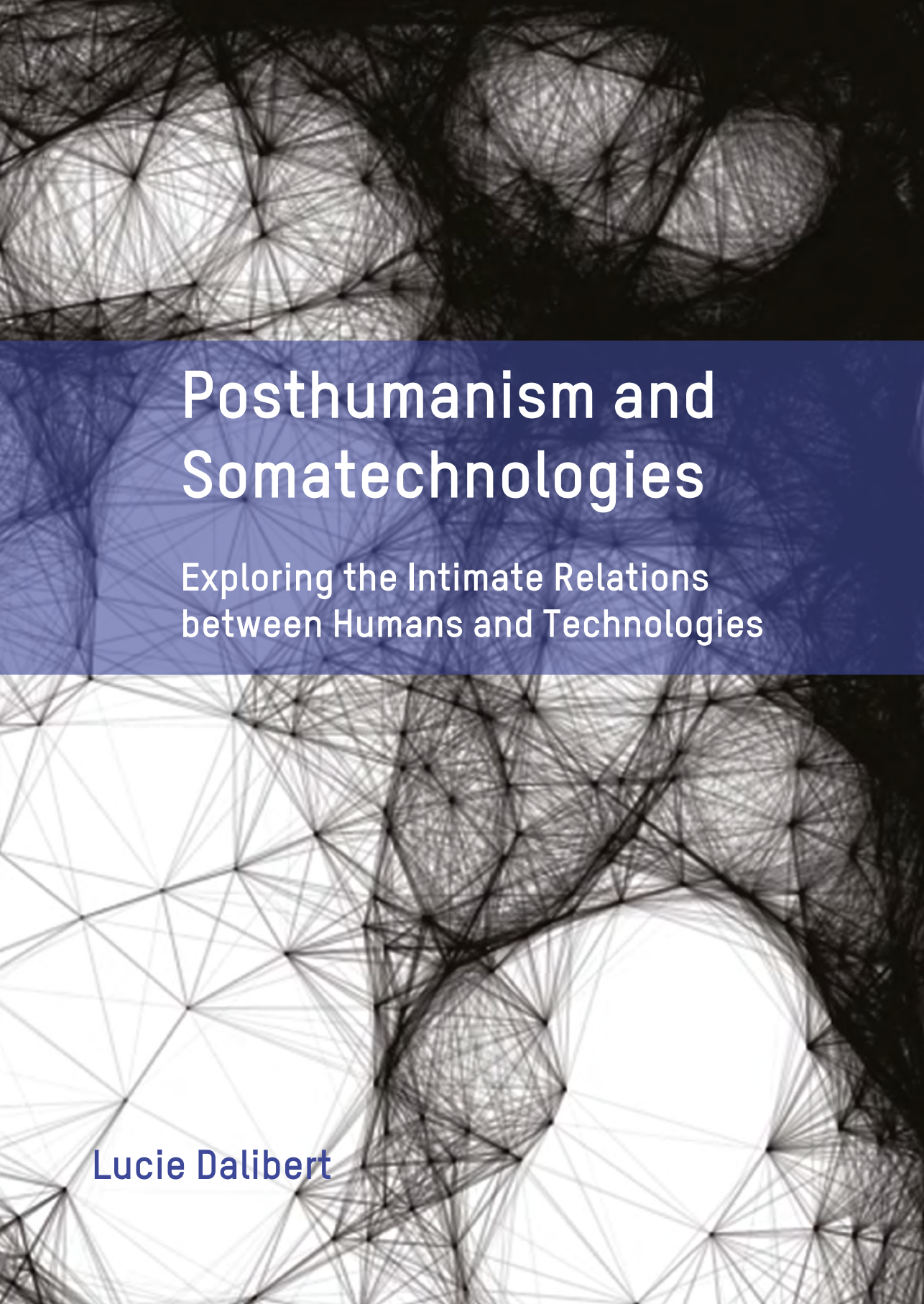

Posthumanism and Somatechnologies

Exploring the Intimate Relations between Humans and Technologies

Lucie Dalibert

Posthumanism and Somatechnologies:

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Exploring the Intimate Relations between Humans and Technologies

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by

Lucie Dalibert

born on August 24th 1984
in Châteaubriant, France

This dissertation has been approved by promotor and assistant promotor:

Prof.dr.ir. P.P.C.C. Verbeek
Prof.dr. O. Aydin

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Introduction

'Some of the most important watersheds in human history have been associated with new applications of technology in everyday life: the shift from stone to metal tools, the transition from hunting and gathering to settled agriculture, the substitution of steam power for human and animal energy. Today we are in the early stages of an epochal shift that will prove as momentous as those other great transformations. This time around, however, the new techniques and technologies are not being applied to reinventing our tools, our methods of food production, our means of manufacturing. Rather, it is ourselves who are being refashioned. We are applying our ingenuity to the challenge of redesigning our own physical and mental capabilities. Technologies of human enhancement are developing ever more rapidly'

Michael Bess (2008) 'Icarus 2.0'

'If my nightmare is a culture inhabited by posthumans who regard their bodies as fashion accessories rather than the ground of being, my dream is a version of the posthuman that embraces the possibilities of information technologies without being seduced by fantasies of unlimited power and disembodied immortality, that recognizes and celebrates finitude as a condition of human being, and that understands human life is embedded in a material world of great complexity, one on which we depend for our continued survival'

N. Katherine Hayles (1999) How We Became Posthuman

An epochal shift. Since the discovery of the structure of deoxyribonucleic acid (DNA) by James Watson and Francis Crick in 1953[1] and the subsequent development of the field of so-called modern biotechnologies, comments such as Michael Bess's have become rather commonplace[2]. More than ever, what it means to be human appears to be at stake with technology. The twenty-first century has been dubbed 'the biotech century' (Rifkin 1998) or 'the century of molecular biology' (Jennings 2003: 132), thereby closing the (all too lethal) century of physics and chemistry (Venter and Cohen 2004) – but before 'the century of the brain' became the new (prior to the next one, that is) expression à la mode. The advent of biotechnology and molecular medicine (Boenink 2009; 2010) is expected to engender transformations that are not only 'alter[ing] people's lives as radically … as did electricity, telecommunications, and the automobile in the twentieth century' (Rudolph and McIntire 1996: v), but that are also more potentially destructive and life-threatening than the atomic bomb[3] (Joy 2000: np).

1. Watson and Crick allegedly fathered the double helix structure of DNA. This paternity claim has however recently been challenged as some scholars have pointed out that they may have been using data gathered at the time by other scientists (Davis 2006: 95), and by Rosalind Franklin more especially. Her unpublished draft evidences that she had established the B-form of the DNA structure before her male colleagues. As Donna Haraway states it, Franklin's work 'was stolen by the flamboyantly sexist and heroic James Watson on his way to the immortalizing, luminous fame of the Double Helix' (Haraway 2004: 114).
2. See e.g. Rudolph and McIntire (1995) and more generally the various reports written for policy makers on human enhancement, such as Allhoff et al. (2010); Calland et al. (2007); Coenen et al. (2009); Miller and Wilsdon (2006); van Est et al. (2008); Zonneveld et al. (2008).
3. While in a doom-mongering style, Bill Joy refers to the twentieth-century nuclear and chemical technologies as enabling weapons of mass destruction (WMD), he characterises the twenty-first-century technologies that rely

With the advent of technoscience, or rather with the convergence of nanotechnology, biotechnology, information and communication technology and the cognitive sciences (NBIC), the ability to (re-) engineer and (re-) design bodies and life itself and vitalise technology has gained momentum. In the meantime, dreams of a second Genesis have flourished (Rifkin 1998: 15) and found incarnation in the figure of the posthuman. Whether or not these technological developments are to engender Homo sapiens 2.0 as the next (man-made) evolutionary step (Bess 2008) or to lead to a posthuman future (Fukuyama 2002), the converging technologies appear to challenge what it means to be human (Verbeek 2009). The discussion about the future of humanity has come to be centred on the prospect of 'human enhancement.' Hopeful promises and fearful scenarios bring Prometheus and Frankenstein's creature to life again, haunting the discussions regarding the societal, political, and ethical implications of NBIC technologies. The discussion about human enhancement has indeed developed into a very polarised debate, with fervent defendants and vehement opponents of the ambition to enhance humans into posthuman beings. Posthumanism is a disputed field.

The convergence of nanotechnology, biotechnology, information and communication technology and the cognitive sciences has tended to crystallise into the issue of human enhancement and the opposition between so-called transhumanists and bioconservatives or bio-luddites over the latter's desirability. In these utopian versus dystopian visions[4] of the future (of humanity), the posthuman has become an (in)famous figure, one that has coalesced in transhumanist pleas for a posthuman future as the improved and perfected successor human being and in bioconservative lamentations over the violation of human nature as the debasement of humanity.

Even though they appear irreconcilable, the views held by transhumanists and bioconservatives concerning humanity's future within NBIC convergence share a notable common point, namely a (unacknowledged) celebration of the modern liberal humanist subject – the autonomous, self-contained and disembodied individual who is not only the uncreated creator and actor of its own life but also the master of its environment and the producer of true knowledge. However different the two positions may seem, the human being that bioconservatives are defending and the posthuman being that transhumanists are desiring can in fact be both characterised in terms of hyper-humanism. As poststructuralist, feminist and postcolonial scholars have forcefully demonstrated over the past decades, the modern liberal humanist subject has historically crystallised in the figure of Man and relied upon the devaluation and domination of non-human, non-white, non-male, non-heterosexual, differently-abled bodies (Braidotti 2002; Haraway 1991; Harding 1998; Hayles 1999). And remarkably enough, in transhumanist and bioconservative accounts, Man – whether in the dis/guise of the huMan or the posthuMan – has to remain the measure of all things (Palladino 2003: 86).

Still, the debate between bioconservatives and transhumanists over human enhancement, and the directions to be taken in its respect, has gotten mired into an impasse over human nature. While

upon the knowledge of genetics, nanotechnology and robotics as knowledge-enabled mass destruction (KMD) due to their self-replicating potential, relatively cheap cost and large availability (Joy 2000: np).

4. Note though that holding utopian and/or dystopian views on the implications of enhancement technologies (conceived as stemming from the convergence of nano-, bio- and information technologies and the cognitive sciences) for the future of the human being is not the exclusive preserve of transhumanists and bioconservatives. Assuredly, many scholars – whether philosopher or not – and commentators – journalists, etc. – partake too in positive and negative assessments of the question of human enhancement, but the polarisation of the debate between transhumanists and bioconservatives is a central feature of such question. Note too, that besides the transhumanists and bioconservatives not being the sole voices in the human enhancement debate, both groups are not monolithic entities but encompass a certain variety of voices. This will be further developed in chapter one.

normative discussion about posthumanism have reached a deadlock, bionic prostheses and implants are developing and gaining momentum, alongside neuromodulation devices, nano-pills and chips, and engineered tissues. Therefore, a pressing question emerges: how to apprehend and conceptualise the relations between humans and enhancement technologies so as to improve the current discussion on human enhancement? It is by addressing this research question that it will become possible to account for what it means to be human with/in enhancement technologies, that is, with/in technologies that are getting increasingly closer to the (human) bodies they propose to modify.

To tackle and answer this critical, if not vital question, which constitutes this thesis's central interrogation, both a conceptual and an empirical investigation needs to be undertaken. First, for achieving an appropriate – anthropologically, conceptually, methodologically sound – exploration of 'the human' with/in enhancement technologies, an excavation or mapping of the idea of posthumanism and the ways in which humans have been and are to be understood in relation to technologies is necessary. While the human enhancement debate has remained at a rather speculative level concerning the implications of potential enhancement technologies (Nordmann 2007), it has also been pervaded by normative assumptions concerning what human beings are and should be. This has impeded an understanding of putatively enhancement technologies and their implications for human beings – humans and technologies are conceived as hermetically separated. But even though posthumanism has taken on a hyper-humanistic shape in the human enhancement debate, it also has an alternative genealogy and actuality. The figures of the cyborg and the posthuman not only show how a modern liberal humanist paradigm is neither conceptually nor anthropologically appropriate for apprehending human beings, but they also make visible that humans must be apprehended in relation to technologies – humans are and have always been technological beings.

To develop a posthumanist conceptualisation of the ever more intimate relations between humans and technologies is a complicated task though, as an exploration of posthumanist approaches and philosophical anthropology will reveal. In order to apprehend the relations that putatively enhancement technologies initiate with human beings and the ways in which humans are transformed with/in these technologies, I propose and elaborate the concept of 'somatechnology' as a posthumanist heuristic tool. The intimate relations between bodies and technologies on the one hand, and the bodies that materialise – come to exist and matter (as human) – with/in (enhancement) technologies on the other, are the central foci of this heuristic device.

Understanding so-called enhancement technologies as somatechnologies requires empirical investigations of the intimate and intricate relations between humans and technologies, bodies and artefacts. When human beings develop such relations with technologies, the issue is not whether these technologies threaten or improve 'the human,' but rather how and which bodies materialise with/in them. What appears to be at stake in such relations is not the abstract idea of the enhancement of humanity, but the quality of the very concrete way in which people are constituted as bodily beings in relation to technologies, and via these technologies to the people and things around them. N. Katherine Hayles's words in the opening epigraph particularly resonate with somatechnology: living in an intimate relation with somatechnologies is ultimately about continued survivals and liveable futures. The concept of somatechnology intends to show a way out of the deadlock of the human enhancement debate by opening a way to discuss the liveability of such futures.

Outline

More concretely, this conceptual and empirical investigation of how to apprehend and conceptualise the relations between humans and enhancement technologies so as to improve the current discussion on human enhancement will unfold as follows.

Chapter one, 'The Journey Towards Posthumanity: Mapping the Field of Human Enhancement,' introduces human enhancement, its underpinning technologies, and its delineation as an issue concerning human nature and future in the discourses of transhumanists and bioconservatives. Insofar as transhumanists and bioconservatives have been the dominant voices with respect to human enhancement and it becoming an issue for what it means to be human, I expose their views in this chapter. More particularly, on the one hand, I draw attention to the ways in which they have envisioned the impacts of enhancement technologies on human beings and on the other hand, I highlight their assumptions about the ontology of humans and technologies. Besides (enhancement) technologies being imbued with an instrumental, almost magical, neutrality by transhumanists and conceived as alienating and dehumanising by bioconservatives, the human that informs both accounts is a rather abstract and generic, even hygienic figure. More precisely, it is the disembodied modern liberal subject that, hermetically separated from technologies, informs both transhumanist pleas for a posthuman future and bioconservative lamentations over human nature. Ultimately, humans, technologies, and (human) enhancement are blackboxed categories within bioconservative and transhumanist accounts; human enhancement is not conceived as an instance of human-technology relations. Rather, posthumanism amounts to a hyper-humanism.

Chapter two, 'Human Enhancement as Normation?' continues this critical exploration of posthumanism, or rather, of human enhancement and the posthuman as emerging within a modern liberal humanist framework. In particular, it is the value-ladenness and normative dimension of the human that inhabits human enhancement that is under review. After discussing some of the ethical issues that have been raised with respect to human enhancement and how it has been apprehended as reviving the spectre of eugenics, I examine human enhancement as an instance of normation (Foucault 2009a). By highlighting its relation to – and d/evaluation of – dis/abilities and by introducing the figure of the normate (Garland-Thomson 1997), I emphasise the centrality of norms concerning who counts as human (i.e. humanness) in the delineation of human enhancement. This exploration not only enables me to unpack the concept of (human) enhancement but also to signal the intertwinement of bodies, technologies and humanness within human enhancement. I rely upon cosmetic surgery to illustrate this point. Finally, I hint at how human enhancement is about the materialisation – coming to existence and coming to count – of (certain) bodies with/in (putatively) enhancement technologies. On this basis, and especially due to the risk of human enhancement becoming an instance of normation within hyper-humanism, I alert on the need to devise a new – other than modern liberal humanist – framework for apprehending the intimate relations between humans and enhancement technologies.

Chapter three, 'Of Cyborgs and Posthumans: Rewriting Posthumanism,' takes this necessary step by mapping another genealogy to the posthuman and posthumanism. As such, it not only marks a rupture with the previous chapters but also revisits them. Through a detour via cybernetics and technoscience, the artificiality, or rather the artifices necessary for the subsistence of the modern liberal humanist subject as the quintessential human are not only further exposed but modern liberal humanism is revealed as onto-anthropologically flawed and unable to account for what it means to be human in a technological lifeworld. This chapter is conceived as a turning point in the apprehension of the relations between humans and technologies: the latter are not hermetically separated but onto-anthropologically entwined. In this context, the posthuman and posthumanism appear metamorphosed and promising for apprehending the ever more intimate relations between humans and potentially or putatively enhancing technologies especially as they emphasise situatedness, relationality, materiality and accountability. However, the posthuman, its sibling the cyborg, and in their lineage the conception of humans as prosthetic beings have fallen victim of their success, becoming used and ultimately abused metaphorical figures for capturing and expressing the intimate relations between humans and technologies.

In chapter four, 'Somatechnologies and the Intimate Relations of Humans and Technologies,' I turn to philosophical-anthropological approaches to human-technology relations to devise a (posthumanist) heuristic tool to apprehend the intimate relations between humans and technologies which, I argue, is key for understanding enhancement technologies and what it means to be human with/in them. After examining the potential of the concepts of organ projection and extension, anthropotechnologies, and originary technicity, I propose somatechnology, insofar as it points to the entanglement of bodies, technologies and (putative) humanness, as a heuristic tool to encapsulate the intimate relationships between humans and technologies and to account for and be accountable to the materialisation of bodies with/in (enhancement) technologies. A heuristic tool, somatechnologies are also intimate technologies. With this chapter, I close my conceptual excavation of posthumanism and human-technology relations.

In chapter five, 'Living with Somatechnology: Intimacy and Materiality,' I turn to practices. Or rather, I explore the intimate relations between humans and somatechnologies in practice. After introducing spinal cord stimulation and upper-and lower-limb prostheses as the technologies with respect to which I conducted fieldwork, and discussing some methodological issues, I explore these technologies as instances of (technical) mediation. After indicating several limits to this (postphenomenological) approach for apprehending somatechnologies, I attend to the becoming intimate of somatechnologies and to the transformation of bodies with/in somatechnologies. Bodies and materiality in general are crucial in one's becoming intimate with somatechnology.

Chapter six, 'Materialising Bodies with/in Somatechnologies: Humanness at Stake,' continues the exploration of what it means to be living with somatechnologies. While chapter five explores the intimate relations between bodies and these technologies by focusing especially on humans' and technologies' material dimension, in this chapter I not only continue this investigation but also unravel their normative dimension by attending to the bodies that materialise and especially matter as (putatively) human with/in somatechnologies.

Finally, in the conclusion of this thesis, I come back to my initial question by discussing how somatechnology as a heuristic tool has contributed and can contribute to shed light on what is at stake and what it means to be human with/in enhancement technologies.

Chapter One
The Journey Towards Posthumanity – Mapping The Field Of Human Enhancement

As nanotechnology, biotechnology, information technology and the cognitive sciences (NBIC) have been gaining momentum, issues concerning their implications on society and what it means to be human have emerged. Yet, as previously said, they have tended to crystallise into the endeavour of human enhancement, the latter referring to the technological improvement of humans beings or, as the Science and Technology Options Assessment of the European Parliament defines it, to 'any modification aimed at improving individual human performance and brought about by science-based or technology-based intervention in the human body' (Coenen et al. 2009: 6). Bodies, technologies and the 'human' are therefore central categories in the concept of human enhancement.

What are the technologies and the human that inhabit, inform and constitute human enhancement? How are the technologies deemed to reconfigure bodies and what it means to be human? How do they feature and have been conceptualised in the human enhancement debate? Human enhancement and the prospect of a posthuman future has indeed become the object of a heated debate, one that has developed into an opposition between two apparently irreconcilable positions: transhumanism, on the one hand, that defends the idea that we should aim to overcome the limitations of the human and evolve towards a posthuman being, and bioconversativism, on the other hand, that fiercely oppose human enhancement in the name of human nature. In this discussion, however, many crucial dimensions of the relations between human beings and technology are neglected, omitted, or silenced. If enhancement technologies are assumed to be dramatically challenging, revolutionising even, for human beings, the very relations between humans and technologies and the emergence of new configurations are ignored. Rather, a specific – and exclusive – conception of the human informs the transhumanist and bionconservative understandings of human enhancement. It is the modern liberal humanist subject, namely Man, the bounded, autonomous and uncreated creator who uses technological artefacts but remains hermetically separated from them, that is safeguarded and consecrated in this debate. Posthumanism becomes hyper-humanism.

