Yet, not everyone accepts to be implanted. Some people reject the implant because of religious beliefs. Others simply can not understand life without death. Those who make the choice of not being implanted become a minority. They are seen as suspicious people and eventually they are marginalized.

How are ethical concerns framed within this novel? The main issue that the novel raises is: To what extent are we still humans when life is not defined in relation to death anymore? Is death the limitation or the condition of a rich and happy existence? Particular ethical concerns appear as related to this general issue. Some of these concerns are: identity loss (as people became transformed through the resurrection process), forgiveness (should you forgive the person who made your life unbearably within a previous incarnation?), religion and dogmatism (should you sacrifice your life or the life of your children because of your beliefs?), the capacity of promising and committing oneself to something ‘forever’, individualism, criminality, overpopulation, suicide, colonization.

Within the novel, these concerns are transmitted in the form of personal narratives. The novel problematises the *Kèthani* nano-tech implants and the enhancement they enable by focusing on the particular lives of a group of common people. This focus can be seen as an attempt of the author at producing identification between the protagonists of the novel and the reader. This identification, we will argue below, may facilitate an effect of ‘cognitive estrangement’. The protagonist group is made up by old friends who live in a small village in Northern England. The narratives focus on how the nano-implants have changed the life experiences and the world around these people. The novel combines moments of collective discussions about the technology with stories in which each of these friends have to deal a series of ethical dilemmas. In the weekly meetings in the local pub, these friends reflect on their experiences since the arrival of the alien. Particularly, they reflect on how the choice for being implanted (or not) entails a series of ethical implications. It is especially interesting to see how, in this novel, ethical problems are framed within a **multidimensional appraisal**: they are presented as both personal and social problems. At the same time they are framed as ‘topics of collective debate’ and ‘individual practical dilemmas’. In

addition, as the same issue is often approached from a variety of perspectives, differing angles of this issue are displayed. For instance, differing concerns on religion/dogmatism are experienced by a British/Islamic woman, a Christian priest and an atheist father whose child is not implanted because her catholic mother does not accept the *Kèthani* technology. When the child is diagnosed with leukaemia, the father goes into an agonistic state. Through this kind of multi-dimensional appraisal, the complexity of the ethical problems becomes more apparent.

In exploring how ethical concerns are framed in '*Kèthani*', it is especially interesting to focus on the 'cognitive estrangement' structuring the novel. The narratives are articulated on the basis of a fundamental tension between the familiar and the unknown. Notably, the *Kèthani* are never the focus of the narrative, as mentioned, they remain mysteriously unknown. The technicalities of the *Kèthani* implants are not described in the novel; however, they are presented as a plausible technology (one that we already use: nanotechnology). Remarkably, the *Kèthani* culture and intentions and the basis of their advanced knowledge remain unknown, producing an intense feeling of uncertainty within the group of protagonists. In their chats in the local pub, this group of friends question who the *Kèthani* are, what are their motives and intentions and which will be the consequences of immortality. Doubts and hopes are mixed up within these talks. The protagonists of the novel constantly experience a 'cognitive estrangement', which is transmitted to the reader (through identification). Their everyday lives develop within this tension between the familiar and the unknown. The need for ethically oriented reflections can be seen as emerging from this tension (a need to understand/situate an 'unknown' element within the familiar/everyday life).

2.5 Implications for WP2 in particular and for the Technolife project in general.

The particular aim of this scoping paper was to comply with the targets of WP1/research line 3, providing a map of ethical concerns on body enhancement. Concretely, we have in this part of the paper identified ethical concerns on body enhancement within the science fiction literature. We have presented ethical concerns as related to imaginaries (narratives), types of technology (bio/nano/cogno) and type of enhancement. Furthermore, in order to explore *how* ethical issues are framed within science fiction literature, we have provided in-depths analysis of a relevant novel.

In WP2, this ethical map will be used to identify ‘imagined communities’. As specified in the theoretical basis of Technolife, these communities emerge around particular ethical concerns. The transhumanist associations all around the world are a good example of those communities. Others would be sports associations concerned with doping/cheating.