Therefore, this chapter consists of a contextualisation of the phenomenon of human enhancement and a necessary mapping of the field. Firstly, I will sketch the contours of the posthuman, the figure that occupies the discussion around human enhancement, and will trace the roots of the latter to the so-called NBIC report. Secondly, I will show that technologies are key in the current framing of human enhancement and I will provide an overview of them. Thirdly, as it dominates any discussion about human enhancement, I will introduce the opposition between transhumanists and bioconservatives and its apparent impasse. If, as I will highlight, their respective conceptions of technology and claims with respect to human nature are conflicting, they are both defending the modern liberal humanist subject – a rather conservative and exclusive conception of the human and ultimately an anthropologically flawed understanding of human-technology relations.

1. Human Enhancement and the Posthuman

> *Steve Austin, astronaut. A man barely alive. Gentlemen, we can rebuild him. We have the technology. We have the capability to make the world's first bionic man. Steven Austin will be that man. Better than he was before. Better, stronger, faster (The Six Million Dollar Man, 1974-1978).*

The Posthuman

Steve Austin, the Six Million Dollar Man, is a posthuman. If one were to replace the term 'bionic man' with 'posthuman,' a rather accurate, and general, description of human enhancement would be emerging. 'Better, stronger, faster,' as the cover voice utters in the opening credits of the famous television show[5], Steve Austin is equipped with technological devices that endow him with super-human abilities, or at least faculties that are above human norms. 'Rebuilt' by technology, his left eye, right arm, and both legs are technological – bionic – providing him with enhanced vision, strength, and speed. Indeed, in the famous television show that was originally broadcast on the ABC channel in the United States from 1974 to 1978, his bionic eye not only consists of a 20.2:1 zoom lens, but is also equipped with infrared technology, hence enabling him to see further away and at night, while his right arm not only contains a Geiger counter but has also the strength of a bulldozer. As for his legs, they give him the ability to run at speeds of sixty miles – namely, ninety-seven kilometres – per hour. 'Better, stronger, faster' does not come cheap however. Steve Austin's technological reconstruction and enhancement amounted to six million dollars.

The Six Million Dollar Man, its Bionic Woman spin-off, and their bionic super-human yet all too attractive white and young – i.e. stereotypically human – bodies are some of the most famous science-fictional creatures and cultural icons that populate Western imaginary surrounding the posthuman (Åsberg 2010b: 24-25). The hyper-masculine, hard bodies, of Terminator and Iron Man, as well as the ultra-muscular and over-sexualised bodies of Superman and WonderWoman are also posthuman examplars. In these representations, posthumanity – like humanity, as feminist and postcolonial scholars have forcefully demonstrated – is still embedded in and imbued with whiteness (Dyer 1997), informed by heteronormativity and able-bodiedness, and entwined with gendering, racialisation and sexualisation processes (Åsberg 2010a; Balsamo 1996; Braidotti 2002; Haraway 1991; 1997). While the import and influence of science fiction and the (Western) cultural imaginary and norms are undeniable with respect to the posthuman and posthumanism, technoscience and recent technological advances are critical in the emergence of a poshumanity and its conceptualisation as the next (Man-made) step in human evolution – 'Homo Sapiens 2.0.'

5. The voice is Richard Anderson's, the actor impersonating Oscar Goldman who, in The Six Million Dollar Man TV show, is Steve Austin's superior. Steve Austin's part has been played by actor Lee Majors in the five seasons of the ABC series broadcast in the United States from 1974 to 1978. The Six Million Dollar Man TV show is based on the 1972 novel Cyborg written by Martin Cardin and retraces the adventures of Steve Austin, a former Air Force pilot, who after almost dying in a plane crash, has become a unique intelligence agent working for the Office of Scientific Intelligence (OSI). If he is unique, it is because he has been 'rebuilt' by technology and is endowed with more-than-human abilities. The opening credits of The Six Million Dollar Man can be found on: http://www.youtube.com/watch?v=HofoK_QQxGc [last accessed on January, 20th 2013].

Human Enhancement and the NBIC Report

In this contextualisation and retracing of the roots of the phenomenon of human enhancement, assuredly The Six Million Dollar Man and the aforementioned cultural icons created, already in the 1970s and 1980s, a certain imaginary around technologically enhanced humans – posthumans. However, what really put to the fore and onto the political agenda the issue of human enhancement is the publication of the report, funded by the United States National Science Foundation and published in 2003, Converging Technology for Improving Human Performances: Nanotechnology, Biotechnology, Information Technology, and Cognitive Science. It is widely known under the name of NBIC report[6] (Roco and Bainbridge 2003). Written by scientists and engineers, experts in the fields of nanotechnology, biotechnology, information technology, and the cognitive sciences, this report advocates and calls for a renewed impulse in research and development towards the convergence of technologies that focus on the enhancement of human performance. With the convergence of nanotechnology, biotechnology, information technology, and the cognitive sciences, an impending technological revolution is announced, one that 'with proper attention to ethical issues and societal needs ... could achieve a tremendous improvement in human abilities, societal outcomes, the nation's productivity and the quality of life' (Ibid.: 1). Human enhancement, therefore, not only amounts to a technological improvement of human performance but also to a betterment of humanity. Determinisms, especially technological, abound. Indeed, as shown in table 1 below, technologies are construed as following a steady path of linear progression, one that will inevitably lead to human enhancement through NBIC convergence, and ultimately to a new step in human evolution where, with the disappearance of the boundaries between living and inert matter, the 'cells, body, and brain' will be transcended. Technologically enhanced and beyond the limit of the organism, the posthuman will be post-biological.

6. This foundational report has been followed by others, which were also funded by the US National Science Foundation. Interestingly, two directions have been taken, one led by William Sims Bainbridge and investigating NBIC Convergence, the other conducted by Mihail C. Roco and exploring human enhancement. See Roco and Montemagno 2004 and Bainbridge 2007.

Generations	Several Key Advancements (human kind, tools and technology, communication)
-m	Cell, body and brain development
- 100,000	Old Stone Age (Paleolithic), Homo Erectus, speech
-10,000	Homo Sapiens, making tools
-500	Mesolithic, creating art
-400	Neolithic, agricultural products, writing, libraries
-40	Universities
-24	Printing
-16	Renaissance in S&T, accurate clocks
-10	Industrial revolution
-5	Telephone
-4	Radio
-3	TV
-2	Computers
-1	Microbiology, Internet
0	Reaching at the building blocks of matter (nanoscience) Biotechnology products Global connection via Internet; GPS/sensors for navigation
½	Unifying science and converging technologies from the nanoscale Nanotechnology products Improving human performance advancements Global education and information infrastructure
1	Converging technology products for improving human physical and mental performance (new products and services, brain connectivity, sensory abilities, etc.) Societal and business reorganization
n	Evolution transcending human cell, body, and brain?

Table 1. 'History of some very significant augmentations to human performance: Improving our ability to collectively improve ourselves'[7] *(Roco and Bainbridge 2003: 23)*

The table's title is particularly instructive. Human evolution is not only linked to technological innovation, technological development being even construed as the motor of human evolution, but human enhancement, or the enhancement of human performances, is conceived as intrinsically generating or amounting to a qualitative and collective improvement, the betterment of humanity. From language and tools to Homo Erectus and Homo Sapiens, from Letters and clocks to the birth of Man, from the acceleration of technological development, with the industrial revolution, the radio, the telephone, the television, the computer and the Internet, to the convergence of information technologies, biotechnologies, nanotechnologies, and the cognitive sciences and the transcendence of the human: an unflustered journey towards posthumanity. History rewinds. Nano- and bio-technologies are the new Anno Domini, the new Genesis.

The report resonates with ideas promoted by the transhumanist movement[8]. The transhumanist movement brings together scientists, engineers, social scientists and philosophers who share the belief that the improvement of human (physical, intellectual, psychological) abilities is not only possible but also desirable, and even constitute a moral duty. Humans should be allowed to acquire control over their biology and to endow themselves with 'superhuman' physical and cognitive abilities. Transhumanists regard the technoscientific convergence advocated by the NBIC report as a transitional phase toward the posthuman, the technologically enhanced being that transcends and succeeds to the human. Transhumanists are fervent proponents of the posthuman.

7. This table, and its title, are a replication of table 3 of the report Converging Technologies for Improving Human Performances: Nanotechnology, Biotechnology, Information Technology, and Cognitive Science (Roco and Bainbridge 2003: 23).

8. The transhumanist movement, but especially its conceptions of the posthuman and underlying views of humans and technology will be the object of a subsequent part. As such this paragraph will limit itself to introducing, very generally, said movement insofar as traces of its visions can be found in the conclusions of the NBIC report.

2. Technologies of Enhancement / Enhancement Technologies

In the journey towards posthumanity, technologies are key. The posthuman relies upon specific technologies and their expected – at times highly speculatively – actions and applications. In order to discuss human enhancement and posthumanity, it is therefore necessary to have an adequate understanding of what these so-called 'enhancement technologies' entail.

In Mihail C. Roco and William Sims Bainbridge's foundational report – previously referred to as the NBIC report – enhancement technologies can be internal or external, temporary or permanent, cognitive or physical, or aiming at the individual or a collective (Roco and Bainbridge 2003). For instance, new agricultural products or food but also organisational changes as well as the introduction of robots, virtual worlds and wearable items are considered external – because situated outside of the body – human enhancements or improvements. New ingestible medicine is however conceived as a temporary individual internal – that is, inside the body – enhancement while new organs, genes and skills are considered a permanent internal improvement (Ibid.: 7). Brain-to-brain interaction is viewed as enhancing – 'expanding' – human cognition (and communication) whilst body replacements, physiological self-regulation, and life extension are regarded as improving human physical capabilities and health (Ibid.: 17). Individual enhancements are those that take the human body (which includes the brain) as their point of application and/or operation, such as the improvement of spatial cognition or sensorial capacities, but other enhancements are collective or soci(et)al in their goal and implementation, such as the unification of science and education, the amplification of a networked society, the direction towards sustainable and so-called "intelligent" environments, as well as the enhancements regarding national security.

Even though they are heuristically useful, these distinctions – internal/external, temporary/permanent, cognitive/physical, individual/collective – are problematic. Technological enhancements aiming at the improvement of national security, for instance, take the body of the soldier as their field of operation. Likewise, individual enhancements are collective and soci(et)al in their consequences and outcomes[9]. Furthermore, boundaries are eroding within technoscience, making the distinction between internal and external, but also temporary and permanent, difficult to sustain, especially if one recalls that technoscience is the theatre of an on-going 'technologisation' of biology and 'biologisation' of technology (Bensaude-Vincent 2009; Haraway 1991; Hayles 1999; Thacker 2003). I will come back to this aspect in the third chapter, where the 'anti-humanism' of technoscience will be discussed.

In the NBIC report, the convergence of various technological fields is central with respect to human enhancement – the 'improvement of human performances.' It is the complementarity and synergy between the fields of nano-, bio- and information technology, and the cognitive sciences[10] that creates the concept and prospect of human enhancement. Indeed, humans have a long history of undertaking enhancement practices, of attempting to increase their abilities with the use of new knowledge and techniques. As Paul Wolpe writes it,

> *[w]e send our children to school, memorize poetry, develop training programs, meditate, enrich our word power, read novels, go to therapy, try to get a good night's sleep before exams, eat 'brain food' such as fish … all actions that, to one degree or another, are intended to create environments, inner states or improved functionality that will encourage and support a desired level of neurological performance (Wolpe 2002: 391).*

Nutrition, with a diet providing vitamins and trace elements, and possibly nutritional supplements, alongside physical exercises, meditation practices, and education activities are commonly used[11] – in the wealthy Western world – to improve one's health, physical condition and cognitive abilities. However, these practices are hardly conceived as forms of human enhancement, or rather, they do not fall within human enhancement's common acceptation. The latter is technologically driven, or at least informed. 'Technology is … a game-changing field,' Patrick Lin and Fritz Allhoff maintain as they announce an impending 'human enhancement … revolution' (Lin and Alhoff 2008: 252). In fact, any consideration of human enhancement cannot dispense with technologies of enhancement.

As previously mentioned, human enhancement has originally been conceived as intimately linked to – dependent on and constituted by – the emergence, development, and convergence of certain technologies. Even though convergence, once the cornerstone of human enhancement (the latter stemming from the former), is no longer central in the reports and scholarly papers on human enhancement that have flourished after the publication of the NBIC report, nanotechnology, biotechnology, information technology, and the cognitive sciences are still pivotal. Among them, it is however pharmacology, genomics, neuromodulation, and prosthetics, respectively epitomised by the (in)famous Ritalin®, 'designer baby', deep brain stimulation, and Flex-Foot Cheetah® blades used by Paralympics champion Oscar Pistorius, that have been construed as the cardinal enhancement technologies (e.g., Allhoff et al. 2009; Bess 2008; Bostrom 2003, 2005; Coenen et al. 2009; Fukuyama 2002, 2004; Gordijn and Chadwick 2008; Habermas 2003; Savulescu 2009; van Est et al. 2008; Zonneveld et al. 2008).

(Psycho-) Pharmacology

Ritalin®, the trademarked name (by Novartis Corporation) of methylphenidate, is a psychostimulant, more precisely a norepinephrine-dopamine reuptake inhibitor that, by its action on the central nervous system's activity, increases concentration – as well as attentiveness and alertness. While generally and rather commonly prescribed for individuals suffering from attention deficit-hyperactivity disorder (ADHD) to regulate their (attention and concentration) deficit, Ritalin® is also more and more used by healthy adults and university students in order to focus and perform 'better' during exams or in writing papers (Lin and Alhoff 2008: 253). Alongside Prozac®, the trademarked name (by Eli Lilly Company) of fluoxetine, a selective serotonin reuptake inhibitor (SSRI) that is widely used as anti-depressant or 'mood elevator,' and Provigil®, the trademarked name (by Teva Pharmaceutical Industries) of modafinil, a eugeroic drug widely used as a 'wakefulness promoting agent,' Ritalin® is one of the (psycho-) pharmacological agents that count as cognitive enhancers.

9. With respect to national security, it can be remarked that the nation, its borders and its members rely upon a principle of exclusive inclusion. The national security of some is the collective threat of others. Biopolitics are at the heart of the nation, and national security. See Agamben 1999; Butler 2004; Foucault 1997 and 2009; Esposito 2008; Mbembe 2003.

10. The complementarity between the four fields is also understood as a certain division of labour, as expressed in this quote from W.A. Wallace, one of the participants in the workshops organised by the United States' National Science Foundation (NSF) previous to the NBIC report, '[i]f the Cognitive Scientists can think it, the Nano people can build it, the Bio people can implement it, and the IT people can monitor and control it' (Roco and Bainbridge 2003: 13, emphasis in the original).

11. With the advent of personalised medicine, these activities are even more and more encouraged, as they become part of monitoring practices for a healthy, or 'biological', citizenship. See Rose 2001; 2007.

Insofar as they '[alter] a brain state or mood,' psycho-pharmacological agents are generally distinguished from other pharmacological agents, which rather '[alter a] bodily form or function,' as in Paul Miller and James Wilsdon's rather comprehensive classification of enhancement technologies (Miller and Wilsdon 2006: 16-17). As such, growth hormone, that enables to enhance one's height, figures in this category alongside erythropoietin, that is widely known as EPO in the cycling world and boosts one's athletic performance by increasing the rate production of red blood cells, as well as steroids that build up muscle mass, and Viagra®, the trademarked name (by Pfizer) of sildenafil citrate that enhances penis erection.

As beta-blockers exemplify however, the distinction between pharmacological and psycho-pharmacological agents is rather fluid. Initially used for the regulation of cardiac arrhythmias and blood pressure, beta-blockers are increasingly ingested by performers (in the arts, sports, but also universities) to reduce anxiety and nervousness, ergo enabling a better concentration and performance, both cognitively and physically (e.g., Elliott 2008; Tindall 2004). In fact, to a certain extent, every enhancement technology comprises of both cognitive and physical elements.

Genetic Technologies

In their classification of enhancement technologies, besides psycho-pharmacological and other pharmacological agents, Miller and Wildson (2006) cite pre-implantation genetic diagnosis (PGD) and gene therapy, cybernetics and neural implants, nanotechnology, regenerative medicine, and finally cosmetic surgery as the main types of enhancement technologies. Pre-implantation genetic diagnosis (PGD) and gene therapy – and more generally the technologies stemming from the field of genomics – with the designer baby as their herald are the enhancement technologies that have triggered the most controversies (e.g., Fukuyama 2002; Habermas 2003; Kass 2003; and more fundamentally the debate and deadlock between bioconservatives and transhumanists). With PGD enabling the selection of embryos for or against certain genetic traits, such as cystic fibrosis, Down syndrome, and Huntington's disease, the prospect of the designer baby – soon followed by the saviour, cosmetic, and disability babies[12] – has arisen, together with the spectre of eugenics (Bess 2008; Bradshaw and Ter Meulen 2010; Hogle 2005; Koch 2010). With respect to gene therapy, somatic therapy is generally demarcated from germ line therapy: in the former case, the genetic modification is limited to the individual, while in the latter case, it is passed on to the individual's offspring. Insofar as the alteration of one's genetic make-up is then inheritable, germ line therapy – or, at least, the prospect thereof –– is the most controversial type of gene therapies (e.g., Fukuyama 2002).

12. The expression 'cosmetic babies' is used to emphasise the (solely) cosmetic considerations that might inform the choice of prospective parents in selecting certain genetic traits for their unborn child. In this respect, the expression is similar to the term 'designer babies.' 'Saviour babies' designates children who are conceived and born in order to provide an organ or cell transplant to a sibling suffering from a fatal disease. Adam Nash, born in 2000 in Colorado (USA), is the first so-called 'saviour baby.' He was conceived using in-vitro fertilisation (IVF) with pre-implantation genetic diagnosis to save his sister Molly who suffered from Fanconi anaemia, a fatal genetic disease that often leads to leukaemia. As for the denomination 'disability babies,' it refers to embryos that have been 'chosen for a specific, monogenetic characteristic that in daily life is perceived as an undesirable deviation by most people, such as deafness or dwarfism' (Coenen et al. 2009: 75). The first putative 'disability baby' is Gauvin Duchesneau-McCullough who is born deaf in 2001 in Washigton DC (USA). Gauvin was conceived through artificial insemination using the donated sperm of a deaf friend of his mothers.

Cybernetic technologies

Cybernetics, understood as the 'alteration of mental or physical function by embedding engineering or electronic systems within the body,' is also cited by Miller and Wilsdon (2006: 17) as a type of enhancement technology. The research on human-computer interactions[13] led by Kevin Warwick at Reading University, United Kingdom, is given by the authors as an example of cybernetic technologies. In the Cyborg 1.0 project conducted in 1998, a silicon chip transponder (or Radio Frequency Identification, RFID) was implanted in Warwick's forearm. As the chip emitted a unique signal, doors would open and lights would switch as they detected Warwick's presence. The Cyborg 2.0 project started on the 14th of March 2002 when Warwick's left arm was surgically implanted with a micro-electrode array consisting of a hundred electrodes. The implant 'could send signals back and forth between Warwick's nervous system and a computer'[14]. As a consequence, the neural interface enabled him to operate, at a distance, an electric wheelchair as well as an artificial hand. (Neural) implants and neuromodulation in general are also included in this category. As stated by the International Neuromodulation Society, neuromodulation consists of 'implantable as well as non-implantable devices that deliver electrical, chemical or other agents to reversibly modify brain and nerve cell activity'[15]. As previously mentioned, deep brain stimulation (DBS), or the electrical stimulation of parts of the brain, has become its archetype. First resorted to in the case of individuals suffering from Parkinson's disease to reduce tremor, DBS has become used to manage chronic pain, but also obsessive-compulsive disorder (OCD) and cases of major depression, auguring broader applications – and the promise, feared or celebrated, of enhancement (Ranson 2012). Among these so-called cybernetic technologies, prosthetic limbs, which are seen as '[having] improved to such a degree that they are already enabling greater than normal strength and capabilities to those that use them, sparking a debate on whether athletes with those artificial limbs may participate in the Olympics'[16] (Allhoff et al. 2009: 11), join exoskeletons and new generations of contact lenses that have built-in electronic circuits and light-emitting diodes (e.g., Parviz 2009) in their promise to enhance humans.

Nanotechnology

Nanotechnology is another enhancement technology in Miller and Wilsdon's classification (Miller and Wilsdon 2006). Nanotechnology consists of the understanding and manipulation of matter at the nano-scale, that is, at a scale of one billionth – 10-9 – of a meter. At such a scale, molecules, as well as atoms, can be handled and controlled. As the title of Bernadette Bensaude-Vincent's book indicates,

13. Kevin Warwick's research is accessible on http://www.kevinwarwick.com/. See also Warwick's 2004 I, Cyborg.
14. Source: http://www.kevinwarwick.com/Cyborg1.htm [last accessed on January 20th 2013].
15. Source: http://www.neuromodulation.com/ [last accessed on January 20th 2013].
16. This particularly concerns the controversy over the participation of Oscar Pistorius in the 2008 Summer Olympic Games in Beijing. Pistorius, who has had both legs amputated below the knee when he was eleven months old and who has been nicknamed the "Blade Runner" as well as "the fastest man on no legs" [sic] was accused of techno-doping in 2008 insofar as his prosthetic J-shaped legs – the Cheetah® Flex-Foot – manufactured by Icelandic company Össur were seen as giving him an unfair advantage over able-bodied runners. In fact, in 2007, the International Association of Athletics Federations (IAAF) ruled Pistorius ineligible for the 2008 Summer Olympics. This decision was however reversed by the Court of Arbitration for Sport in May 2008. Despite being then eligible to compete for the 2008 Summer Olympic in Beijing, Pistorius did not qualify for the South African Team. Nevertheless, he won gold medals for the 100m, 200m, and 400m sprints during the 2008 Summer Paralympics Games.

nanotechnology enables to 'shape the world atom by atom' (Bensaude-Vincent 2009, my translation), which has prompted promises and expectations about being capable of reshaping and remaking the human body at the molecular level, of endlessly curing and repairing any illness and affliction of the body. While nanotechnology is currently particularly promising as a screening and diagnostic tool with e.g. the 'Nanopil' and other labs-on-a-chip (Lucivero 2012), it takes on a much more militarised attire in the context of human enhancement with Miller and Wilsdon referring to nanodevices able to destroy tumours or reconstruct cell walls. This nanotechnological form of human enhancement, together with regenerative medicine, contribute to the broader field of radical life extension – categorised as another type of enhancement technologies.

Regenerative medicine

As it endeavours to replace, repair and regenerate damaged tissues and organs (Badylak and Nerem 2010; Berthiaume, Maguire and Yarmush 2011), regenerative medicine, along with tissue engineering and stem cell research, holds considerable promises in terms of human enhancement. While technologically engineered tissues and organs constitute a welcome substitute to (the shortage of) organ transplants[17], regenerative medicine also has the potential to bring about new therapies and cures for yet incurable conditions. As Stephen F. Badylak and Robert M. Nerem state it, 'the creation of insulin-secreting, glucose-responsive cells for the treatment of diabetes, the constructive functional remodelling of the heart after a myocardial infarction, and the regeneration of nerves after spinal cord injury all represent realistic targets for regenerative medicine' (Badylak and Nerem 2010: 3285). The regenerative capacities of the salamander and newt are powerful inspirations for the field in its attempt to stimulate the body's regenerative potential, an enterprise that gives rise to the prospect of anti-aging medicine, a (radically) extended lifespan, and even rejuvenation (Allhoff et al. 2009: 12; Lafontaine 2009: 62).

Cosmetic surgery

Regenerative medicine, and more particularly tissue engineering, also gets intertwined with the last, but not least, enhancement technology of Miller and Wilsdon's classification (2006). Cosmetic surgery[18], a rather common practice and very lucrative business[19], counts as enhancement technology insofar as it permits to change and enhance one's physical appearance, whether it consists of augmenting or reducing the size of one's breasts, tights, arms and belly (generally for women) or the size of one's pectoral muscles and penises (for men, generally). The alteration of one's nose, chin and eyelids, as well as the reduction of the signs of ageing with a face-lift or the injection of Botox are also rather typical cosmetic interventions. In 2012, for instance, while breast implants was the leading intervention worldwide (and especially in the United States of America and Europe), rhinoplasty was the chief cosmetic intervention in China, Japan, and South Korea (Bohineust 2013). The field of cosmetic surgery is also getting intertwined with that of tissue engineering, with the latter promising enhanced, but 'natural,' breasts (see Begley 2010).

Conclusion

These technologies are all conceived as holding the promise to radically alter and improve physical and cognitive abilities. Because of their perceived human enhancement potential, they have been conceived as opening the prospect of a 'posthuman future,' as Francis Fukuyama (2003) phrased it. In this view, posthumanity is to be composed of (post)humans who not only defy ageing but whose abilities considerably surpass those of 'current' human beings. Humans are to become posthumans, technologically enhanced individuals, who might eventually constitute a different species. Transhumanists, as previously mentioned, extol the posthuman and celebrate the emergence of a posthumanity. Whether or not posthumanity will materialise however, it seems that these technologies – with their enhancement potential – are bringing us to the limits of humanity and engendering new challenges (Verbeek 2009).

17. The field of regenerative medicine has also incorporated innovative technologies stemming from other fields. On the 4th of February 2013, the development by Dr Will Shu and his colleagues at Heriot-Watt's Biomedical Microengineering group (Scotland) of a 3D printer using stem cells that could (eventually) build organs was publicised. See: http://www.hw.ac.uk/news-events/news/printed-human-organs-testing-transplantation-11075.htm[Retrieved on February 12th, 2013].

18. Following Linda Hogle (2005: 704), by cosmetic surgery, I refer to elective rather than reconstructive plastic surgery, the latter being 'performed to correct congenital abnormalities or damage from an injury' while the former is not 'performed ... as treatment of illness.' This distinction echoes that which is drawn between therapy and enhancement in the human enhancement debate – I will come back to this question in the next chapter.

19. As reported by Armelle Bohineust (2013), in 2012, the global market for cosmetic surgery and less invasive treatments (Botox injections, laser, etc.), so-called 'medical aesthetics,' was valued at 4.4 billion euros, which marked a 10% increase compared to 2011. A similar trend is expected until 2017 by the IMCAS, the international congress of the cosmetic industry. The growth is however not homogeneous worldwide: due to the economic crisis experienced by the European Union, it has been of 6.6% in 2012 in Europe. By 2017, it is expected that Asia, with a steady growth of 14% per year in cosmetic interventions, will supplant the old continent, which is then to represent less than a quarter of the global market of cosmetic surgery. The United States of America (USA) are expected to keep a growth similar to that of the global market. The country shall still count for nearly half of the total amount of cosmetic interventions in 2017. Both in Europe and the USA, the share of people over 50 years old who have recourse to elective cosmetic surgery has increased by 28 to 36 % from 2005 to 2011. Breast implants, however, had a 9.2 % decline in Europe in 2012, and their worldwide progression is expected to be of no further than 5 %. Yet, breast augmentation, together with liposuction, is still the leading cosmetic surgical intervention (worldwide, as well as in Europe). According to the International Society of Aesthetic Plastic Surgeons, in 2011, the USA were the biggest market for cosmetic surgery with 3.1 million procedures that year. They were followed by Brazil (1.45 million procedures) and China (1.05 million procedures). Nevertheless, in proportion with the amount of inhabitants, South Korea, Greece and Italy are the main consumers of cosmetic surgery, ahead of the USA, while Russia, China and India – despite the increasing popularity of cosmetic surgery in India – are at the bottom of the list. Finally, if breast implants and liposuction are the leading interventions worldwide, rhinoplasty is the chief cosmetic intervention in China, Japan, and South Korea. Source: Bohineust 2013.

3. At the Limits of Humanity, The Transhumanist-Bioconversative Deadlock

In face of the enhancement potential of technologies and technological fields, Friedrich Nietzsche's Übermensch, Mary Shelley's Frankenstein, and Prometheus find awakening, while references to Aldous Huxley's Brave New World, Man's hubris and Gods' anger and thunder are revived. Ingrained in Western cultural symbolism and imaginary, these figures and images act as boundary markers. Mobilised to draw attention to the issues that arise at the limits of humanity, they point to the dangers of pursuing the enhancement potential of technologies and of venturing beyond "the human." That is, to over(t)ly caricature one bioconservative opus, Francis Fukuyama's Our Posthuman Future, designer babies meet Friedrich Nietzsche's Übermensch alongside nineteenth-century eugenics in Aldous Huxley's Brave New World where genetic engineering tends to subsume the whole biotechnological field. Theses built on mixtures of present-day technoscience, fictional science and science fiction are however neither Francis Fukuyama's (2003; 2004) nor the so-called bioconservatives' exclusive preserve[20] (i.e., Francis Fukuyama, Leon Kass, Jürgen Habermas, Michael Sandel, Jeremy Rifkin, Bill McKibben). Transhumanists have also made of projections and conjectures with regard to the direction and potential enhancement outcomes of technoscientific researches their main selling argument. As such, professor of robotics Hans Moravec's (1988) vision of human consciousness that, uploaded into advanced electronic hardwares, would transcend the limits of human biology meets biomedical gerontologist Aubrey de Grey's (2007) dream of extended, and even infinite, lifespan. In fact, a post-biological existence – i.e., no longer tied to and constrained by the life of the human organism – is an aspiration shared, albeit to varying degrees, by transhumanists, be they Hans Moravec, Aubrey de Grey, Ray Kurzweil, Max More, Natasha Vita-More, Anders Sandberg, Nick Bostrom, James Hughes, Andy Miah or Julian Savulescu.

As said in the introduction, two dominant views have developed with respect to human enhancement. One is utopian and advocated by transhumanists, while the other is dystopian and upheld by bioconservatives, and they oppose each other vis-à-vis the denouement and desirability of a posthuman future. Crystallised into the transhumanist-bioconservative polarity, the debate on human enhancement has reached a deadlock. Behind their opposition on issues of safety and risks, justice and equity, freedom and coercion, as well as on the distinction between therapy and enhancement – aspects that shall be tackled in chapter two – it is the question of human nature, hence of the morally and politically acceptable human future, that has particularly polarised transhumanists and bioconservatives. Whereas a posthuman condition amounts to dehumanisation for bioconservatives, it constitutes the fulfilment of humans' quintessence for transhumanists. In any case, it is indicative of both their conceptions of what a human being is and should be; and paradoxically, transhumanists and bioconservatives meet in their views of what and who counts as human.

I shall therefore introduce both the bioconservative and the transhumanist views. While both groups comprise certain heterogeneity of viewpoints, this is even more accurate for bioconservatism insofar as it is not an established movement like transhumanism but a rather loose constellation of scholars. While I will open with the transhumanist movement and close with bioconservatives, I will draw the attention towards their respective conceptions of technology and claims with respect to human nature, which are conflicting, as well as towards their common defence of the modern liberal humanist subject as the one true human and posthuman – a rather conservative and exclusive conception of the human and ultimately an anthropologically flawed understanding of human-technology relations.

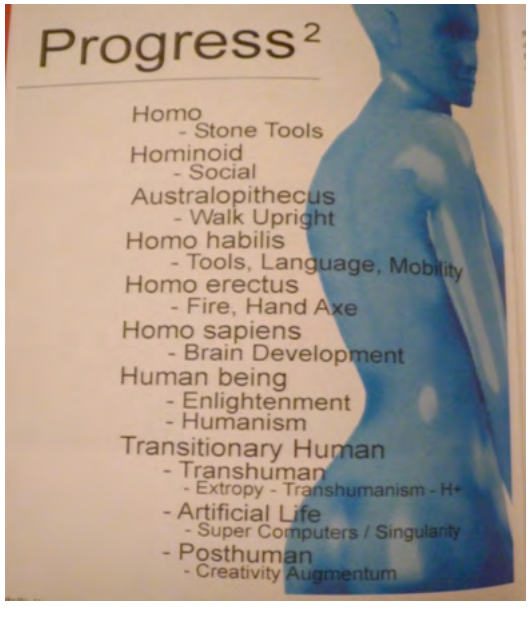
20. Assuredly, the construction of scenarios, however fantastic, prophetic, utopian, dystopian, or realistic and grounded they might be, can constitute an appropriate way to attend to contemporary technoscience in general and enhancement technologies in particular (e.g. Boenink et al. 2010; Stemerding et al. 2010; Lucivero 2012). Beside future studies in which such method has become pivotal, Donna Haraway has proposed that 'SF – science fiction, speculative futures, science fantasy, speculative fiction – is an especially apt sign under which to conduct an inquiry into the artifactual as a reproductive technology that might issue in something other than the sacred image of the same, something inappropriate, unfitting, and so, maybe, inappropriated' (Haraway 2004: 70). That Haraway would concur with the diverse diegeses advanced by both bioconservatives and transhumanists is nevertheless doubtful. The kind of SF – in its different variations – referred to by the feminist technoscience studies scholar operates on a diffractive mode, that is, on a mode informed by optics of difference and interference. As a means for opening and exploring new worlds and possible configurations – an 'elsewhere' – SF does not mirror and transpose present-day situations, arrangements and issues into a future horizon which thereby becomes nothing but a repetition, albeit a (technoscientifically) altered copy, of the same, the here and the now, hence merely projecting an illusion of change and novelty while actually reinstating, reinforcing, even fossilising and naturalising contemporary, namely contextual, circumstances and its share of quandaries. In fact, as Haraway explains, 'diffraction does not produce "the same" displaced, as reflection and refraction do. Diffraction is a mapping of interference, not of replication, reflection, or reproduction' (Ibid.: 70). When discussing contemporary technoscience in general and biotechnology in particular – as well as their projected development and societal implications – these differences matter. These differences matter all the more when it is 'human nature' that constitutes the main bone of contention between bioconservatives and transhumanists.

3.1 Transhumanism and Human Enhancement: Towards the PosthuMan

Transhumanism is an international movement that brings together scientists, engineers, social scientists, and philosophers who celebrate and advocate the enhancement and improvement of human abilities and condition by means of new and emerging technologies. In the words of Nick Bostrom, one of transhumanism's leading lights and co-founder of the World Transhumanist Association (WTA, recently renamed H+ or Humanity +, which currently counts more than 6.000 members), transhumanism is

> *(1) The intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate aging and to greatly enhance human intellectual, physical, and psychological capacities. (2) The study of the ramifications, promises, and potential dangers of technologies that will enable us to overcome fundamental human limitations, and the related study of the ethical matters involved in developing and using such technologies21 (Bostrom 2003: 4).*[21]

Transhumanists are fervent proponents of the posthuman, the technologically enhanced (human) being that not only succeeds to the human but also transcends the human and its limits – towards, possibly a post-biological condition. Therefore, we are currently in a transitional phase towards posthumanity. Transcendence and transition inform transhumanism.



Transhuman, Progress 2 (Vita-More, in Gevers 2009: 218)

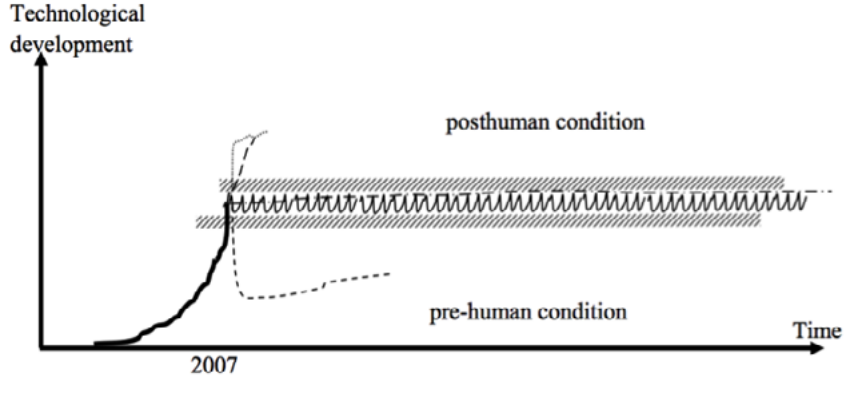
21. Nick Bostrom's definition was written for the version 2.1 of the Transhumanist Frequently Asked Questions (FAQ). It is still the sanctioned one in the latest Transhumanist FAQ 3.1. See 'What is transhumanism?' in http://humanityplus.org/philosophy/transhumanist-faq/ [last accessed February, 7th 2013].

Technology and the Inevitability of Posthumanity

Technology is key in transhumanist accounts. Resonating with the NBIC report, technology is conceived as the motor of human evolution and condition: technological innovation is human evolution, of which the posthuman is the ultimate and necessary outcome (Thacker 2003). As such, from the erection of Man with stone tools, to its increasing mobility and literacy, and the liberation of cognition and creativity from the limits of biology, 'progress' in transhumanist artist Natasha Vita-More's depiction follows an unruffled and linear path. For transhumanists, in fact, posthumanity is unavoidable, necessary. In Bostrom's four scenarios concerning the future of humanity for instance, posthumanity is an ineluctable outcome – all the more so, when its most likely competitor is extinction (Bostrom 2009). While he rejects the notion of progress, Bostrom still upholds a conception of technology that amounts to a cumulative, accelerating, and guiding process, one that even seems infinite. Rhetoric overflows.

> It may be tempting to refer to the expansion of technological capacities as "progress." But this term has evaluative connotations. ... It is preferable ... to use a more neutral term such as "technological development," to denote the historical trend of accumulating technological capability. Technological development has provided human history with a kind of directionality. Instrumentally useful information has tended to accumulate from generation to generation, so that each new generation has begun from a different and technologically more advanced starting point than its predecessor (Bostrom 2009: 6).

In this context of ever increasing and accelerating technological development, it is assumed that technology, construed as applied reason or instrumentally useful information, is the pivotal element in and for humanity's future. Furthermore, '[i]f scientific and technological development efforts do not effectively cease, then all important basic capabilities that could be obtained through some possible technology will be obtained,' Bostrom argues while naming his self-fulfilling prophecy 'Technological Completion Conjecture' (Ibid.: 5). He devises four ensuing scenarios for the future of humanity, namely recurrent collapse, plateau, extinction, and posthumanity. However, the first two are discarded for their low probability insofar as the reality and necessity of technological development would circumvent the stasis inherent in plateau while force the oscillation trajectory of recurrent collapse to resolve into either extinction or posthumanity (Ibid.: 12-19).



The pre-human, human and post-human conditions: On the inevitability of posthumanity (Bostrom 2009: 25)[22]

22. On the inevitability of posthumanity, the following comment accompanies Bostrom's diagram: '[n]ote how the scenarios that postulate that the human condition will continue to hold indefinitely begin to look increasingly

In this eschatological framework that flirts with catastrophism[23], posthumanity is the only viable and liveable option, a vital resolution. It is a blackmail wherein technological determinism gives way to 'rampant super-voluntarism' (Terranova 1996[24], quoted in Sharon 2011: 46). Indeed, even though technologies are the driving force behind human evolution, the direction of the latter is neither left to chance nor to technological determinism. Rather, technologies are to fulfil the transhumanists' utopian vision of posthumanity.

The Posthuman, between Transcendence and Super-Voluntarism

As defined in the Transhumanist Declaration, posthumans are:

possible future beings whose basic capacities so radically exceed those of present humans as to be no longer unambiguously human by our current standards. The standard word for such beings is "posthuman." ... Many transhumanists wish to follow life paths which would, sooner or later, require growing into poshuman persons: they yearn to reach intellectual heights as far above any current human genius as humans are above other primates; to be resistant to disease and impervious to aging; to have unlimited youth and vigor; to exercise control over their own desires, moods, and mental states; to be able to avoid feeling tired, hateful, or irritated about petty things; to have an increased capacity for pleasure, love, artistic appreciation, and serenity; to experience novel states of consciousness that current human brains cannot access[25].

Making individuals that are physically and cognitively stronger and faster, ageless and in control of themselves, thus ultimately better, will bring humanity to a new, and superior, stage of evolution. In fact, as technologies have historically been part of the human condition, constitution and evolution, having recourse to technologies of/for enhancement and towards the realisation of the posthuman is a logical, even natural, step for transhumanists (Bostrom 2009; Vita-More 2009). More precisely, with the growing momentum and availability of enhancement technologies, evolution turns into design. In the words of transhumanist sympathiser Gregory Stock, for instance,

[l]ife, having evolved a being that internalized the process of natural selection, has finally transcended that process. ... Through Metaman, trial and error are giving way to conscious design. Thus, the future will be ever more directed by the present (Stock 1993: 215[26]*, quoted in Ansell-Pearson 1997: 32).*

If evolution is to be technologically driven, humans remain in charge of the direction and destination, namely, the linear and ameliorative road from humans, to transhumans, to posthumans. This apparently natural path is not without demanding its set of constructions and artifices however.