This scoping paper situates itself within the general frame of the Technolife paper. In this sense, it aimed at providing early insights on the possibilities of generating alternative ethical frames. If the particular objective of the paper was to provide the WP1 ‘ethical mapping’, in a broader sense, the paper aimed at exploring to what extent is science fiction literature is a good channel to access, diffuse and discuss ethical concerns? (and perhaps for informing policy making). As it appears in our analysis, the science fiction literature differs from the literature of bioethics in several aspects; For instance, regarding relevant types of concerns, but also how these concerns are framed. It can be said that science fiction literature presents ethical concerns in a more context embedded ways as these concerns are presented through personal narratives and concrete situations. In addition, within the same SciFic novel, an ethical concern can be presented from different points of views and within a variety of time/space/social settings (such as conversations in a pub and practical dilemmas of the everyday life). Because of this kind of ‘multi-dimensional appraisal’, the complexities of an ethical problem may appear more apparent. Furthermore, because of science fiction entails a distancing view (or cognitive estrangement), it may facilitate a more reflexive view on the future of emerging technologies. In short, through this paper, we have provided a number of arguments that suggest that science fiction analysis is a good alternative means to access, express and communicate ethical concerns. However, there are, of course, arguments to disqualify the science fiction literature as a good channel in that respect. For instance, one could argue that the focus on the ‘future’ may produce an effect of ‘non-urgency’ in the audience, differing from the more present-oriented and urgent-framed issues of the bioethics and nanoethics. Nevertheless, one can easily foresee interesting synergies that could emerge from the combination of the science fiction literature and the ethics literature: they appear as taking contrasting approaches and could possibly complement each other. The question of what could be the specific contribution of science fiction

literature to the production of alternative ethical frameworks will be addressed in WP5.

Part 3 Communities and imaginaries

In this section we will briefly identify a set of communities and imaginaries that have been identified as part of the work on the scoping paper and that may be of relevance to WP2 and WP3.

The imaginaries projected in the academic and SciFi literature are quite different. The academic imaginaries are often very thin, often either completely utopian or completely dystopian and without much description of the way life is lived in the future societies created by BE&M. As mentioned above in the section on justice there is a copious literature on the potential effects of BE&M on distributive justice, but were little of this is, for instance concerned with how it would be to live in a society with increased, biologically based differences between the upper and lower strata of society.

The SciFi imaginaries are, on the other hand often thick and ambivalent and very much focused on the social life of the protagonists and they therefore often project a more nuanced picture of a future created by BE&M.

This indicates that those groups that will become involved in WP3 should be asked not only to reflect on the bodily enhancements themselves, but should be asked to reflect on what kind of society these enhancements will create and asked to project themselves into that future society and reflect upon how their own life is likely to be.

It is furthermore important that the material presented to participating groups and persons in WP3 reflect the two principal ways a future with widespread use of BE&M is likely to come about, according to the literature. That is, either 1) as the result of a slow incremental process where technologies originally developed for medical treatment purposes are increasingly being used for enhancement purposes, or 2) as the result of a much more rapid process where the BE&M potential of a range of technologies (and the convergence of these technologies) is actively being pursued.

The scoping work done has also identified a number of potential communities that it could be valuable to engage with,

These include transhumanist groups, groups coalescing around an interest in various body modifications (tattoos, piercings, implants etc.) and SciFi discussion groups.

The web-sites, blogs and discussion groups can easily be identified from the already produced Issucrawler and Touchgraph maps or by additional mapping of the blogosphere relevant to these topics.

It is more difficult to find communities or groupings that identify with the 'bioconservative' side of the later phase of BE&M academic debate (see above).

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Appendix A Methodology – Academic literature and web

Academic literature

The academic literature was initially identified by the use of PubMed, The Philosopher's Index and Google Scholar using search terms appropriate for the particular search engine / database covering the areas of human enhancement, body enhancement and body modification.

This search strategy created a very large set of potentially relevant scholarly outputs. Requiring the exact phrase “human enhancement” does, for instance provide more than 1500 books or papers in Google Scholar.

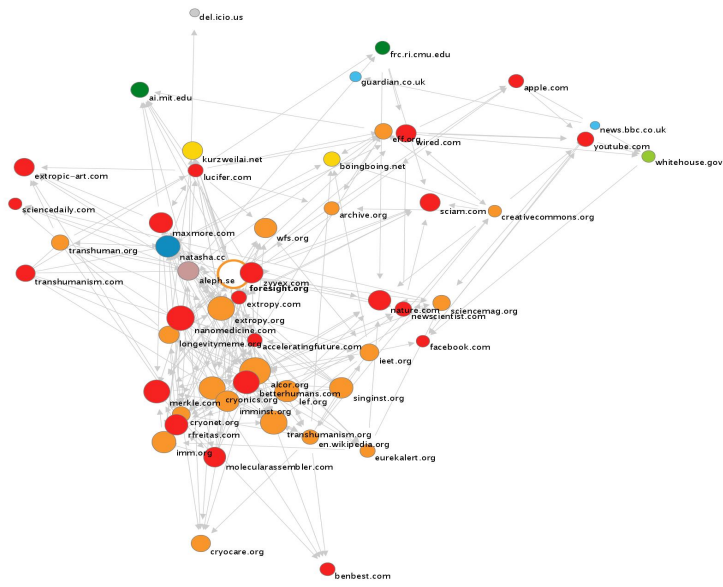
A comprehensive overview of the complete literature is therefore not possible within the scope of WP1. The current overview is thus selective in the sense of focusing on the most important, i.e. original and highly cited contributions to the literature.

The scoping paper only deals with the literature in English.

Web

Major sites of discussion of bodily enhancement and modification were identified using Google, Touchgraph Google visualisation and Issuecrawler web-cartography. Initially Google was used to identify the 50 top sites for the search terms “Enhancement” + “Human”, “Body Modification” and “Transhuman” the total set of sites were then submitted to the Issuecrawler software which with site-specific linkage and a crawl depth of 2 provided a map of the interlinkage between these sites, including the frequency of interlinkage (<http://www.issuecrawler.net/>). This identified 52 interlinked sites of interest. All of these sites were visited and notes made concerning their contents and the main discussions on the sites (if any). Simultaneously the Touchgraph program was used to provide maps of Google similarity links between sites identified by the three keywords (<http://www.touchgraph.com/TGGoogleBrowser.html>). Those sites that were not identified in the Issuecrawler map were then visited.

Issuecrawler map of interlinkage detected by crawling the top 3x50 sites for the relevant Google keywords



transhumanism-body modification-machine interaction 3x50

Co-link Map Details:
 Author: Soren Holm
 Email: soren.holm@manchester.ac.uk
 Crawl start: 23 Jun 2008 - 20:27
 Crawl end: 23 Jun 2008 - 22:53
 Privilige starting points: off
 Co-link analysis Model: 144
 Iterations: 2
 Crawl Depth: 2
 Node count: 52
 Map generated from www.covocom.org by the Covocom Foundation, Amsterdam.

Legend:
 (Color) (Label) (Color) (Label) (Color) (Label) (Color) (Label)
 (C.com) (C.edu) (Org) (C.se) (C.net) (C.us) (C.co.uk) (C.cc)
 (Gov)

Statistics:
foresight.org
 Destination URL: <http://www.foresight.org/UTFF/unbound...>
 Page date stamp: 23 Jun 2008 - 21:38
 Links received from crawled population: 1353

Links from network (1 - 20)

1. cryonics.org	11. longevitymeme.org
2. alcor.org	12. lucifer.com
3. alphaz	13. merkle.com
4. betterhumans.com	14. nanomedicine.com
5. transhumanism.org	15. acceleratingfuture.com
6. zyxex.com	16. extropycorp.com
7. rrebas.com	
8. extropycorp.com	
9. immi.org	
10. immiinst.org	