The transhumanist conception of human enhancement engendering a flawless and perfected humanity – a posthumanity – is underpinned by 'a mechanistic individualistic ethos,' as Tom Koch phrases it (Koch 2010: 694). That is, in line with a Lamarckian conception of evolution, it is assumed that changing the characteristics of individuals will eventually and ultimately transform the species. In this respect, while enhancement bioethicist[27] John Harris makes a case for Enhancing Evolution (2007), transhumanists Julian Savulescu and Anders Sandberg consider that '[e]volutionary theory predicts that genes promoting psychosocial and physiological traits that lead to a greater number of successful offspring will become more common over time' (Savulescu and Sandberg 2008: 33[28], quoted in Koch 2010: 691). In fact, this account is informed by and conveys a mechanistic, reductionist, and individualistic understanding of (human) evolution: individual characteristics are conceived as being directly, and mechanistically, correlated to beneficial outcomes at the level of the species. In other words, while it is supposed that (un)desirable traits can be identified and selected, human evolution, thereby consisting of an aggregate of (these) individual traits, is construed as linear and directed towards constant improvement[29]. As Tiziana Terranova explains it,

[b]elievers in posthumanism are not so much saying "we are what genes are" but "we are what we want to be," and "thanks to technology, there are no limits to what we can be." In this triumph of the will society is erased, and the social universe emerges as a fragmented aggregate of individuals in a void without historical and material constraints (Terranova 1996: 174[30]*, quoted in Sharon 2011: 46).*

In the transhumanist acceptation, as human enhancement is naturalised, evolution amounts to a hierarchical linearism wherein post/humans occupy the central and superior position, a conception that is unpleasantly and dangerously, to say the least, reminiscent of Ernst Haeckel's oppressive colonial and racist, anthropocentric and Eurocentric, tree model with each upper branch or evolutionary step being construed and constructed as a qualitative improvement (Ansell-Pearson 1997: 132; see below).

peculiar as we adjust the scales to reveal more of the larger picture' (Bostrom 2009: 25). With extinction being the alternative to posthumanity, the latter constitutes the only viable option for humanity. Posthumanity is a necessity.

23. In this respect, it is interesting to note that the assessment and evaluation of the risks brought about by new and emerging technologies is an integral part of the transhumanist platform. Articles 3, 4, and 5 of the Transhumanist Declaration explicitly focus on technological and, in connection to Bostrom's extinction scenario, existential risks: '(3) We recognize that humanity faces serious risks, especially from the misuse of new technologies... (4) Research effort needs to be invested into understanding these prospects. We need to carefully deliberate how best to reduce risks and expedite beneficial applications... (5) Reduction of existential risks, and development of means for the preservation of life and health, the alleviation of grave suffering, and the improvement of human foresight and wisdom should be pursued as urgent priorities, and heavily funded' (Transhumanist Declaration: http://humanityplus.org/philosophy/transhumanist-declaration/ [last accessed on February 7th, 2013]). Research of existential and global risks, as well as a focus on probability, is part of Bostrom's work for instance (see http://www.nickbostrom.com), while the Future of Humanity Institute, the transhumanist think tank located at the University of Oxford and led by the same Bostrom has for stated mission to '[use] the tools of mathematics, philosophy, and science [to] explore the risks and opportunities that will arise from technological change, weigh ethical dilemmas, and evaluate global priorities. Our goal is to clarify the choices that will shape humanity's long-term future' (http://www.fhi.ox.ac.uk/home [last accessed February 7th, 2013]). 'Global catastrophic risks' is one of the institute's research axes, alongside 'human enhancement,' 'applied epistemology and rationality,' and 'future technologies.' Devising scientific and probabilistic tools as well as methodologies are crucial for the transhumanists who emphasise the importance of rationality. For an account of the significance conferred to rationality by transhumanists and how it is used to differentiate them from bioconservatives and their putative irrational, emotional arguments and gut reactions, see Sharon 2011: 176-180.

24. Terranova, Tiziana. 1996. 'Posthuman Unbounded: Artificial Evolution and High-Tech Subcultures.' In George Robertson; Melinda Mash; Lisa Tickner; Barry Curtis and Tim Putnam. Eds. FutureNatural: Nature, Science, Culture. London and New York: Routledge: 165-180.

25. Source: 'What is a posthuman?' in http://humanityplus.org/philosophy/transhumanist-faq/ [last accessed February 7th, 2013]

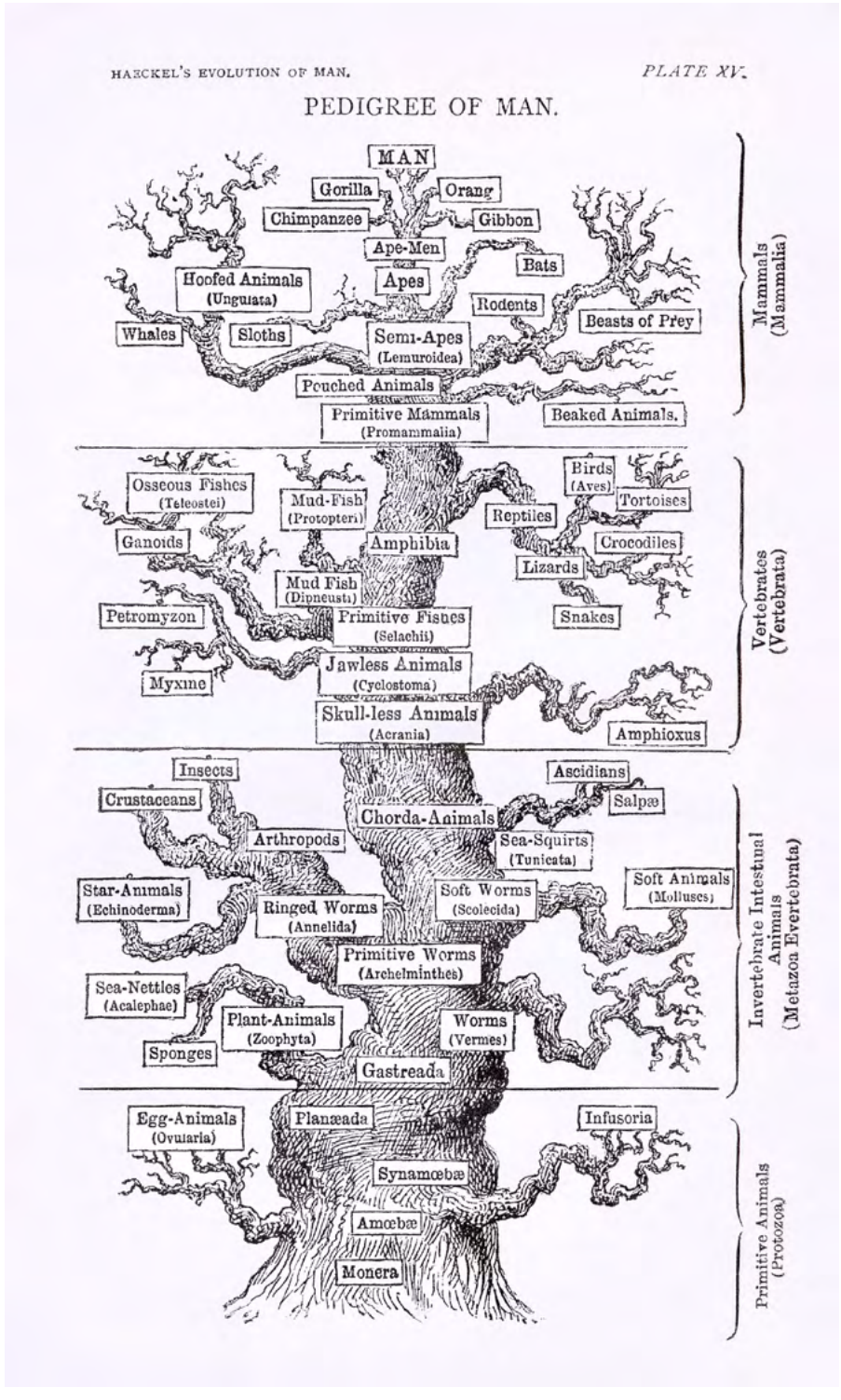
26. Stock, Gregory. 1993. Metaman: The Merging of Humans and Machines into a Global Superorganism. New York: Simon and Schuster Publishing

27. I borrow the formula 'enhancement bioethicist' from Tom Koch (2010). It designates (bio) ethicists who are proponents of human enhancement yet do not consider themselves to be transhumanits or identify publicly with transhumanism.

28. Savulescu, Julian and Anders Sandberg. 2008. 'Neuroenhancement of Love and Marriage: the Chemicals Between Us.' In Neuroethics 1(1): 31-44

29. As I will explain later, it is such a conception that has had some scholars drawing attention to human enhancement being reminiscent of twentieth-century eugenics.

30. Terranova, Tiziana. 1996. 'Posthuman Unbounded: Artificial Evolution and High-Tech Subcultures.' In George Robertson; Melinda Mash; Lisa Tickner; Barry Curtis and Tim Putnam. Eds. FutureNatural: Nature, Science, Culture. London and New York: Routledge: 165-180.



Ernst Haeckel's 1879 'Pedigree of Man'[31]

31. http://commons.wikimedia.org/wiki/File:Tree_of_life_by_Haeckel_cleanup_2.png [Retrieved on January, 2nd 2014].

The PosthuMan or the Observance of the Modern Liberal Humanist Subject

Key too in the transhumanist formulation and celebration of the posthuman and posthumanity is a specific understanding of the human and technology. Indeed, despite the undertones of change, transformation, and rupture that inhabit the prefix 'post,' the posthuman of transhumanism is nothing but the repetition of the 'sacred image of the same' to borrow Donna Haraway's words (2004: 70). More precisely, as I will address, with enhancement technologies conceived as mere instruments, it is Man – the modern liberal humanist conception of the human – who in the guise of the posthuman – or shall I say posthuMan? – is to remain the measure of all things in technologically enhanced posthumanity. That is, as Tamar Sharon encapsulates it,

[i]n the framework of liberal posthumanism, posthumanism does not indicate a break from classical or liberal humanism, but an extension of humanist ideals into a posthuman era. … The "post-" of liberal posthumanism refers to a rupture that takes place within the biological conception of the human – it is specifically posthuman, all the while it retains a humanist narrative of the human (Sharon 2011: 43; 47).

In fact, transhumanism is both ingrained in the Enlightenment's view of science and technology as the factors of progress and at the service of Modern humanist valuation of reason, autonomy, self-determination, and individual freedom as the true qualities of the huMan (Hughes 2010; Sharon 2011; Thacker 2003).

Like humanists, transhumanists favor reason, progress, and values centered on our well being rather than on external religious authority. Transhumanists take humanism further by challenging human limits by means of science and technology combined with critical and creative thinking. We challenge the inevitability of ageing and death, and we seek continuing enhancements to our intellectual abilities, our physical capacities, and our emotional development. We see humanity as a transitory stage in the evolutionary development of intelligence. We advocate using science to accelerate our move from human to transhuman or posthuman condition (More 1998, paragraph 4)[32]

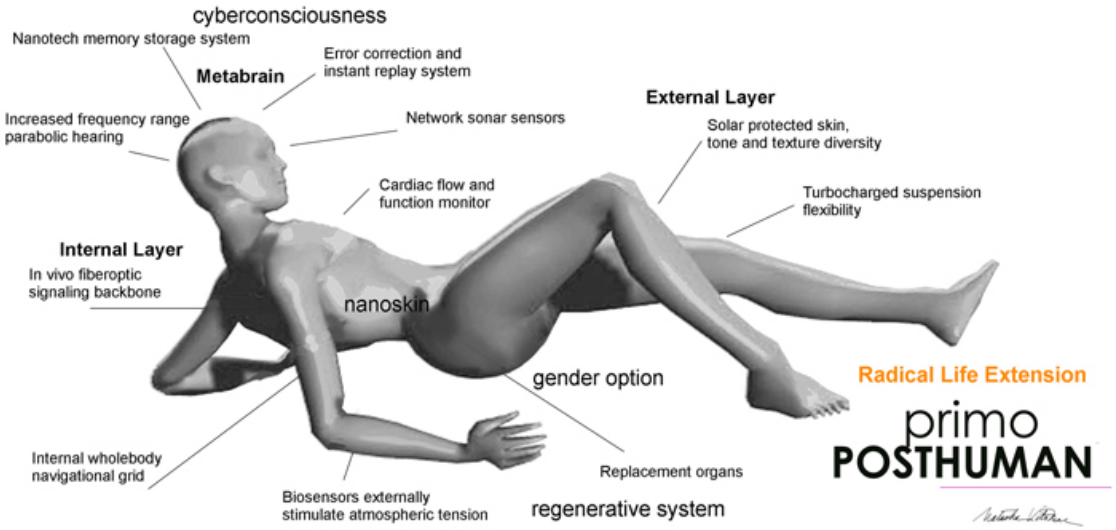
Max More's 'Transhumanist Declaration' is not only a eulogy of the Englightenment and humanism, but also the proclamation of transhumanism as both their legitimate heir and upgraded – or shall I say enhanced – version.

The technological enhancement of the human towards the posthuman is conceived as the fulfilment of human nature, the latter being regarded as dynamic insofar as it is in human nature to (rationally) strive for self-improvement and progress. Indeed, as Nick Bostrom phrases it, 'human nature … is dynamic, partially human-made, and improvable' (Bostrom 2005: 613). Paradoxically, however, while the human is enhanced – improved and perfected – to become the posthuman, it remains identical to itself, i.e. the post/huMan (Thacker 2003: 75). Transhumanism's allegiance to a liberal humanist conception of the human and technology is, as I will describe, the necessary sleight of hand.

32. Source: 'The Extropian Principles, Version 3.0: A Transhumanist Declaration.' In http://www.maxmore.com/extprn3.htm [last accessed on May, 12th 2013].

The Hygenic/ist Body of the PosthuMan

The liberal humanist conception of the human – the human as the disembodied, self-contained and autonomous individual who is free to reason, produce true knowledge and act in and onto the world, of which it is part albeit in a separate yet exceptional position especially as it uses technology to master it – already transpired in the previously introduced anthropocentric and individualistic ethos that informs the transhumanist conception of (human) evolution and its insistence on the individual and voluntary aspect of human enhancement, the latter amounting to the realisation of individuality (Sharon 2011: 44-45). It is however in the transhumanist conception of the body – the technologically enhanced posthuman body – that the extent to which transhumanist views on the human, technology, and their relations are informed by a modern liberal humanist worldview singularly materialise.



Future Body: Primo Posthuman (Vita-More 2006)[33]

Even though it is a specific visual rendition of the posthuman, and one that is not as notorious as Hans Moravec's vision of consciousness uploaded into advanced electronic hardwares, Natasha Vita-More's Primo Posthuman (2006) displays several characteristics which makes it typical of transhumanist conceptions of the (technologically enhanced) human. As rendered visible in this depiction, the compartmentalisation of the bodily sensorium and the general segmentation and ordering, of the body, both paradigmatic of the Modern(ist) project, are amplified. Indeed, as Caroline A. Jones argues, '[m]odernist self-fashioning was based on an atomization of the senses that would necessarily need reintegration into a "system" that was the self' (Jones 2006: 40). Similarly, the Primo Posthuman's body is entirely defined by its atomised yet newly aggregated upgraded functions and functionalities and enhanced senses and sensors (e.g., between others, 'turbocharged suspension flexibility,' 'error correction and instant replay system,' as well as 'in vivo fiberoptic signalling backbone,'

33. Source: http://www.natasha.cc/primo.htm [last accessed May, 12th 2013].

and 'network sonar sensors'). This sleek, un-fleshed and un-leaky body with sharp and well-defined edges and borders does not just build upon and echo the Modern hygienic and hygienist body (Jones 2006: 43) – which historically cannot be but male and white[34] (the huMan body of Modernity) or genderless and bleached (the poshuMan body of trans-/post-humanity) – but takes it and its decorporealisation to new heights.

Implicitly reinstating and consecrating the all too famous mind-body dualism – i.e. the dichotomous conception of mind and body with the mind as the seat of the self and the correlate disavowal and deprecation the body as inert, passive matter – transhumanists fall prey to a long-lived utopia, that of a silenced and erased, transparent, transfigured and transcended, incorporeal body, from which stem, according to Michel Foucault, our (Western) fairy tales and the great myth of the soul (Foucault 2009 [1966]).

> *Mon corps, c'est le lieu sans recours auquel je suis condamné. Je pense, après tout, que c'est contre lui et comme pour l'effacer qu'on a fait naître toutes ces utopies. … L'utopie, c'est un lieu hors de tous les lieux, mais c'est un lieu où j'aurais un corps sans corps, un corps qui sera beau, limpide, transparent, lumineux, véloce, colossal dans sa puissance, infini dans sa durée, délié, invisible, protégé, toujours transfiguré ; et il se peut bien que l'utopie première, celle qui est la plus indéracinable dans le cœur des hommes, ce soit précisément l'utopie d'un corps incorporel (Foucault 2009b [1966]: 10, emphasis in original)*[35]

In this flight from the body – the 'meat' in cyberpunk idiom – and this dream of disembodiment and incorporeality, the resonance with transhumanist representations and visions of a transcended and erased[36], or at best ornamental[37], body that is controlled and moved by an all-powerful mind or 'cyberconsciousness,' is uncanny. The self emanates from the mind for transhumanists, thereby reiterating the in/famous Cartesian dualism on which modern liberal humanism is grounded.

34. As feminist and postcolonial scholars have showed, non-white, non-male, non-heterosexual bodies have been devalued and excluded from who and what counts as properly human within modern liberal humanism (Braidotti 2002; Haraway 1991; Harding 1998; Hayles 1999).
35. 'My body, it is the place without recourse to which I am condemned. And actually I think that it is against this body (as if to erase it) that all these utopias have come into being. …Utopia is a place outside of all places, but it is a place where I will have a body without body, a body that will be beautiful, limpid, transparent, luminous, speedy, colossal in its power, infinite in its duration. Untethered, invisible, protected – always transfigured. It may very well be that the first utopia, the one most deeply rooted in the hearts of men, is precisely the utopia of an incorporeal body' (Foucault 2006 [1966]: 229, emphasis in original, translated by Lucia Allais in consultation with Caroline A. Jones and Arnold Davidson).
36. Hans Moravec's notorious envisioning of consciousness being uploaded into computers in Robot: Mere Machine to Transcendent Mind (1999) is an archetype of this fantasy of transcending and erasing the body and all corporeal matter – the 'meat.' Moravec describes this process of uploading one's consciousness as 'a "brain in a vat," sustained by life-support machinery, connected by wonderful electronic links to a series of artificial rent-a-bodies in remote locations and to simulated bodies in virtual realities. … Bit by bit our failing brain may be replaced by superior electronic equivalents, leaving our personality and thoughts clearer than ever, though, in time, no vestige of our original body or brain remains' (Moravec, 1999: 169-170, quoted in Sharon 2011: 44).
37. In transhumanist visions, and especially in Natasha Vita-More's, the body is also seen as an accessory, and as such becomes ornamental, disposable. 'Could you imagine a Versace body design? Can you imagine a Thierry Mugler body design? These individuals, the late Versace was an incredible designer. What if he was a transhuman? What if he was an artist who really wanted to combine art and science? I bet his designs would be astounding' Natasha Vita-More tells the viewer in the opening lines of Frank Theys' documentary Technocalyps (2006).

An 'Antiseptic Posthumanism'

However, the transhumanist dream of transcendence does not only concern the body, but also nature and matter. Anthropocentrism – i.e. the conception of the human (anthropos) as not only the central and superior species in the living realm but also as separate and superior from nature, which humans can therefore exploit for their benefits – which is another facet of liberal humanism is revived. Transcending the body amounts to overcoming biology and its limitations and defying nature. It means, in Tamar Sharon's words, 'a liberation form the human species' biological bondage to finitude, disease and decay, a triumph over nature in which the anthropocentric project of harnessing and colonizing all of nature is complete' (Sharon 2011: 45) In this regard, transhumanism repeats and pursues the Modernist stance towards nature, namely the control, colonisation, and exploitation of the latter for human/huMan ends (Haraway 1991; Harding 1998). Therefore, if 'human nature' is dynamic, absorbing technology in its quest for self-improvement and progress, humans and posthumans remain separated from the world in the transhumanist view.

Even technologies, however pivotal in the making of the posthuman, are kept in a separate, hermetic position. In fact, transhumanists abide to a technophilic (Thacker 2003: 77) or utopian (Dorrestijn 2012: 67) conception of technology. Indeed, technologies are conceived as applied reason or as the products of applied science, and as enabling humans to fulfil their goal of self-improvement and ultimately reach completion. However, if transhumanists thereby acknowledge that humans and technology are interdependent – for them, human progress is linked to technological development –, technologies are not independent forces. As previously mentioned, technological determinism has no place in transhumanism. Technologies are only neutral instruments or means that are used for a pre- and human-determined end, namely the enhancement of humans towards the posthuman, or rather the posthuMan insofar as the modern liberal humanist subject – Man – remains the measure of all things. Indeed, as Eugene Thacker expresses it,

> *[t]he human – or rather a humanist standpoint – becomes the safeguard against the threat of technological determinism. It is the human user that guarantees the right, beneficial use of otherwise value-neutral technologies (Thacker 1997: 77).*

Vita-More's Primo Posthuman is paradigmatic of this conception of technology that not only relies on but also naturalises the liberal humanist subject. Assuredly, the Primo Posthuman is technologically enhanced, but technology, its marks, its scars, and its alterations are nowhere to be encountered in/on its self-contained body. As Tom Koch phrases it, '[h]ere … is the failure of the enhancement enthusiast's promise: nothing significant has changed. The technology is irrelevant' (Koch 2010: 688, emphasis in original). In its magical neutrality and straightforward instrumentality, technology has no bearing on the body and it seems to play no role in transforming human embodiment. There even appear to be no/body to be enhanced, just a set of functionalities. To a certain extent, even technology is irrelevant. That is, despite a fascination with so-called posthuman technological extensions of the body, the project offered by transhumanists reiterates a very conservative view: what is (technologically) enhanced is an abstract human rather than living, breathing, material human beings; what is enhanced is a modern liberal humanist conception of what human beings are.

In transhumanist accounts, as Sharon phrases it, 'the essential rational self endures unimpeded – augmented and improved, certainly, but not essentially transformed, by technological enhancements' (Sharon 2011: 43). Therefore, while the terms posthuman and posthumanism denote a departure from and/or a rupture with the human, in their transhumanist acceptation they become a repetition and (technological) consecration of the Same, the One true human, the rational, self-contained, autonomous, and even free-floating individual. As such, Keith Ansell-Pearson argues, transhumanists promote a 'clean and tidy conception of the transhuman, which reeks of antiseptic posthumanism' (Ansell-Pearson 1997: 34). Indeed, for him,

> *cybercelebrations of the transhuman or even more dubiously, of the posthuman condition, can ultimately be shown to rest on a (non-dialectical) cancellation of this condition. It is not a question of 'self-overcoming' since there is nothing to overcome (Ibid.: 2)*

To summarise, while transhumanists proclaim the posthuman as the next evolutionary step, one that is human-made and technologically driven, the type of posthumanism that is convened and conveyed by transhumanists does not break with liberal humanism – hence their designation as liberal posthumanism in Sharon's taxonomy (Sharon 2011). Their conception of technology as transparent, value-neutral and instrumental, as well as separated from humans and posthumans, is pivotal in their promotion of the technologically enhanced yet disembodied liberal humanist subject. In the guise of the posthuMan, the latter also stands in a separated and dominating – transcendent – position with respect to the/his world. Anthropocentrism and human exceptionalism prevail in transhumanist accounts. Interestingly, so-called bioconservatives, the most fervent opponents of transhumanists with respect to human enhancement, join their adversaries in their celebration of the modern liberal humanist subject. Indeed, even though their conception of both technology and human nature is different from transhumanists', they ultimately oppose human enhancement in the name of liberal humanism, which has the debate on human enhancement caught into an ironical deadlock.

3.2 A Claim on Human Nature, A View of Technology: Bioconservatives and the HuMan

Along with the transhumanists, another voice has dominated the debate on human enhancement, that of bioconservatives. The latter consists of a rather disparate group of scholars who oppose human enhancement on moral and political grounds: insofar as it is conceived as constituting a threat to human nature, human enhancement is morally wrong and should be (politically) banned or at least strictly regulated. Bioconservatives have been pejoratively designated as such by transhumanists who also used the label bio-Luddites. In Humain, posthumain, Dominique Lecourt refers to bioconservatives as 'bio-catastrophists' (Lecourt 2003) while Tamar Sharon denominates this group as 'dystopic posthumanists' (Sharon 2011). Bioconservativism, bio-Luddism, bio-catastrophism, and dystopic posthumanism, these appellations encapsulate the technophobic and even doom-mongering ethos of the group composed by, amongst its most prominent members, Francis Fukuyama, Leon Kass, Jürgen Habermas, Michael Sandel, Jeremy Rifkin, and Bill McKibben.

Human Enhancement, A Threat to Human Nature

The prospect of a posthumanity comprised of technologically enhanced humans whose abilities dramatically surpass existing ones is apprehended by bioconservatives as a threat to human nature, as fundamentally jeopardising what it means to be human. With genomics and genetic technologies (e.g. pre-implantation genetic diagnosis and selection, genetic intervention) figuring at the forefront of – and even subsuming – the bioconservative resistance towards the technoscientific ability to modify and 're-design' human beings, Aldous Huxley's Brave New World has become a bioconservative canon or at least a necessary cautionary tale. While it pervades both Leon Kass's work (Kass 2001; 2003) and Francis Fukuyama's Posthuman Future (2003)[38], it acts as a forewarning of the dehumanisation potential (at best) of enhancement technologies. Indeed, in 'Preventing a Brave New World,' Kass alerts that

> *[h]uman nature itself lies on the operating table, ready for alteration, for eugenic and psychic "enhancement," for wholesale re-design. In leading laboratories, academic and industrial, new creators are confidently amassing their powers and quietly honing their skills, while on the street their evangelists are zealously prophesying a post-human future. For anyone who cares about preserving our humanity, the time has come to pay attention. … Our immediate ancestors, taking up the challenge of their time, rose to the occasion and rescued the human future from the cruel dehumanizations of Nazi and Soviet tyranny. It is our more difficult task to find ways to preserve it from the soft dehumanizations of well-meaning but hubristic biotechnical "re-creationism" (Kass 2001: 1-3, my emphasis).*

38. This common reference for Kass and Fukuyama does not come as a surprise. Indeed, they worked together in the President's Council on Bioethics that was created in November 2001 by the President of the United States George W. Bush in order to advise the U.S. administration on bioethical issues. Appointed by President G.W. Bush, Leon Kass was chairman of the council from 2001 to 2005 while Francis Fukuyama was a member from 2002 to 2005. Note too that another prominent bioconservative, Michael Sandel served on this Council from 2002 to 2005. Besides Huxley, Nietzsche and his Übermensch have also become classics for both Fukuyama and Kass.

Similarly, Fukuyama warns that

> *[t]he deepest fear people express about technology is … a fear that, in the end, biotechnology will cause us in some way to lose our humanity – that is, some essential quality that has always underpinned our sense of who we are and where we are going, despite all of the evident changes that have taken place in the human condition through the course history (Fukuyama 2002: 101, my emphasis).*

In these accounts that epitomise bioconservatism's anxieties, enhancement technologies amount to dehumanising instruments. Rather discreet and inconspicuous, these technologies that develop behind laboratory doors are all the more insidious and detrimental to human nature that they promise advances in terms of health and medical care (see also Sandel 2004). At stake however are human nature and future, and as I shall address, the ability to be part of the community of moral and political beings – of truly human beings (Habermas 2003).

The Technophobia of Bioconservatives: A Substantive and Romantic View of Technology

This conception (of enhancement technologies as dehumanising) echoes the traditionally technophobic view of technology that has prevailed in (Western) philosophy, especially after the Second World War as manifest in the work of Jacques Ellul (1964), Martin Heidegger (1977), Hans Jonas (1979), and the Frankfurt school of which Jürgen Habermas (1968) was a member alongside Theodor W. Adorno and Max Horkheimer (1944), as well as Herbert Marcuse (1964) – all of them composing the so-called classical approach to philosophy of technology (Achterhuis 2011; Dorrestijn 2012; Verbeek 2005).

Whereas, as previously showed, transhumanists rest on an instrumental notion of technology insofar as they view the latter as a means to reach huMan-determined ends (e.g. posthumanity), bioconservatives abide by a substantive understanding of technology. There, technologies are no longer neutral instrument but materialise some values. Technology is value-laden as well as an agent of change. That is, technology, or rather Technology inasmuch as it is conceived in a transcendental way, becomes a system that shapes, even constitutes, and ultimately enslaves human existence and social life (Sharon 2011: 60; Wiener 1991: 7). Indeed, while transhumanists are technophile, even utopian vis-à-vis technology since they see the latter as intrinsically linked with progress and as enabling huMan mastery (over nature), technophobia is an integral part of the substantive approach and has bioconservatives conceive of technology as rather deterministic, or at least autonomous, and dominating human beings – dehumanising. Technologies and technological development must therefore be controlled and regulated – re-humanised (e.g. Fukuyama 2002; Kass 2001, 2003; Habermas 2003). In this respect, Kass explains that

> *[o]ur views of the meaning of our humanity have been so transformed by the scientific-technological approach to the world that we are in danger of forgetting what we have to lose, humanly speaking. … But … [t]hough we love our gadgets and believe in progress, we have lost our innocence regarding technology (Kass 2001: 3)*

In other words, technology is more than a neutral tool to reach an end. It constitutes a particular approach to the world that has profoundly transformed what it means to be human, to such an extent that humanity is at risk of being subjugated to Technology and falling into a situation of false consciousness and alienation – 'of forgetting what [it has] to lose, humanly speaking.' Fortunately, however, innocence is lost.

Read against Heidegger's 'Question Concerning Technology' (1977), the resemblance and resonance are uncanny. Indeed, in his famous article, Heidegger argues against the instrumentalist definition of technology, showing that it is indeed a correct, but not true, conception of technology. Technology is rather an ontological relation insofar as it is a 'bringing forth' and a 'challenging forth,' a way of revealing and (un)concealing the world to human beings – an emerging out of concealment into unconcealment (Heidegger 1977: 11). Even more, for the German philosopher, modern technology is an 'enframing' (Ge-stell) of the world, of a world. That is, modern technology reveals or rather, challenges forth and enframes 'the real' – i.e. the world, nature – as 'standing reserve' (Bestand). As stated by Heidegger, '[t]he essence of modern technology starts man upon the way of that revealing through which the real everywhere, more or less distinctly, becomes standing-reserve' (Ibid.: 24). In other words, the world appears to humans as a set of orderable and seizable raw materials, 'as an object open to the attacks of calculative thought, attacks that nothing is believed able any longer to resist,' Heidegger gloomily adds in his 'Memorial Address' (Heidegger 1966: 50[39], quoted in Verbeek 2005: 58). Therefore, because it transforms or reveals everything into standing-reserve, Technology, or rather the essence of technology (Gestell), is the 'greatest danger.' Indeed, not only is the human itself coming 'to the brink of a precipitous fall; that is, he [sic] comes to the point where he himself will have to be taken as standing-reserve'[40] (Heidegger 1977: 27), but the Gestell also conceals any other and more fundamental ways of disclosing reality and the essence of being. Going back to enhancement technologies, it is the instrumentalisation and objectification, hence latent dehumanisation of human beings that inhere in the essence of technology in Heidegger's conception with which Kass's analysis, and more generally the bioconservative theses, resonate.

An Evolution Against Nature...

The human enhancement potential of technologies is conceived by bioconservatives as crossing – and overstepping – a crucial, foundational, even vital, line. In Jürgen Habermas's words,

> *[d]ue to the spectacular advances of molecular genetics, more and more of what we are "by nature" is coming within the reach of biotechnological intervention. From the perspective of experimental science, this technological control of human nature is but another manifestation of our tendency to extend continuously the range of what we can control within our natural environment. From a lifeworld perspective, however, our attitude changes as soon as this extension of our technological control crosses the line between "outer" and "inner" nature (Habermas 2003: 23)*[41].

39. Heidegger, Martin. 1966. 'The Memorial Address.' In Discourse on Thinking. New York: Harper and Row. Heidegger's 'Memorial Address' is considered to be a postscript to 'The Question Concerning Technology' (Verbeek 2005: 50).
40. Hans Jonas makes a similar point when he states that '[t]echnologically mastered nature now again includes man who (up to now) had, in technology, set himself against as its master' (Jonas 1979, quoted in Habermas 2003: 47).
41. Further, Habermas adds that '[b]odies stuffed with prostheses to boost performance, or the intelligence of angels available on hard drives, are fantastic images. They dissolve boundaries and break connections that in our everyday actions have up to now seemed to be of almost transcendental necessity. There is fusion of the organically grown with the technologically made, on the one hand, and separation of the productivity of the human mind from live subjectivity, on the other hand' (Habermas 2003: 41). Enhancement technologies being conceived by bioconservatives as blurring foundational boundaries and categories, such as the one between the grown and the made, inner and outer nature, that maintain the separation between humans and technology, they threaten the ontological separation that is necessary for sustaining human nature and the integrity of the Modern liberal humanist subject.
42. Kass, Leon. 2003. Beyond Therapy: Biotechnology and the Pursuit of Happiness. A Report by the President's

As the technological mastery over nature (romantically understood as 'external' nature,' i.e. flora and fauna, unspoilt by artifice) inherited from Modernity extends to human nature (ambiguously navigating between human nature understood as human biology and human nature understood as human essence, both free of any outside influence), it amounts to technology mastering and controlling humans and jeopardising what it means to be human. With the growing momentum of enhancement technologies, dehumanisation looms large for bioconservatives. In this regard, this newly acquired technological ability to alter and master human nature is decried as 'hubris,' be it Promethean or human (Kass 2001, 2003; Sandel 2004), or as 'playing God' (Habermas 2003; Kass 2003; Sandel 2004). Yet, as Ansell-Pearson explains,

> *[t]o maintain that technology is making us "less human" is to suppose that there exists some fixed nature of the human by which one could measure the excesses of technology, and so appraise its inventions in terms of some metaphysical cost-benefits analysis (Ansell-Pearson 1997: 153)*

Whereas human nature is dynamic for transhumanists, it is fixed for bioconservatives, while remaining separate from technology for both. For bioconservatives, given technology's substantive nature, technologically altering, transforming, and remaking human beings is conceived as a corruption of authenticity and a threat to the givenness and 'giftedness' of life and nature.

... Seen as Endangering Authenticity...

With respect to their concerns about authenticity, which usually serves as lexical ground for human nature (Sharon 2011: 169), bioconservatives point to the fracture between one's actions and one's life achievements and happiness, between one's degree of involvement and the end result when one uses enhancement technologies. Kass (2003), for instance, warns against psychopharmacologically-induced happiness and decries that with the availability of enhancement technology, its pursuit along with excellence will no longer be attained with discipline, effort and dedication, but will result from drugs, implanted devices, and genetic engineering. Technological instant gratification will replace practice, training, study and hard-earned accomplishments. Yet, as the former President of the United States President's Council on Bioethics summarises it, '[a] drug to induce fearlessness does not produce courage' (Kass 2003: 21). That is, in this process in which achievements, moods and emotions are no longer rooted in 'real' conditions, genuine human happiness and authenticity will be lost.

> *We want to perform better in the activities of life – but not by becoming mere creatures of our chemists or by turning ourselves into bionic tools designed to win and achieve in inhuman ways. ... We want to be happy – but not by means of a drug that gives us happy feelings without the real loves, attachments, and achievements that are essential for true human flourishing' (Kass 2003: xvii*[42]*, quoted in Bess 2010: 651, my emphasis)*

Mood enhancers and pre-implantation genetic selection are particularly under bioconservative fire. Assimilated to Huxley's Soma and deprecated as 'cosmetic pharmacology' (Kramer 1993), Prozac®, the widely used selective serotonin reuptake inhibitor, begs the question of 'who is the real me?' For Michael Bess, only the 'pristine me' – i.e. unpolluted by external influences –, the 'potential me' – i.e. the (better) self that one aspires to be but that is not yet realised – and the 'hard-earned me' – i.e. the potential self realised through hard work and dedication – count as authentic and legitimate human beings for bioconservatives (Bess 2010: 650-651). 'Pharmacological me,' however, the potential self realised through (psycho-) pharmaceutical means is regarded as inauthentic and degraded – as not fully human.

This bioconservative conception of an authentic good life and legitimate human is fittingly encapsulated in Kass's famous – and rather classist or elitist – tirade:

> *The final technical conquest of his [sic] nature would almost certainly leave mankind utterly enfeebled. This form of mastery would be identical with utter dehumanization. Read Huxley's Brave New World, read C.S. Lewis's Abolition of Man, read Nietzsche's account of the last man, and then read the newspapers. Homogenisation, mediocrity, pacification, drug-induced contentment, debasement of taste, souls without loves and longings – there are inevitable results of making the essence of human nature the last project of technical mastery. In his moment of triumph, Promethean man will become a contented cow' (Kass 2002: 48[43], quoted in Bostrom 2005: 205).*

In this view, if people who have recourse to mood enhancers and enhancement technologies in general experience their life as fulfilling and gratifying, they are actually alienated insofar as the ground of their existence, emotions, feelings, achievements, and happiness are artificial. Their very nature is inauthentic. One's accomplishments and contentment must be the result of one's individual and autonomous actions. To count as such, the human/huMan must be its uncreated – especially if technology is involved – creator. There, the model and dogmatic figure of the modern liberal humanist subject transpires. In fact, as I shall further describe, it is consecrated in the bioconservative defence of human nature.

... Undermining the Givenness of Life...

Alongside the issue of authenticity which is opposed to the artificiality induced by technology in general and enhancement technologies in particular, the bioconservative defence and fixation of/on human nature materialises in their conception of nature and life as 'given.' That is, while the use of enhancement technologies is construed as a surrender of sovereignty over one's life, this is also linked to the latter technologies being seen as a threat to the 'givenness' and 'giftedness' of life.

> *Most of the given bestowals of nature have their given species-specified natures: they are each and all of a given sort. Cockroaches and humans are equally bestowed but differently natured. To turn a man into a cockroach – as we don't need Kafka to show us – would be dehumanizing. To try to turn a man into more than a man might be so as well. We need more than generalized appreciation for nature's gifts. We need a particular regard and respect for the special gift that is our given nature (Kass 2003: 20, emphasis in original)*

Counctil on Bioethics. New York: Regan Books

43.Kass, Leon. 2002. Life, Liberty, and Defense of Dignity: The Challenge for Bioethics. San Francisco: Encounter Books

In this passage in which he alerts against the dehumanisation potential of enhancement technologies, Kass ambiguously navigates between two understandings of givenness (and nature), one referring to the biology of living entities and its pre-determined aspect, and the other, more spiritual and morally charged, alluding to certain traits and aptitudes as 'gifts' (Sharon 2011: 170). Such slippages – already highlighted in Habermas's – are actually typical of bioconservative defences of human nature.

With respect to this notion of gift and 'giftedness,' in his 'Case Against Perfection' (2004) imbued with Christian undertones, Michael Sandel has argued that the Promethean hubris and drive to mastery ingrained in enhancement technologies insofar as they hold the promise to alter human nature pose a threat to the perception and appreciation of the giftedness of life and 'the gifted character of human powers and achievements' (Sandel 2004: 54). In fact, humility, responsibility, and solidarity, three important aspects of the moral landscape would undergo some significant changes. Enhancement technologies would weaken humility, the moral quality that 'invites us to abide the unexpected, to live with dissonance, to rein in the impulse to control' (Ibid.: 60) and more generally to respect nature's wisdom, complexity and even mystery (Sharon 2011: 170). In the failure to appreciate the giftedness of life, not only is a crucial safeguard against human hubris compromised, but also responsibility is heightened. Indeed, as the technological possibility to alter and master some genetic traits expands, chance fades into choices for which we become individually responsible. Furthermore, as individuals become increasingly responsible for their own talents and flaws, for their own achievements and failures, they also become particularly aware of their and the others' aptitudes and weaknesses. As a result of such developments, solidarity erodes to the extent that everybody has less reason 'to share [one's] fate with others' (Sandel 2004: 60).