Links to network: 19

Appendix B: Science fiction literature mapping

Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
THE ISLAND OF DR. MOREAU (1896, Wells)	Shipwrecked protagonist meets hybridised animal/human experiments. Failure of conditioning Vivisection as transgenetic technology.	Biotechnology	Medical	Identity (transgressing the limits of the 'human')
BRAVE NEW WORLD (1932, Huxley)	In a futuristic society, social control is carried out through engineering and conditioning. From embryos to adults, people are manipulated (stimulated or retarded) through the use of chemical substances. Traditional and family values have disappeared. Bernard and other unique characters struggle with this society.	Biotechnology	Medical and Political	Social control (society vs Individuals, violence). Social inequality (Class)
LIMBO (1952, Wolfe)	Martine is a veteran of the Third World War and a neurosurgeon. Back home he proposes a new doctrine: the 'new men' must amputate their arms and legs and substitute them with cybernetic prosthesis in order to avoid war. They will eventually find out that the body is not the source of aggressiveness.	Cybernetics	Political	Violence control
TO LIVE FOREVER (1956, Vance)	Galvin is an Amaranth, superior class which has the privilege of immortality through clonation (they copy prototypes and keep memory banks). Galvin murders another Amaranth. Masquerading as his own (blameless) clone, he tries to find a place in society.	Biotechnology	Medical	Immortality Lost identity Class inequality Over-population Intergenerational disorders
THE SHIP WHO SANG (1961, Caffrey)	Helva was a gravely ill girl. Her parents refused Euthanasia. They accepted that the healthy mind of the girl was separated from her ill body. The mind of the girl will control a spaceship, so that the ship becomes the Helva's new body.	Cybernetics	Medical	Life-span extension/immortality
THE IMMORTALS (1962, Gunn)	A millionaire takes a blood transfusion. The donor is the first immortal, possessor of a mutation that produces an anti-aging effect. Marshall, the immortal, knows that he will never die and so he will never live. The millionaire soon gets into trouble.	Biotechnology	Medical	Immortality Class inequality

Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
DO ANDROIDS DREAM OF ELECTRIC SHEEP? (Dick, 1966)	Androids have been created to serve humans. However, they have become so enhanced that they are not easy discernable	Biotechnology Cybernetics	Political/social	Life-span extension 'Humanity' status

Appendix B: Science fiction literature mapping

	from humans. Distinctively, androids do not have empathy (towards animals, i.e.). Willing to be fully humans, a group of androids rise against their master. Rick Deckard must track and hunt those androids. Questions and doubts come to his mind when he falls in love with Rachel, one of the androids.			Identity (empathy) Social distinctions 'Animals' status
THE LEFT HAND OF DARKNESS (1969, Le Guin)	Genly Ai is an emissary from the human galaxy to Winter, and exotic arctic world in which there is no sex differences. Genly is evold to exchange ideas and technologies with them. He will have to understand their culture overcoming his prejudices.	Biotechnology	Social/Political	Social distinctions (gender)
BUG JACK BARRON (1969, Spinrad)	Barrow (popular TV presenter and Social Justice Coalition founding member) and Howards (billionaire director of the non-profit Foundation for Human Immortality) get entangled in a political battle as Howards wants to get the legal monopoly of freezing people to turn it into a 'public utility'. Progressively, things get more complicated and corrupted.	Nanotechnology (cryonics)	Medical	Immortality
CYBORG (1972, Caidin)	Steve is an astronaut pilot. He has an accident during and flight and gets gravely damaged. He attempts to commit suicide. He is rebuilt and turned into a bionic being. As a cyborg-agent, he is sent to Middle East to fight Islamic extremism.	Cybernetics	Political	Social/violence control
RIDING THE TORCH (Spinrad, 1974)	Survivals of the Earth planet travel in the last spaceship. They are searching for a new planet to inhabit. They discover there is no other inhabitable planet. They will have to communicate the news through the 'senso'.	Biotechnology Cybernetics	Medical Social	Communication Extinction
THE SHOCKWAVE RIDER (1975, Brunner)	In a near future society, a universal network of information is dominated by corporations. Everyone's information can be known and controlled. Nickie Hallinger is a computer genius. He plans to save the world, replacing the political system with direct democracy through the internet. He uses his talents to switch his identity and escape the government.	Cybernetics	Political	Privacy/security (information control) Identity (mind/body)

Appendix B: Science fiction literature mapping

Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
MAN PLUS (1976, Pohl)	In order to explore Mars and adapt to its life conditions, the <i>homo sapiens</i> must be biologically modified.	Biotechnology	Political	Expanding the geographical limits/Conquering Marginalization of modified humans
NEUROMANCER (Gibson, 1983)	Multinational corporations with AIs and biotechnology rule. Case is a computer hacker in virtual reality - in and around cyberspace (marginality and high-tech). Case meets the wrong people, he is deleted from cyberspace and he loses his skills. He gets the chance of restoring his life by taking part in a conspiracy.	Cybernetics Biotechnology (Brain Implants)	Medical	Identity (privacy) (life-spam?)
BLOOD MUSIC (1985, Bear)	Vergil Ulam, a genetic engineer, carries out a private research project. He injects himself with microscopic biological computers. By accidents these alive computers take his body and eventually, they spread out infecting and transforming the whole planet. People who have been infected develop a new structure and consciousness.	Biotechnology Nanotechnology Cybernetics	Medical	Technology out of control (risk of extinction) Evolutionary transcendence.
WHEN GRAVITY FAILS (Effinger, 1987)	Dominant tech culture is Muslim while Europe, Soviet Union and USA have disintegrated. Marid Audran is extensively enhanced to investigate series of crimes. He must track down the most brutal psychopathic killer.	Cybernetics (Brain implants)	Political Social	Identity (modification) Violence control
GREAT SKY RIVER (1987, Benford)	Background of “Mech” civilization which is dominant and trying to wipe out human/bio civilization. Humans are mechanically and cognitively enhanced. Memories of dead stored electronically and embedded in brains of live humans.	Cybernetics Biotechnology	Political/social	Political control (Geographical expansion/extermination of human species)
DAWN (1987, Buttlar)	Lilith is a survival of the almost extinguished human species. The Oankanli are an alien species. They enhance their bodies through advance genetic engineering. Because of extreme genetic enhancement, they have lost their genetic diversity and ability to adapt. They need to exchange genes with other species. Lilith faces the choice of trading her genes. In return she and her half-Oankanli children would receive privileges of enhanced health.	Biotechnology	Medical Social	Evolution disorders/extinction Lost of adaptability Lost of social distinctions (i.e. gender).

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Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
PLAYER OF GAMES (1988, Banks)	Gurgeh is a brilliant player of games in the culture, an equalitarian and peaceful society. He is sent as an especial agent to the primitive Empire of Azad. Inequality and violence characterize this society. Social status is determined through the game of Azad. Gurgeh accepts to play the game. Facing his opponents, he understands the logics of the game: the values of the players (equality/inequality) inform their strategies.	Biotechnology Nanotechnology Cybernetics	Social Political Medical	Cheating in games Hedonism Social Equality Colonization (geographical expansion/political relations)
BUYING TIME (1989, Haldeman)	The "immortals" are wealthy people who can afford periodical medical treatment that would allow them to prologue their lives or even become immortals. Barr is one of them. He has the opportunity to become part of the immortals' elite but as he become aware of the conspiracy to take control over the secret of immortality, he runs away.	Biotechnology	Medical	Life-span extension Class inequality
FRANKENSTEIN UNBOUND (1990, Aldiss)	20 th century protagonist confronts the environment of Mary Shelly (creator of "Frankenstein") and issues of her time.	Electricity Biotechnology ⁹	Medical Social	Immortality Technology out of control Questioning the borders of humanity.
USE OF WEPONS (1990, Banks)	The "Culture" is a colonizing and utopian interstellar society inhabited by humans, drones and AI machines. A large variety of enhancements are practiced in this society. Cheradenine, a citizen of a technologically under-developed civilization is hired by the culture as an especial agent to influence conflict in several planets. He reflects upon his difficult past in his primitive society. He will have to measure the use of weapons.	Biotechnology Nanotechnology Cybernetics	Social Political Medical	Social equality Violence control Colonization (geographical expansion/political relations).
QUEEN OF ANGELS (Bear, 1990)	Mary Choi, a "transformed" policewomen is extensively enhanced to help carry out her duties. She becomes the 'ideal police women'. She tracks down a famous poet and mass killer.	Nanotechnology	Political	Violence control Identity

⁹ As manipulated biology.