...and Ultimately Jeopardising the huMan

Similarly, yet more secularly, for Jürgen Habermas, the givenness of human nature is undermined by (genetic) enhancement technologies that make chance recede into choice. However, what he takes issue with and disquiets over in The Future of Human Nature (2003) is not so much an increase of responsibility as a loss of autonomy. Indeed, he conceives of the growing momentum and availability of pre-implantation genetic diagnosis (PGD), selection and future intervention as so many infringements of the individual's 'spontaneous self-perception of being the undivided author of his [sic] own life' (Habermas 2003: 62). It is ultimately the Modern liberal subject that is endangered. For the individual to learn that s/he is a 'designer' or a 'made-to-order' child (Sandel 2004) may have deleterious consequences insofar as

> *knowledge of one's own hereditary features as programmed may prove to restrict the choice of an individual's life, and to undermine the essentially symmetrical relations between free and equal human beings (Habermas 2003: 23).*

If the 'projected child' is thereby excluded from the deliberation and communication process, which is key for Habermas, it is his/her potential inability to locate him/herself as part of the human species that is the most distressing for the German philosopher. Indeed, as he flirts with genetic determinism, he attributes full participation in liberal democracy and membership in the moral community to the randomness and contingency of one's genetic makeup which is determinant for 'how we see ourselves anthropologically as members of the same species' (Ibid.: 62). With enhancement technologies in general, and genetic intervention in particular, the basis of our morality is swept away. Therefore, to guarantee

'an ethical self-understanding of the species which is crucial for our capacity to see ourselves as the authors of our own life histories, and to recognize one another as autonomous persons' (Ibid.: 25), Habermas defends a moralisation of human nature in the form of a 'species ethics.' Values and morality are conflated, and even subsumed, into biology (Lecourt 2003: 36-37). Concurrently, the figure of the Modern liberal subject – the uncreated creator or the 'undivided author of his own life' – is naturalised and universalised as it henceforth not only rests on an un-tampered with genetic make-up but also has become the seal of the human species. (Human) nature simultaneously navigates between fixed and free of influence biology, (human) essence, and universality.

Francis Fukuyama (2002) also perpetrates this conflation. Indeed, technologically manipulating or tinkering (especially genetically) with the body and bodily processes will undermine human nature – what he calls Factor X – and thereby liberal democracy, the former being the founding basis of the latter – rather than a political construct(ion)[44]. For the author of Our Posthuman Future,

> *[w]hen we strip all of a person's contingent and accidental characteristics away, there remains some essential human quality underneath that is worthy of a certain minimal level of respect – call it Factor X (Fukuyama 2002: 149).*

Yet, even though Factor X is the only bioconservative attempt at delineating the components of human nature, it still remains a vague notion.

> *[T]here is no simple answer to the question, What is Factor X? That is, Factor X cannot be reduced to the possession of moral choice, or reason, or language, or sociability, or sentience, or emotions, or consciousness, or any other quality that has been put forth as a ground for human dignity. It is all of these qualities coming together in a human whole that make up Factor X. Every member of the human species possesses a genetic endowment that allows him or her to become a whole human being, an endowment that distinguishes a human essence from other types of creatures (Ibid.: 171, my emphasis)*

Factor X, the ground of human dignity and the necessary attribute to count as human, appears to be rooted in a given – that is, technologically un-tampered with – genetic make-up. In this frame, insofar as it advocates the technological overcoming and transcendence of the human, thus the obliteration of human nature, transhumanism is considered by Fukuyama to be 'the world's most dangerous idea' (2004).

44. In Fukuyama's words, '[h]uman nature shapes and constrains the possible kinds of political regimes, so a technology powerful enough to reshape what we are will have possibly malign consequences for liberal democracy and the nature of politics itself' (Fukuyama 2002: 6).

Reclaiming Nature, Salvaging the Liberal Humanist Subject

Habermas's species ethics, Fukuyama's Factor X, and more generally the conflation of one's belonging to the universal moral community with one's pristine biology has become a bone of contention with transhumanists who, like James Hughes, uphold 'the idea that the moral standing of a person depends on their level of consciousness and not the biology or hardware they are instantiated on' (Hughes 2010: 634) and defend a 'posthuman dignity' (Bostrom 2005). Such divergence of opinions between bioconservatives and transhumanists is rooted in their antagonistic views on human nature. Indeed, as previously said, whereas it is dynamic for the latter, it is fixed for the former, while remaining separate from technology for both.

Like transhumanists' however, the bioconservative view of human enhancement as a threat for human nature is inscribed in a modern liberal humanist conception of human beings. As previously indicated, in such a frame, humans are separated from technology and from the world more generally, of which they are part but in a distinct, exceptional position. For the human to remain 'human,' or rather 'huMan,' this separation must endure. The modern liberal subject must indeed remain its uncreated creator – 'the undivided author of his life' to use Habermas's aforementioned formulation. Technologies, insofar as they are not instrumental but rather instrumentalising in their bioconservative acceptation, jeopardise the human/huMan in its core. The bioconservative opposition to human enhancement in the name of human nature is a defence of the modern liberal humanist conception of human beings; it is a defence of the liberal humanist subject.

Besides the 'nature' of the human being modern liberal humanist (or conceived as such), another issue arises with respect to the 'naturalness' – and fixity – of human nature. While epigenetics and the transformative effects of the environment on genes and their expression throw into doubt the fixity of human nature, it is necessary to mention that appeals to nature have historically been instrumental in excluding certain bodies from human rights, political participation and moral status – i.e. from being recognised as (fully) human. More precisely, within modern liberal humanism, references to nature have been used to justify and legitimate the inferiorisation – and othering – of certain bodies: gendered (female), racialised (non-white), classed (not-middle class), aged (neither young nor middle-age), differently-abled (not putatively able) bodies have historically been regarded as too close to nature, and as such have not been considered as fully human but rather monstrous and as such at the limits of humanity. With respect to women, Italian humanist [sic] thinker Leon Battista Alberti wrote for example in the fifteenth century that '[m]en are by nature of a more elevated mind than women. … Women … are almost timid by nature, soft, slow, and therefore more useful when they sit still and watch over things. It is as though nature thus provided for our well-being, arranging for men to bring things home and for women to watch over' (Alberti, quoted in Birke 1992: 66). Such a thinking which legitimated women's exclusion from education and the public sphere in general is dead and buried history in Western societies some would retort while pointing out the progresses of science for understanding the human species. Yet, The Inevitability of Patriarchy was written in 1973 by Steven Goldberg who relied upon endocrinological knowledge[45], while in a psychological framework, John Gray's Men are from Mars, Women are from Venus was published in 1992, and more recently a study in neuroscience (Ingalhalikar et al. 2013) made headlines in the press as it allegedly demonstrates the existence of such hardwired sex differences (see Fine 2013 for an apposite

45. Steven Goldberg's thesis is encapsulated in the title of his book, The Inevitability of Patriarchy. In a nutshell, drawing a hormonal determinism, Goldberg argues that the testosterone bath occurring at an early stage of the male foetus' embryonic development is the biological basis of male aggressiveness. From there, it is just one step to claiming that male dominance hence patriarchy is inevitable insofar as it is biologically, read naturally, grounded.

critique). As both Donna Haraway (1991; 1997), Evelyn Fox Keller (1995) and Nelly Oudshoorn (1994) have shown, biology is a discourse whose language and metaphors are not innocent but embedded in power relations: its explanatory tropes have historically proved to be key in processes of naturalisation, animalisation, sexualisation and racialisation of White Man's 'others.' Therefore, I cannot but be wary of Fukuyama's and Habermas's pleas for human nature and underlying defences of the modern liberal humanist subject as they discuss putatively enhancement technologies[46].

For bioconservatives and their romantic (substantive) view of technology, human enhancement threatens to breach the hermetic – and foundational – separation between humans and technologies, and therefore must be opposed. In their defence and fixation of human nature as separated from technology, bioconservatives uphold the modern liberal humanist subject as the 'natural,' universal, and timeless human. In fact, if putatively enhancement technologies are dehumanising it is with respect to a particular – modern liberal humanist – conception of the human; human enhancement is a 'dehuManisation.'

46. Similarly, were bioconservatives to claim and reclaim the naturalness of the body, as it crystallises in its untampered with genetic makeup, as the ground for human and moral status, the body would be a purified, hygienic body. The body has indeed been disciplined and normalised, as Michel Foucault powerfully showed. It has been invested, marked and produced, by the power-knowledge discourses and practices of (bio-) power (Foucault 1976). Against bioconservatives' claims, technologies have been pivotal in these processes. As Foucault explains in Discipline and Punish, through its distribution in the networks of discourses and practices of institutions such as the army, the factory, the hospital, schools, '[t]he human body was entering a machinery of power that explores it, breaks it down and rearranges it. A "political economy," which was also a "mechanics of power," was being born; it defined how one may have a hold over others' bodies, not only so that they may do what one wishes, but so that they may operate as one wishes, with the techniques, the speed and the efficiency that one determines. Thus discipline produces subjected and practiced bodies, "docile" bodies' (Foucault 1977 [1975]: 138-139). Subjected to power/knowledge apparatuses, the body has been ordered and segmented. To some extent then, the body has been rendered 'hygienic.' It is this disciplined body that would be taken as the natural, originary, state of the human condition by bioconservatives and through which the fiction of the disembodied modern liberal subject – the One true human/huMan – would be produced and reproduced.

Conclusion – The Human and Technology as Blackboxes

The deadlock in which bioconservatives and transhumanists are mired is therefore rather ironical. Transhumanist pleas for human enhancement and bioconservative calls in defence of human nature consecrate the modern liberal humanist conception of human beings, i.e. the human as the disembodied, self-contained and autonomous individual who is free to reason, produce true knowledge and act in and onto the world, of which it is part albeit in a separate yet exceptional position. Whether in the guise of the huMan or the posthuMan, Man, this historically exclusionary figure who is hermetically separated from technology, has to remain the measure of all things. Bioconservatives' and transhumanists' posthumanism – discourses on the posthuman – are a hyper-humanism. Furthermore, while transhumanists conceive of human nature as dynamic yet hermetic as they rely upon an instrumental conception of technology, and while bioconservatives apprehend human nature as fixed and uphold a substantive view of technology, both not only regard humans and technology as being ontologically separated, but also blackbox 'the human,' 'technology' and their relations.

With respect to the bioconservative and transhumanist conceptions of technologies, as Andrew Feenberg explains it,

> *[d]espite their differences, instrumental and substantive theories share a "take it or leave it" attitude toward technology. On the one hand, if technology is a mere instrumentality, indifferent to values, then its design and structure is not at issue in political debate, only the range and efficiency of its application. On the other hand, if technology is the vehicle for a culture of domination, then we are condemned either to pursue its advance towards dystopia or to regress to a more primitive way of life. In neither case can we change it: in both theories, technology is destiny (Feenberg 1991: 8)*

In both accounts, be it transhumanism's super-voluntarist and instrumental attitude or bioconservativism's technophobic and substantive stance, technology is blackboxed. Embraced by the former and rejected by the latter, technology is taken-for-granted. Subsumed into a homogeneous whole, it is essentialised. The characteristics of different technologies and practices, the norms they convene and convey in different contexts, the singular relations and practices they create with human beings are crucial yet ignored in transhumanist and bioconservative accounts. Yet, if we are to understand what it means to be human and how the human is changed with enhancement technologies, technologies in their materiality and normativity have to be investigated in their (intimate) relations with human beings.

In addition, as I shall further demonstrate in the next chapter wherein I will continue this excavation – and decryption – of (the issue of) human enhancement, if 'the human' who inhabits not only bioconservative and transhumanist accounts but also the phenomenon of human enhancement in general, is a rather abstract entity, i.e. the modern liberal humanist subject, it is also a highly normative and exclusive construction. When interrogating human enhancement as an instance of normation, it is the matter of humanness – who and what counts as human – that will be particularly central in the second chapter.

Chapter Two
Human Enhancement as Normation?

Bioconservatives and transhumanists, as well as the posthuman and human nature, are inescapable actors and elements of the phenomenon of human enhancement. However, there are additional ways in which human enhancement has been formulated as an (ethical) issue. In particular, issues of safety and risks, justice and equity, as well as freedom and coercion have been raised. Nevertheless, three pivotal aspects inherent in the phenomenon of human enhancement and the ways in which it has been hitherto conceived and delineated have been neglected and must be addressed in this initial mapping and contextualisation. These aspects concern the value-ladenness and normative dimension of the human that inhabits human enhancement – the modern liberal humanist conception thereof, i.e. as it has been delineated in transhumanist and bioconservative discourses.

As I will show in the first section, the spectre of eugenics has been repeatedly raised with regard to human enhancement, becoming the main and most fundamental issue brought about by the latter. Despite this association, scarce attention has been given to the fact that eugenics foregrounds the exclusive and arbitrary character of humanness and forces us to question what and who is 'the human' of human enhancement. Even though I will confront this issue concerning the intrinsic normativity of the human as it unfolds in the phenomenon of human enhancement when I will address the matter of eugenics, it will become even more pressing when I will draw attention to the ways in which human enhancement might amount to a system of (de-) valuation of (dis-) abilities. Indeed, in the second part of this chapter, I will attend to the ways in which human enhancement can be seen as an instance of normation of (human) bodies, the devaluation of certain bodies being pivotal in the construction of human enhancement. In fact, the phenomenon of human enhancement re-enacts and reinstates dualisms. I will tackle this aspect in the third and last section of this chapter. Dualisms, all reminiscent and symptomatic of upholding modern liberal humanism, not only participate in human enhancement becoming normation but they also impair the comprehension of human enhancement as a configuration of human-technology relations. However, crucially, it is as they interact materially with bodies that what and who counts as (putatively properly) human materialises. The example of cosmetic surgery will not only illustrate this last point but it will also alert on the arbitrarity of humanness and emphasise that attention to materiality and normativity, to bodies and humanness, is crucial to apprehend what it means to be human with enhancement technologies.

1. Human Enhancement, Ethical Issues and the Spectre of Eugenics

As said in introduction, the prospect of human enhancement has had ethicists and philosophers – however not necessarily bioconservative or transhumanist – mull over the challenge brought about by enhancement technologies and reflect on the directions to take as well as the paths not to cross. In this section, I will show that while ethical issues have been raised with respect to human enhancement – or the prospect thereof – what is especially at stake is the normative and exclusive dimension 'the human' of human enhancement. Even though concerns about safety and risks, justice and equity, freedom and coercion have been issued, it is the spectre of eugenics, whether brandished as a consolidating argument against human enhancement – the latter being assimilated to a eugenist programme – or as a differentiating strategy – human enhancement being grounded in and consecrating individual freedom and choice thus in rupture with old eugenics – that has highlighted the normative dimension of 'the human.' As it tends to rely upon and enact a valuation of human beings – of who and what counts as putatively human – human enhancement is a particularly political question.

1.1 Human Enhancement as an Ethical Issue

While debates over human nature and a posthuman future have framed and crystallised human enhancement into a particularly controversial phenomenon (see previous chapter), other issues have been raised when facing the prospect and possibility of technologically enhancing human beings. In particular, human enhancement has given rise to concerns of safety and risks, justice and equity, and freedom and coercion. As I will discuss, it is especially in relation to the latter concern that the question of eugenics – which foregrounds the underlying normativity of 'the human' – has sprung.

Safety and Risks

When it is apprehended in terms of safety and risks, the challenges raised by human enhancement concern the current uncertainty that exists with respect to the technologies' side effects and their unintended consequences[47]. As enhancement technologies are, for the most part, emerging technologies, knowledge about their implications and practical consequences for human beings is still limited. That is, while secondary or long-term side effects are unknown for new and emerging technologies, applications and potential deleterious effects are based on expectations. For instance, the long-term consequences and side effects – if any – of psychopharmacological agents such as Ritalin® are still unknown and can only be speculated (premature loss of memory, addiction, etc.) (Alhoff et al. 2009; Turner and Sahakian 2006). Furthermore, the risks associated to technologies such as deep brain stimulation – and neuromodulation in general – are surely those inherent in invasive surgery but they are also connected to technical problems and dysfunctions. More fundamentally however, neuromodulation technologies join with genetic manipulation in the kind of risks and uncertainty that are attached to them. These are epistemic and concern state-of-the-art knowledge with respect to the brain's complexity and the complex interactions between genes and the environment. In Patrick Lin and Fritz Allhoff's words,

> *given how precious little we still know about how our brains and other biological systems work, any tinkering with those systems would likely give rise to unintended effects, from mild to most serious. … [M]aking radical changes to our bodies undoubtedly will have surprising side-effects (Lin and Allhoff 2008: 258).*

Due to the current knowledge – or lack thereof – concerning technologies, their interactions with the human organism, their consequences and side effects, uncertainty resides with respect to the harm these technologies might cause. As such, human enhancement is commonly seen – especially when negatively assessed – through the lens of safety and risk.

Lin and Allhoff, however, point too that the risks enhancement technologies might generate are not only a question of individual safety but also concern society's safety, understood as stability. Enhancement technologies and the coming of a population of posthumans with greater abilities (e.g. strength, dexterity, memory, concentration, and so forth) and much longer life expectancy might become socially disruptive. Education, sports, the labour market, to name but a few, are as many institutions likely to be substantially impacted by and redefined with the availability of enhancement technologies. Societies would be profoundly reconfigured. In this framework, it is not rare to see scholars balance the benefits, both individual and collective, with the costs, harms, and risks brought about by enhancement technologies, and thereby to provide a positive or negative utilitarian assessment of human enhancement (e.g. Bostrom and Roache 2008; Harris 2007; Savulescu and Kahane 2009; Turner and Sahakian 2006).

Justice and Equity

Nonetheless, knowledge, it is assumed (with deterministic undertones), will steadily increase; uncertainty will recede and give way to safe(r) technologies. In these circumstances in which enhancement technologies (were to) become available, issues of justice and equity emerge. Indeed, with the spectre of a 'brave new world' ahead (Kass 2001) and a scission between technologically enhanced humans and non-technologically enhanced humans, possibly leading to the oppression of the latter, the 'haves,' by the former, the 'have nots,' (Fukuyama 2002), not only is the issue of social disruption revitalised but at stake is also the question of fair (re-) distribution. The (re) distributive institutions and procedures, as well as the criteria defining a fair (re) distribution, are at issue. In a globalised world, if human enhancement is to be prohibited in a country or a supranational union, issues related to safety and risks become once more prominent. Risks of enhancement tourism or related to the emergence of a black market are envisioned and conceived as jeopardising the safety of the people resorting to enhancement technologies (Coenen et al. 2009).

Left to the market, some scholars argue, enhancement technologies would only be available to those who can afford them (Alhoff et al. 2009; Fukuyama 2002). Consequently, the existing inequalities and gaps between the richest and the poorest countries and segments of the population would not only dramatically widen but also sediment in an 'ability divide.' Should 'the haves' or Fukuyama's 'GenRich' pass on their enhanced genetic material to their offspring, they might ultimately become a different species, possibly one that is oppressive to 'the have nots,' the 'techno-poors,' and other 'GenPoor' (Fukuyama 2002). In the world's current – and historical – state of affairs, it is highly likely that Western white

47. Note too that each technology comes with its own challenges, and its own ethical and societal issues. Yet, what is at stake in this cartography are the ways in which the phenomenon of human enhancement is framed, delimited, constructed.

middle- and upper class able-bodied and heterosexual men would remain the privileged, and enhanced, part of the population. Furthermore, insofar as human enhancement would constitute a 'positional advantage' (Bostrom and Roache 2008), the commercial availability of enhancement technologies, some scholars advance (e.g. Rose 2007: 22), would raise issues of fairness and equity in competitive institutions, such as the educational system, especially during exams, and sports where the implementation of a biological passport keeping a record of profiles of biological markers of doping and of one's doping tests results has already been effective for the 2012 Summer Olympics Games in London, and adopted by certain organisations, such as the World Anti-Doping Agency (WAPA, 2009), the International Cyclist Union (ICU, 2011), the International Association of Athletics Federations (IAAF, 2011), and the Tennis Anti-Doping Programme (2013).