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Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
STATIONS OF THE TIDE (Swanwick, 1991)	Miranda is an exotic world colonized by the humankind. Technology is controlled by the state. Within a virtual reality system, civil servants delegate tasks to their virtual copies. “Te bureaucrat” is an official of the Technology Regulating Agency. He tracks down a magician who is using a forbidden technology. In the course of his investigation, the bureaucrat makes an incredible finding: the native species from Miranda is not extinguished as thought	Nanotechnology Cybernetics	Political	Social control Identity
THE TURING OPTION (Harrison and Minsky 1992)	Brian is a world leading expert in artificial intelligence. A group of criminals steal his research and would him gravely. His brain is recomposed and enhanced. He regains part of his knowledge and memories. His implant allows him to connect to external artificial intelligence systems. He tries to find out about the criminals.	Cybernetics (Brain implants-chips)	Medical	Identity (reconstruction)
MOVING MARS (Bear, 1993)	Enhanced human beings colonize Mars. Casseia, a student at the Mars University and a political leaders, tries to fight the tyranny of the colonizers.	Nanotechnology	Political	Social inequality (colonization)
PERMUTATION CITY (1994, Egan)	Immortality is possible. ‘Emulations’ of persons exist in a virtual reality program which is controlled by the originals. Emulations have subjective conscious experience. Paul and other rich copies seek for immortality by controlling the computing system.	Cybernetics	Medical Political	Life-span extension Identity (autonomy) Human/copy rights
INTERFACE (1994, Bury) ¹⁰	Cozzano is a presidential candidate. Through a biochip implanted in his brain, he is connected to a computerized polling system. He feels the mood of the citizens and act accordingly. Nothing but his own mind can stop him in his race to the White House.	Biotechnology Cybernetics	Political	Social control
NECROVILLE -TERMINAL CAFÉ- (1994, McDonald)	Resurrected people are used as labour force and have their own ghettos, called Necrovilles. Lived and dead people cannot mix. Santiago, an artist and 4 of his friends go to a Necroville to record Santiago’s death and resurrection. In this encounter with the dead, they will change forever.	Nanotechnology	Social	Immortality Social inequality (class).

¹⁰ Pseudonym for Neal Stephenson.

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Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
SLOW RIVER (Griffith, 1995)	Lore belongs to a very powerful family. She is kidnapped and loses her identity implant. Her life falls into crime and deception. She has the choice to steal the identity implant of a death woman and get back a normal life	Nanotechnology Biotechnology Cybernetics	Social	Identity (lost)
THE TERMINAL EXPERIMENT (1995, Sawyer)	Dr. Peter Hobson, a brain scientist experimenting with the brain patterns of the dying recently dead. He creates 3 duplicates of himself: the first is just virtual, the second is immortal and the third is a control copy. The copies get out of control and one of them starts a series of murders.	Cybernetics	Medical (cognitive)	Immortality Identity (personality splitting, body and soul connections)
HOLY FIRE (1996, Sterling)	Mia is a 94 years old wealthy lady. She decides to take a treatment for rejuvenation. The treatment has physiological effects on her. Seeking for stimulus and meaning, she travels to Europe.	Cybernetics Nanotechnology Biotechnology	Medical	Life-span extension Identity social inequality
TESTIMONI DE NAROM (Barceló y Romero 1997).	This novel problematizes the “femto-technology”, the possibility of intervening and manipulating the matter (alive or not) in nano scales. The narrative is a reflection of the social consequences of this technology.	Nanotechnology	Social	Religion. Social change
THE FIRST INMORTAL (Halperin, 1998)	Ben suffers a grave disease and he is placed into cryonic suspension. This opens up for ethical controversy within his family. When Ben is reanimated more than 30 years later, he finds out that other members of his family have also been frozen.	Nanotechnology Biotechnology	Medical	Immortality Inter-generational disorders Eugenic selection
eXistenZ ¹¹ (1999, Priest)	eXistenZ is a confusing computer game, more real than reality. The “hardware” of the game is like a living organism. The game links to a new artificial body orifice.	Biotechnology Cybernetics	Social Political (military)	Extreme violence
VITALS (2001, Bear)	Hal is a scientist who is researching on bacteria that colonizes the human body and enables to prologue life. This bacteria may end up in the wrong hands, allowing social control by biological manipulation.	Biotechnology	Medical Political	Life-span extension Social control

¹¹ David Cronenberg’s movie novelised by Priest.

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Title	Imaginary: Narrative	Technology	Enhancement	Ethical concern
CRECENT CITY Rhapsody (2001, Goonan)	Aliens attack the Earth and bring the Silence. The Age of information collapse, cities become organisms and humans adapt to cities. Maurice is assassinated. She is resurrected and wants vengeance and to save the World. Dr Zeb understands that the Silence contains a message that will save the humankind form extinction. All the characters face ecoterrorism and xenophobia.	Nanotechnology	Medical Political	Life-span extension Xenofobia Violence Extinction
KIL'N PEOPLE (2002, Brin)	Albert is a detective investigating the murder of the inventor of a cloning technology. Humans can make cheap copies of themselves. The copies live for a single day to serve their owners (working for them, going through hurting experiences, i.e.). The owner can chose whether or not to inload the memories of the copy. In his search, Albert uses copies of himself.	Biotechnology Cybernetics	Social	Identity (individualism, privacy) Social control (surveillance)
THE SKINNER (Asher, 2002)	A distant planet, inhabited by exotic life forms is found and colonized. A virus provides life extension and biorepair. Infected by this virus, the longer human live, the less human they become. Three travellers with different missions arrive to the planet. They face problems of immortality, mind expansion and extreme violence.	Cybernetics Biology	Political	Life-span extension Violence
BROKEN ANGELS (2004, Morgan)	Nano-biowarfare. Militarization of human enhancement. The protagonist is a militarised bionanofighting machines capable of “backing” up his memories and personality.	Nanotechnology Biotechnology	Political (military)	Extreme violence
MINDSCAN (2005, Sawyer)	Jake fears he will inherit the genetic defect which destroyed his father’s personality. But a new technology appears. It enables to pattern everything in the brain and transfer it into a mechanical body. Copied minds are enhanced and immortal, while the originals are sent for a pleasant retirement to the moon, the copies take on their lives. Problems of reanimating the dead and “uploading” personalities and memories are raised.	Cybernetics	Medical	Life-span extension Identity (memory and personality)
GLASSHOUSE (2006, Stross)	In a futuristic society, digitalization and recreation of people is possible. People wear new bodies and genders. But transferring brains to softwares has a dark side as it enables for social control. A computer virus is a maniacal dictator. It infects the travelling	Nanotechnology Biotechnology Cybernetics	Political	Social control Surveillance (freedom and safety) Identity (memory, loyalty)

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	channels, produces amnesia and gets control. Robin, the protagonist, opposes this power and tries to reconstruct and understand the past.			
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ROLLBACK (2007, Sawyer)	An aging female cosmologist is the only person able to communicate with extraterrestrial being. It is import to keep her alive. She and her husband take a rejuvenate treatment. However, the treatment has no effects on her	Biotechnology	Medical Political	Life-span extension Communication with none-humans
THE PREFECT (2007, Reynolds)	High tech thriller. Dreyful is a prefect in a futuristic interstellar society. Prefects must ensure the political order. He must fight an AI intelligence to save his world. Body enhancement includes featuring digital “back-ups” of people’s minds and memories.	Nanotechnology Biotechnology Cybernetics	Political	Immortality Social control
KETHANI (2008, Brown)	The Kethani are an alien species. They have brought immortality to Earth. Humans can choose to be implanted with a Kethani device so that after dying they will be enhanced and resurrected. Khalid and his friends have to cope with the multiple dilemmas of being implanted or not.	Nanotechnology	Medical Social	Immortality Moral enhancement
NIGHT SESSIONS (2008, Macloed)	Near future thriller set in the Scottish Republic. In a world in which religion wars do not exist anymore, a catholic priest is murdered. A. Ferguson, an enhanced policeman, investigates the case. He discovers a terrorist act. He is assisted by a droid.	Cybernetics	Political Social	Religion and dogmatism Post-human rights