The measures taken in sport and sport competitions are not isolated. In fact, between prohibition and laissez-faire, a middle ground appears to have gathered some consensus with respect to the issue of the fair and equitable (re) distribution of enhancement technologies. Many scholars, and reports especially (e.g. Coenen et al. 2009; Fukuyama 2002; Lin and Allhoff 2008; Miller and Wilsdon 2006; van Est et al. 2008; Zonneveld et al. 2008), call for some form of control and regulation on the part of the state, state institutions, regulatory agencies, international and/or supranational bodies. However, when scenarios are pictured in which the (re-) distribution of enhancement technologies is in the hands of the state, or a state institution, the threat of eugenics is looming. In this context, many scholars, bioconservatives included, have drawn attention to human enhancement being reminiscent of the eugenic programmes implemented in, and by, Western states in the first half of the twentieth century (e.g. Bostrom and Roache 2008; Fukuyama 2002; see Haker 2008, Rose 2007). Although the Nazi regime has become the epitome of eugenics, eugenic programmes have been executed in the 1920s and 1930s especially in numerous European and American countries, e.g. between others, Belgium, Denmark, Finland, France, Sweden, Switzerland, and Brazil, Canada, the United States of America (see Rose 2001: 2-12; Rose 2007: 54-64).

1.2 Human Enhancement and The Spectre of Eugenics

Questions concerning what is to be done and what should be done have been raised concerning the technological enhancement of human beings and framed in terms of safety and risks, justice and equity, and freedom and coercion, but it is especially as it resonates with eugenics and its systematic de/valuation of certain lives that human enhancement and the paths (not) to follow concerning its implementation have become urgent political and vital questions. Human enhancement is indeed a vital matter as who and what counts as human are at stake.

A Definition of Eugenics

Coined by Francis Galton in 1883, eugenics etymologically stems from the positive Greek prefix 'eu,' which means good, and the term 'gens,' translated from Greek as born. In fact, informed by Charles Darwin's theory of evolution, eugenics is intrinsically linked to the concept of degeneration and to the possibility of improving the genetic traits of the/a population (Rose 2007: 19; Esposito 2008: 127). More precisely, as Galton defines it,

> *[e]ugenics is the science of improving stock, which is by no means confined to judicious mating, but which, especially in the case of man [sic], takes cognisance of all influences that tend in however remote a degree to give the more suitable races and strains of blood a better chance of prevailing steadily over the less suitable than they otherwise would have had (Galton 1883, quoted in Rose 2007: 55).*

State-eugenics, or the implementation of eugenic programmes by a state or state institutions, is the political realisation of measures and strategies that aim at intervening in human evolution, in order to circumvent so-called degeneration and to maximise the fitness of the population.

In the twentieth-century eugenic programmes, the fitness of the population is intrinsically linked with the fitness, and generally racial purity, of the nation. Indeed, the nation-state's strength and health, especially on the international scene, passes by the vigour and cleanliness of the body politic. Intertwined with racial(isation) and sexual(isation) politics, eugenics relies upon a categorisation and hierarchisation of the population: a qualitative sorting of the population – the nation – accompanies eugenics. People deemed unfit are regarded as not fully human. Rather, they as situated at the limits of, or outside, humanity. Living a life considered not worth living, being judged not worthy of life, they are dehumanised. Humanity is, in fact, an exclusive and highly normative collective, and humanness comes in degree.

Twentieth-century (state-) eugenics, wherein population was intertwined with 'quality,' 'territory,' 'nation,' and 'race,' have had lethal – murderous – consequences (Rose 2007: 56). Indeed, those deemed fit, and fitting the national ideals, were encouraged, if not exhorted, to procreate and received (reproductive) incentives such as family allowances. But those regarded as physically, mentally, morally, and/or socially deficient and defective (e.g. among others, promiscuous women, homosexuals, immigrants, alcoholics, and criminals) joined the ranks of people deemed to be polluted and polluting the body of the nation, thus forced to be segregated, aborted, sterilised, euthanized, or murdered, and were to eventually become the victims of a genocide (e.g. in the Nazi regime). As Roberto Esposito explains it,

> *to affirm a good genos means negating what negates it from within. This is the reason that a positive eugenics ... directed to improving the race, is always accompanied by a negative eugenics, one designed to impede the diffusion of dysgenic exemplars (Esposito 127-128)*

The vitality of the population as nation, of the human as species, is central within (state-) eugenics. While twentieth-century state eugenics was accompanied and informed by racism, it is the threat of able-ism, and even specie-ism, that loom large when the prospect of a renewed eugenics is brandished in relation to human enhancement. As Nikolas Rose explains,

> *[e]ugenics comprised of a whole set of strategies, which had in common the presupposition that it was desirable, legitimate, and indeed necessary to secure the future welfare of the nation by acting upon the differential rates of reproduction of specific portions of the population, so as to encourage the best to procreate and to limit the procreation of those thought to be of lower, inferior, defective, of diseased stock (Rose 2007: 54).*

Should human enhancement become part of the/a state's political rationale, it is conceivable – as argued by e.g. Fukuyama (2002) – that the enhancement of certain abilities as well as the procreation and reproduction of people with these desired and desirable abilities might be encouraged, while unenhanced people or people without the valued and valuable abilities might be, perhaps not segregated, aborted, sterilised, euthanized and killed, but discriminated against.

Eugenics as a Rhetorical Tool within Human Enhancement

Building upon Lene Koch's work, Rose draws attention to the fact that eugenics, especially in connection with genetics (and human enhancement), has become a rhetorical device (Rose 2001; 2007). When scholars utilise eugenics as a rhetorical instrument (e.g. Buchanan et al. 2000), they frame the issue of human enhancement as a matter of freedom and coercion. For the proponents of genetics, its use for personalised medicine and human enhancement, references to eugenics are part of a distinctive strategy: 'liberal eugenics,' as it has been coined by human enhancement advocate Nicholas Agar (2004), is no longer the state's affair but rather the object of individual choice, hence it has to be differentiated from past eugenic programmes. As Allen Buchanan, Dan Brock, Noman Daniels, and Daniel Wikler, who are exemplary of this rhetoric use of eugenics, argue

> *[r]eprehensible as much of the eugenic program was, there is something unobjectionable and perhaps even morally required in the part of its motivation that sought to endow future generations with genes that might enable their lives to go better. We need not abandon this motivation if we can pursue it justly (Buchanan et al. 2000: 60).*

In this view, state eugenics was wrong not so much in pursuing the enhancement of the fitness of the population, but in denying individuals' (reproductive) freedom. Nowadays, however, the decision to have recourse to enhancement technologies – and among them, genetics and especially pre-implantation genetic diagnosis and intervention – as well as the selection of the abilities and/or traits to be enhanced are based on one's informed, rational, and autonomous choice. Therefore, if the end – and aggregate – result of these 'individual' choices might amount to a form of eugenics, state eugenics dissolves and gives way to 'liberal eugenics,' 'individualised eugenics,' or 'flexible eugenics,' as it has been – generally critically – called (e.g. Taussig et al. 2003; Rose 2007). The selection and enhancement of certain traits is not, or no longer, coerced by the state. In fact, in this rhetorical use of eugenics, to have one's individual choice precluded, restricted or constrained in the matter of enhancement is an impingement on one's freedom[48], hence a form of coercion (e.g. Bostrom and Roache 2008; Buchanan et al. 2000; Savulescu 2001). Latent in the opposition between freedom and coercion that informs this rhetoric function of eugenics in relation to human enhancement, is the consecration of the reign of the modern liberal humanist subject. Separate from and above nature, rational and autonomous, Man, the sole author of his life, is the invisible hand that guides this view.

For critiques of genetics and human enhancement, eugenics is utilised to achieve the opposite effect: to associate them with past eugenics and thus delegitimise and discard the use of genetic for enhancement and human enhancement in general (e.g. Fukuyama 2002; Kass 2003; Koch 2010). This is achieved by emphasising the normative import and underpinnings of genetics – especially pre-implantation genetic diagnosis and selection –, enhancement technologies, and contemporary biomedicine in general, insofar as the latter not only 'still [judge] human life and worth' (Rose 2007: 55) but also generate a

> *resurgence of biological and genetic accounts of human capacities and incapacities. … [L]ike previous appeals to biological nature, such developments will tend to generate a politics that individualises human worth, essentialises variations in human capacities, reduces social phenomena to the aggregate of individual actions, and discriminates against, constrains or excludes those found abnormal or defective (Rose 2001: 2, emphasis in original).*

In this rhetorical use of eugenics, it is argued that even though twenty-first century eugenics rely upon and mobilise a modus operandi distinct from twentieth-century eugenic state programmes, similar processes of categorisation and (de-) valuation, together with the manifest exclusion of certain bodies from humanness are still at play. State concerns for the fitness of the population and the racial purity of the nation subside into socio-cultural and individual concerns for personal health and possession of specific – enhanced – abilities (Hogle 2008; Rose 2007). The individual freedom to enhance, the individual freedom to have recourse to pre-implantation genetic diagnosis and intervention might give rise not only to a proliferation of so-called 'designer babies,' but also to able-ism, thus a coercive situation for differently-abled people, as the disability movement and disability scholars have forewarned (Haker 2008).

The spectre of eugenics – even if 'liberal' – acts as a cautionary tale. Eugenics relies upon a valuation of human beings, ergo highlights the exclusive and arbitrary character of humanness. However, when used as a rhetorical device against and for human enhancement, humanness – who and what counts as human – is scarcely questioned, and even more rarely challenged. As I will draw attention to, disabilities are negatively valued in discussion about human enhancement – especially on part of its advocates. This becomes all the more palpable and striking as the question of 'species typical (or normal) functioning' is introduced in the definition of human enhancement, which raises questions concerning the fate of those who do not conform to the changed standards, norms, and ideals brought about by human enhancement. These individuals might not be considered 'fit' and be 'thought of to be of lower, inferior, defective, of diseased stock' (Rose 2007: 54). As I will discuss, should human enhancement be underpinned by a latent able-ism (i.e a systemic d/evaluation of humans based on ability and what is regarded as able-bodiedness), it might amount to 'normation' (Foucault 2009a: 59), a situation in which every differently-abled body might be excluded from proper (post-) humanness.

48. There, the tension between freedom and coercion intersects – and might be found conflicting – with another issue that informs and delineates human enhancement: the aforementioned issue of equity, justice, and (re-) distribution. The latter is itself based on a tension that has historically had political philosophy (pre-) occupied, that is, the tension that takes place between freedom and equality. These questions are beyond the scope of this thesis, but it can be noted that John Rawls's theory of justice, with his notion of redistributive justice and his view of justice as fairness, is exemplary of political-philosophical attempts aiming at reconciling freedom and equality. See Rawls, John. 1999 [1971]. A Theory of Justice. Oxford and New York: Oxford University Press. Similarly, and still within modern liberal humanism, Allen Buchanan, Dan Brock, Norman Daniels, and Daniel Wikler (2000) try to devise an ethical framework that combines reproductive freedom/autonomy, justice, and the prevention of harm in the context of genetics and human enhancement through genetics.

2. Human Enhancement as Normation

As made manifest by the spectre of eugenics, what and who counts as human within human enhancement is a vital issue, one that cannot be blackboxed in the concepts of human nature or posthuman future – which are also exclusionary concepts, as seen in chapter one, as they consecrate the modern liberal humanist subject as the one true post/huMan. Therefore, this section further addresses the question of humanness and who/what counts as human in human enhancement, especially as it is framed by its advocates. First, I will discuss how human enhancement tends to devalue disabilities while partaking and reinstating the 'ideology of ability' (Siebers 2008). Second, as I will introduce the concept of 'species typical (or normal) functioning' that has been used to define what counts as human enhancement, I will draw attention to the centrality of norms in the phenomenon of human enhancement and alert on the latter's likeliness to become a system of normation. The introduction of the concept of the normate and its othered, differently-abled, bodies will be particularly helpful in highlighting whose bodies count as (post-) human within human enhancement.

2.1. Human Enhancement as a De/valuation of Dis/abilities

In discussions about human enhancement, especially on part of its advocates, disabilities tend to be negatively valued. In this respect, Buchanan, Brock, Daniels, and Wikler insist on prospective parents' moral responsibility 'to avoid the birth of persons with serious disabilities,' and even call for the state to design policies in this direction (Buchanan et al. 2000: 184). Similarly, Julian Savulescu speaks of 'procreative beneficience' with regard to the moral responsibility of prospective parents to select the child(ren) who can be expected to have the best life, i.e. 'whose life can be expected, in light of the relevant available information, to go best or at least not worse than any of the others' (Savulescu 2001: 415; Savulescu and Kahane 2009: 274).

In both accounts, and against the disability movement's claims and self-understanding, the distinction between impairment and disability is downplayed, not to say ignored and disregarded: the responsibility of, and for, disability rests with the individual and is an attribute of the body while society is expunged, thereby promoting, even if only implicitly, an individualised and essentialised conception of (dis)ability[49] (e.g. Buchanan et al. 2000: 278; Savulescu and Kahane 2009: 286). In this respect, the definition advanced by Julian Savulescu and Guy Kahane is exemplary.

49. This view is consistent with the medical model of disability, which has been dominant until the 1980s. The medical model construes disability as impairment, or rather the difficulties and limitations suffered and undergone by people living with disabilities are considered to result only from their impairment, from their impaired body. In this model, disability is viewed as necessitating a medical – rather than social – intervention or 'fix' (Shakespeare 2006; Silvers 2012). This conception has been the object of severe critiques by the disability movement and scholars and replaced by the social model of disability. In the latter, not only is disability regarded as a form of variation amongst human beings, hence normal, but it is also conceived as (resulting from) the interaction(s) between an impaired body and its environment. There, disability is socially constructed; or rather the limitations and disadvantages experienced by people living with disabilities stem from society and biased social practices, and therefore can be mended and remedied through social and political reforms. Some critiques have been issued towards the social model of disability, as the body, or the corporeal, should not be seen as pitted against the social, insofar as an impairment is always situated – contextual and variable, as well as subject to different socio-cultural and material-discursive valuations. Furthermore, as Tom Shakespeare argues, in practice, disability and impairment are intertwined and are part of a continuum rather than dichotomous poles (Shakespeare 2006: 36-37). '[I]mpairments may not be a sufficient cause of the difficulties which disabled people face, but they are a necessary one,' he adds (34). As they will attend to the kind of intimate relationships between humans and technologies that human enhancement might entail, chapters five and six will address some of these issues.

Disability is

> *a stable physical or psychological property of subject S that (1) leads to a significant reduction in S's level of well-being in circumstances C, when contrasted with realistic alternatives, (2) where that is achieved by making it impossible or hard for S to exercise some ability or capacity, and (3) where the effect on well-being in question excludes the effect due to prejudice against S by members of S's society (Savulescu and Kahane 2009: 286, emphasis in original).*

With the prospect of widespread and all-encompassing pre-implantation genetic diagnosis and selection, even though society – through its members' (potential) prejudice – is mentioned, disability is a subject's property, and responsibility and blame lie with the subject as well as his or her parents. This conception is also present in the account given by Buchanan, Brock, Daniels, and Wikler who, in the name of justice, explain that

> *[w]e devalue disabilities because we value the opportunities and welfare of the people who have them. And it is because we value people, all people, that we care about limitations on their welfare and opportunities … Thus, there is nothing irrational, motivationally incoherent, or disingenuous in saying that we devalue the disabilities and wish to reduce their incidence while valuing existing persons with disabilities, and that we value them the same as those who do not have disabilities (Buchanan et al. 2000: 278).*

In this view too, disability is a property of the individual body and is intrinsically linked to one's worth. Disability being viewed as residing within one's body, society and processes of disablement are expunged while physical difference is conceived as being 'a failing, incomplete and inferior [and] marks disabled embodiment as deeply devalued, not so much for what it is, but for what it fails to be' (Shildrick 2009: 42, my emphasis). In such a conception that silences the lived experience of differently-abled people, it is also easier, more sensible and convenient to change – enhance – some bodies and/or to prevent certain – handicapped or differently-abled – bodies from being born, than to hold accountable, question, transform and reform society and its prevailing norms (Haker 2008: 196).

In fact, implicit in the notion of prospective parents' moral responsibility or 'procreative beneficience' is the equation of a good life, or even a life worth living, with one's bodily abilities and impairments. Recalling once more Savulescu and Kahane,

> *[i]n the context of procreative choices, … what matters is not whether particular disabled people have had good lives, but whether parents can reasonably believe that a child with deafness or some other condition is likely to have a better life than a child without this condition (Savulescu and Kahane 2009: 286, emphasis in original).*

This is in view of such frameworks that eugenics is recalled and is at times used as a rhetorical device. A valuation of human bodies is at play in these conceptions, epitomizing that humanness is a highly normative and exclusive notion.

Besides, as the reception of the cochlear implant has showed, technologies that are conceived as an improvement by their developers can be resisted by their target group who do not consider themselves to be disabled and who thereby oppose the normative underpinnings of technological interventions aiming at remedying deafness. For many deaf people, being deaf is not being disabled but being part of a community with its language and culture. Against Savulescu and Kahane, and their conception of the 'best life' for (the selection of) enhanced or un-impaired individuals, so-called technological enhancements in the form of a cochlear implant are here conceived as an oppressive disciplining that is informed by able-ism. As a matter of fact, what the controversy over the cochlear implant, and more generally the disability movement and scholarship brings attention to is the normative import of human enhancement and the value-ladenness of 'the human.' More particularly, these accounts of human enhancement participate in and reaffirm the 'ideology of ability,' wherein '[a]bility is the ideological baseline by which humanness is determined. The lesser the ability, the lesser the human being,' as Tom Siebers puts it before adding that, in fact, '[t]he value of a human life arises as a question only when a person is disabled. Disabled people are worth less than non disabled people' (Siebers 2008: 10). As framed by its proponents, human enhancement becomes the herald of this ideology of ability wherein certain bodies do not count as fully human – and even less as posthuman. As I will show, this becomes all the more palpable and striking as the question of 'species typical (or normal) functioning' is introduced in the definition of human enhancement. That is, humans are being valued against implicit norms, conceptions of normality, and a general notion of 'species normal (or typical) functioning.' When human enhancement is framed along these lines and underpinned by the ideology of disability and latent able-ism, it might amount to 'normation' (Foucault 2009a: 59), a situation in which every differently-abled body might be (ever more) excluded from proper (post-) humanness.

2.2 Human Enhancement as Normation

'Species Typical Functioning' and the Intertwinement of Norms and Normality

Enhancement technologies are conceived as potentially or ultimately bringing human beings beyond what is currently understood as 'species typical (or normal) functioning.' If 'species typical/normal functioning' consists of a statistical distribution of human variation in terms of e.g. abilities, wherein normal distribution takes the shape of a bell curve, it has also become a value-laden, highly political, and ultimately normative concept.

With respect to 'species typical/normal functioning,' normality is differently distributed; in fact, normality is a distribution. Some (statistical) distributions (of abilities) might be considered more 'normal' or 'favourable' than others, and as such some processes of 'normalisation' might be at play – e.g. the implementation of mechanisms that ensure that the least favourable distributions of normalities are brought towards the most favourable, as in the case of epidemic or mortality rate (Foucault 2009a: 59-65) – but variation is the norm. In Michel Foucault's words, 'the norm is an interplay of differential normalities' (Ibid.: 65[50]), and it amounts to the centre of the (statistical) curve. One's distance from this average point – the norm – defines one as (more or less) normal or abnormal.

Yet, while norms and normality can only be understood in context (Canguilhem 1989), as the government and management of (human) life has become pivotal and societies biopolitical, statistics, classifications, and taxonomies have been institutionalised; and with this institutionalisation, the biomedical field has '[become] increasingly oriented toward bringing about the normal, confusing a statistical construct with actual wellbeing' (Lock and Nguyen 2010: 45). The abnormal, associated to the pathological and deviance became value-laden and progressively 'moved into the sphere of – almost everything. People, behaviour, states of affair, diplomatic relations, molecules: all these may be normal or abnormal' (Hacking[51], quoted in Ibid.: 46). In fact, while all pervasive, the 'normal' and the concept of normality are far from neutral: they are imbued with morality, with values and normativity (Hogle 2005: 699). That is, the normal fluctuates, or rather is inhabited by a tension between what is and what ought to be, between an average and an ideal. Building upon and giving an account of Ian Hacking's The Taming of Chance (1990), Margaret Lock and Vinh-Kim Nguyen explains that

> *[t]wo ideas, therefore, are contained in the one concept of normal: one of preservation, the other of amelioration. As Hacking aptly puts it: "Words have profound memories that oil our shrill and quick rhetoric"; the normal now stands at once "indifferently" for what is typical, the "unenthusiastic objective average, but it also stands for what has been, good health, and for what shall be, our chosen destiny." Hacking concludes that this benign and sterile-sounding word, normal, has become one of the most powerful (ideological) tools of the 20th century (Lock and Nguyen 2010: 46).*

Normality and normativity intertwine – and, according to Hacking, can in their most extreme configuration precipitate eugenics, the normal acquiring a moral quality and amounting to e.g. fitness but ultimately to a(n e)valuation of bodies' worth. In the name, and guise, of what is (considered as) normal, certain behaviours have thereby been subjected to processes of normalisation, or rather, normation. Behaviours (e.g. historically, homosexuality and female prostitution) deemed to be immoral, anti-social and/or not

50. 'La norme est un jeu à l'intérieur des normalités différentielles' (Foucault 2009: 65).
51. Hacking, Ian (1990) The Taming of Chance. Cambridge: Cambridge University Press: 160.

conform to the prevailing mores, conventions and values – attributes with which the contemporary, and previously mentioned, 'life not worth living' bears an uncanny resemblance – could be designated and stigmatised as abnormal – pathologised, medicalised and/or criminalised (Hogle 2005: 699).

Human Enhancement and the Normation of Bodies

In connection to human enhancement, and its delineation as an urgent ethical issue, the concept of 'species typical/normal functioning' carries the tension (identified by Hacking) between average and perfection that inheres in 'the normal.' While a statistical average, it is also what ought to be, a state (of perfection) to strive for – e.g. the huMan for bioconservatives and the posthuMan for transhumanists, the disembodied modern liberal humanist subject in any case. With human enhancement and the possibility to have recourse to enhancement technologies, having a certain height and body shape, being able to see and hear at a specific distance, being capable of concentrating and scoring a particular number at Intelligence Quotient (IQ) tests and, one can imagine, exhibiting certain behavioural traits, abilities and skills might become standards one has to conform to, strive for, and/or reach – they might ultimately become the norm and what is considered 'species typical/normal functioning.' In this frame, human enhancement and enhancement technologies become instances of normation[52]. There,

> *ce qui est fondamental et premier …, ce n'est pas le normal et l'anormal, c'est la norme. Autrement dit, il y a un caractère primitivement prescriptive de la norme et c'est par rapport à cette norme posée que la détermination et le repérage du normal et de l'anormal deviennent possibles. … [I]l s'agit d'une normation plus que d'une normalisation. Pardonnez le mot barbare, enfin c'est pour bien souligner le caractère premier et fondamental de la norme*[53] *(Foucault 2009a: 59).*

In normation processes, the norm is central. It constitutes what one has to conform to and strive for, it is both the standard and the ideal. Being regarded as normal or as pertaining to a state of normalcy is to conform to the norm, hence to occupy, as I shall address, the position of the invisible – i.e. unmarked by difference construed as abnormality – and putative universal subject. The abnormal is the one deemed deficient and inferior in relation to the norm(al). Indeed, as critical disability studies scholar Margrit Shildrick recalls, in the dualistic mode of thinking that informs our modern conventions, when

> *someone is defined by a form of anomalous embodiment … she ceases to be an equal, and becomes the lesser term in a hierarchical binary in which the unmarked self is dominant (Shildrick 2009: 20).*

52. Assuredly, human enhancement might also become a normalization process as the (statistical) distribution of variation in terms of abilities is likely to change. However, to emphasise the primary character of the norm, I refer to Foucault's concept of normation.

53. '[W]hat is fundamental and primary…, it is not the normal and the abnormal, it is the norm. That is, there is an originally prescriptive character of the norm and the determination and the identification of the normal and the abnormal becomes possible in relation to this posited norm. … [W]hat is involved [here] is a normation rather than normalization. Forgive the barbaric word, I use it to underline the primary and fundamental character of the norm' (Foucault 2009a: 59, my translation).

It is this marked subject who is othered and subjected to discipline. Foucault has explained in Discipline and Punish that through its distribution in the networks of discourses and practices of institutions such as the hospital but also the army, the factory, schools, '[t]he human body [has entered] a machinery of power that explores it, breaks it down and rearranges it … not only so that [bodies] may do what one wishes, but so that they may operate as one wishes, with the techniques, the speed and the efficiency that one determines. Thus discipline produces subjected and practiced bodies, "docile" bodies' (Foucault 1977 [1975]: 138-139). As the body is subjected to discipline it is ordered and segmented; it is subjected to normation. Indeed, in Foucault's understanding, normation is intrinsic to disciplinary mechanisms that take hold of the body and in which technologies are central (Foucault 2009a: 65). I will elaborate the latter aspect in chapter four.

The Normate and Differently-Abled Bodies

Interestingly enough, in her groundbreaking and founding work in the field of disability studies, Rosemarie Garland-Thomson has coined the term 'normate' to characterise the (normative) position occupied by the unmarked subjects. In the dualistic mode of thinking that informs our modern conventions,

> *[t]his neologism names the veiled subject position of cultural self, the figure outlined by the array of deviant others whose marked bodies shore up the normate's boundaries. The term normate usefully designates the social figure through which people can represent themselves as definitive human beings. Normate, then, is the constructed identity of those who, by way of the bodily configurations and cultural capital they assume, can step into a position of authority and wield the power it grants them (Garland-Thomson 1997: 8, emphasis in original).*

The hierarchical relation between the normate and its deviant and marked others resonates with the dualism between sameness and otherness that is inscribed in our binary structure of thinking inherited from Modernity. Deviant and marked bodies – other(ed) bodies – act as constant reminders and somewhat enforcers of the normative standard, i.e. the unmarked body of the normate that incarnates and signifies sameness (Shildrick 2002: 28). As she evidences the unreachability yet compelling aspect of the norm, Garland Thomson also illustrates and attests to 'the power of the normate subject position' by equating the (vain) actions often undertaken by people to attempt to reach, fit, and conform to this condition, to the effort deployed by Cinderella's stepsisters to 'squeeze their feet into her glass slipper' (Garland-Thomson 1997: 8). For the disability scholar, the normate is an exclusive subject position, one that is fitted by a very small – and highly specific – number of embodied subjects. In this respect, as Shildrick explains,

> *[t]o be named as differently embodied is already to occupy a place that is defined as exceptional to some putative norm, rather than simply represent one position among a multiplicity of possibilities (Shildrick 2009: 1, my emphasis).*

Implicit in the term 'differently-abled' is the existence – and reference to – a norm, to a normative embodiment. The latter is generally 'the unmarked category, the taken-for-granted standard, and the dominant power' (Ibid.: 174), and has historically been incarnated by Western white rather young middle-class heterosexual able-bodied men. With human enhancement and enhancement technologies gaining momentum, the norm is likely to be reconfigured together with the unmarked bodies, while any and every non-technologically enhanced body might join the ranks of those regarded as differently-abled – disabled.

While technologically enhanced bodies might become the new 'normal' with human enhancement, the ways in which Aimee Mullins and Oscar Pistorius have been covered by the media are rather exemplary of the othering processes differently-abled bodies are subjected to. Both Mullins and Pistorius had bilateral below-the-knee amputations in their early childhood – at eleven months for Pistorius and a one year old for Mullins – and both broke record at Paralympics games while they were fitted with the Flex-Foot Cheetah® blades designed and manufactured by the Icelandic company Össur. These prostheses have been construed as human enhancement, to the extent that Pistorius was accused of 'techno-doping' in 2008, his prosthetic legs being seen as giving him an unfair advantage over able-bodied runners. For their accomplishments, Mullins as a disability activist, an athlete, a model, an actress, and a spokesperson for the famous cosmetics company L'Oréal®, and Pistorius as a model and winner of tens of medals at athletics championships (and later as being formally charged in February 2013 for the murder of his girlfriend), they both have received much media attention. Both Mullins and Pistorius have never been seen as normal, i.e. able, bodies however, but as always navigating between disability and super-ability, between pity and super-achievement (Booher 2009; van Hilvoorde and Landeweerd 2009). As Joseph Shapiro explains,

> *[t]o be lauded for superachievement is to suggest that a disabled person can turn pity into respect only at the point of having accomplished some extraordinary feat (Shapiro 1994: 60[54], quoted in Booher 2009: 54).*

Therefore, if Mullins and Pistorius both incarnate the figure of the 'supercrip' (Ibid.), they are nonetheless marked as differently-abled[55]. Even though their (super-) achievements have brought them respect – and fascination – their prosthetically-fitted bodies are still marked as other. Those 'who can represent themselves as definitive human beings,' to use Garland-Thomson's phrasing, that is, those who counts as human and whose bodies fit the contours of proper humanness are but a few and a vivid reminder of the highly normative aspect of humanness.

Against this backdrop, with respect to the discussion on human enhancement, it is rather safe to assume that the notion of 'species typical/normal functioning' is informed and possibly inhabited by 'the normate.' Therefore, with regard to the ways in which human enhancement is delineated and framed as an issue, to posit 'species typical/normal functioning,' or even a specific ability, or a set thereof as what is normal is neither to describe the result of a natural phenomenon or of an evolutionary process, nor to report on a statistical median. Rather, and Buchanan et al. as well as Savulescu and Kahane's conception of a valuable life can be reminded here, it is a highly value-laden and normative operation (Scully and Rehmann-Sutter 2011: 93), one that creates and constitutes a valuation of human beings and establishes what and who counts as human. In fact, the concept of human enhancement begs the question of what abilities are deemed valuable and worth being enhanced, and for whom. In their ignorance (at best) or disregard (at worst) of disability studies, and of feminist, postcolonial and post-Foucauldian scholarships, the aforementioned views of what counts as a valuable life are likely to rely on the normate as the prototype of the normal, and to value the life of those in the unmarked and dominant subject positions as the only one worth living – or at least as the criteria against which all the/its others are evaluated, i.e. the norm. In this context, human enhancement can be expected to constitute a very exclusive and oppressive notion. If left unquestioned and unexamined critically, human enhancement will amount to the enhancement of certain humans, to the enhancement of Man – that unmarked body who counts as the proper human and relies upon the othering, or marking, of non-human, non-white, non-male, non-heterosexual, differently-abled bodies within a modern liberal humanism worldview (Braidotti 2002; Haraway 1991; Harding 1998; Hayles 1999). There, huMan enhancement will prevail.

Furthermore, as enhancement technologies become available, what constitutes 'species typical/normal functioning' is likely to be reconfigured and abilities are likely to be not only differently desirable but also hierarchically valued. In fact, human enhancement and enhancement technologies might reinforce the tension between average and ideal that informs what is considered to be normal. In Linda Hogle's words,

> *as a norm comes to stand for something to strive for, rather than a centered, neutral, or positive condition, the average comes to be seen as the deficient (Hogle 2005: 699).*

Certain (enhanced) abilities can be expected to become the norm, and humans will become evaluated – they will count as more or less human, their life will be regarded as more or less worth living – on basis of the possession or the lack of these (enhanced) abilities (Haker 2008: 196).

Humanness – who and what counts as (putatively properly) human – is at stake within human enhancement. This becomes particularly clear when attention is drawn to the ways in which human enhancement, or rather human enhancement as it is framed by some of its proponents (be they transhumanist or not), is underpinned by and operates a devaluation of disabilities. With the intertwinement of the norm and the normal in the concept of 'typical species functioning' and the correlate consecration of the normate – or its technologically enhanced version the posthuMan – at the expense of putatively differently abled bodies, who tend to be regarded as always already disabled, human enhancement – as it is delineated in discussions about it – tends to become a system of normation. In fact, as it partakes in and reinstates the (ableist) ideology of disability, human enhancement becomes a highly exclusionary phenomenon. Another element contributes to this state of affairs: human enhancement is rarely, if ever, apprehended as a configuration of human-technology relations. Rather, with the normate as both baseline and horizon of human enhancement, the latter is construed as a steady improvement (see also chapter one). Dualisms pervade while the figure of the huMan/posthuMan reigns.

54. Shapiro, Joseph. 1994. 'Disability Rights as Civil Rights: The Struggle for Recognition.' In Jack A. Nelson. Ed. The Disabled, The Media, and the Information Age. New Hampshire: Greenwood Publishing Group: 59-67
55. In this respect, this encapsulation of Mullins and Pistorius in the figure of the super-crip can also be construed as an instance of normation.

3. Unpacking Human Enhancement: The Intertwinement of Bodies, Technologies and Humanness

Conceptions of what constitutes proper humanness inform the ways in which human enhancement is framed and defined. In addition, while hardly interrogated and rather taken for granted, the concept of enhancement further contributes to equate human enhancement with normation. In fact, as I shall describe, modern dualisms resurface and sediment when the particularities of (human) enhancement are addressed, thereby reasserting the normate as the poshuMan horizon. Finally, after having foregrounded the intertwinement of bodies, technologies and humanness by relying upon the practice of cosmetic surgery, I will rely upon this example to open the possibility for human enhancement to become something else than an instance of normation while reaffirming the importance of apprehending it as a human-technology relation.

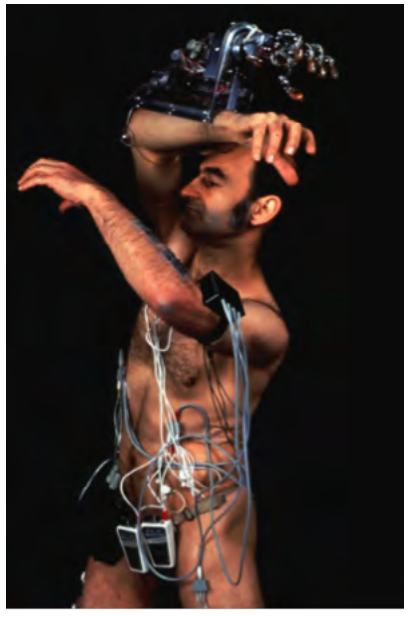
3.1 Antiseptic Enhancement and Reinforcement of Modern Dualisms

Enhancement is generally contrasted with – and opposed to – therapy in the human enhancement debate. While therapy is conceived as the objective and proper goal of medical care, enhancement is construed as going beyond the restoration of health or of a condition (Parens 1998). It is understood as improving human abilities and even as going beyond the now infamous 'species typical/normal functioning.' In short, whereas therapy is about making people better, enhancement aims at 'making better people,' to use John Harris's well-known turn of phrase (Harris 2007). This distinction acts as a boundary marker for what is considered to be a legitimate and conversely dubious part and use of medicine and healthcare (Kass 2003: 13). In this line, it is argued that contrary to the therapeutic process that comes to an end when health is restored, there are no intrinsic measures or limits to enhancement. The latter opens up an infinite space of possibilities and is likely to become an accumulation process, one enhancement becoming the starting point for the next (Coenen et al. 2009: 20). Yet, enhancement and therapy are part of a continuum rather than opposite poles. Their distinction is rather fluid, and limit cases abound. Vaccination, which can be construed as (preventive) medicine or as the enhancement of the immune system; dual uses phenomena, namely the fact that what may be therapeutic in one circumstance can be considered an enhancement when used by healthy individuals; and the unintended effects of some therapeutic treatments or reconstructive surgeries that may exceed the restoration of good health or physical condition, all blur the boundaries between enhancement and therapy (Bess 2010: 646-647).

Yet, dualisms are obstinate. Dualism is the systematic organising and ordering of the world's complexities into binary categories – i.e. either/or; good/bad; man/woman; nature/culture. As dualism is deeply ingrained in (modern) Western science and culture, not only do these categories seem like natural realities, but they are also situated in – and naturalise – an asymmetrical hierarchical relation with one another, one term being the devalued yet necessary half of the pair (Åsberg 2010b; Braidotti 2002; Haraway 1991). The distinction drawn between cognitive and physical enhancement submits evidence to the perseverance and pervasiveness of dualisms as it reinstates the infamous Cartesian dualism between mind and body – the latter being present too in transhumanist conceptions of the posthuman as I have addressed in chapter one. Man's true essence rests in the mind, He is a thinking substance. The body is the devalued half of the binary and is regarded as inert and passive matter (Blackman 2008; Grosz 1994; Shildrick 1997; Shildrick and Price 1998; Sullivan and Murray 2009). Such dualisms also inform the reductionism inherent in some of the assumptions that guide human enhancement. There is a tendency to assume, especially in as concerns (psycho-)pharmacology, that 'all behaviour, interactions and physiological functions are related to neuronal structures. … To make a person happier, more outgoing or better able to perform mental tasks, then, requires taking psychopharmaceutical drugs' (Hogle 2005: 707-708). While this perspective erases the fact that people are part of a general environment and live in a certain milieu, it reinstates the mind, subsumed in neuronal structures and more generally the brain, as the source of our very being. As the notion of a disembodied mind – and a mindless body – is promoted, the modern liberal humanist subject triumphs yet again.

Enhancement as it is exclusively conceived in linear terms becomes highly hygienic or 'antiseptic' to use Ansell-Pearson's formulation concerning the type 'posthumanism' upheld by transhumanists. However, enhancement is itself an ambiguous and polysemic term, one that encompasses a vast and equivocal range of meanings (Bateman and Gayon 2009; Bess 2010; Kass 2003). Although the word enhancement is predominant in the discourses dealing with the issue of human enhancement, the terms improvement, increase, and addition, as well as the more popular – and technologically connoted – boost or upgrade are also encountered. Furthermore, enhancement is rooted in the English language; it has no equivalent in French for instance, where it becomes augmentation – augmentation humaine. In fact, depending on what is being enhanced, other words than enhancement might be more appropriate. As Simone Bateman and Jean Gayon note in their exploration of the term enhancement, appearance and beauty can be improved; abilities can be increased, extended, augmented, or even upgraded; mood can be changed, altered, regulated, or even boosted; while in controversies concerning the use of pre-implantation genetic diagnostic and selection, and genetics in general, the terms perfection or designer as in the perfect or designer child are more frequently used (Bateman and Gayon 2009). Moreover, enhancement technologies radically alter abilities and bodies, thus (re-) engineering, transformations, (re-) compositions, or 'meta(l)morphoses' (Braidotti 2002: 212-264) might constitute more appropriate designations of the ways in which enhancement technologies operates on and intimately interact with bodies. Human enhancement needs not be(come) an instance of normation.

Jerry Jalava and his USB prosthetic finger[56]



Stelarc's Third Hand Project[57]

56. Finnish software developer Jerry Jalava lost his fourth finger in a motorcycle accident, and replaced it with a USB stick. See: http://www.flickr.com/photos/jerry_jalava/sets/72157615074278472/ [Last accessed April 20th 2013].
57. Source for Third Hand Project: http://stelarc.org/?catID=20265. See also Stelarc's Exoskeleton Project http://stelarc.org/?catID=20227 [Last accessed April 20th 2013].

In this regard, the transformation of Jerry Jalava's right forth finger into a Universal Serial Bus (USB) prosthesis or the 'amplified' yet 'involuntary' or 'excessive' body of Australian artist Stelarc in his Third Hand Project (1980-1998) are exemplary. In Bateman and Gayon's words,

> *[t]he polysemy of the word enhancement testifies to the inherent difficulties of the enhancement theme: one constantly switches from simple change to improvement, to enhancement, and even to radical transformation (Bateman and Gayon 2009: np).*

However, despite this equivocality, enhancement is viewed in linear terms. As I have addressed, in the discourses surrounding – and enacting – human enhancement, and especially in the discourses of its proponents, human enhancement is viewed in an evolutionary perspective, where evolution dissolves into telos, the telos of posthumanity (e.g. Roco and Bainbridge 2003; Bostrom 2009). In this teleological frame, enhancement is always for the better and amounts to improvement, and the latter is twofold as it accomplishes both the improvement of human beings and the betterment of humanity.

Synonym of improvement in its mainstream understanding, enhancement becomes an all-encompassing term that erases its ground: what is being enhanced in human enhancement and 'the human' – or conceptions thereof – of hum(M)an enhancement are abstracted yet highly normative notions. As such, not only does enhancement tend to amount to normation but it is also scarcely conceived as entailing (intimate) relations between humans and technology. While all the aforementioned elements constituting human enhancement – i.e. the arbitrariness of putative proper humanness, the becoming normation of human enhancement, the normate as its baseline and horizon, its hygienic or antiseptic dimension – will come together as I will review the practice of cosmetic plastic surgery, the latter considered to be a type of enhancement technology, this example will also illustrate how human enhancement should be conceived as involving intimate relations between bodies and technologies wherein humanness and the enactment thereof is at stake.

3.2. Remaking Bodies with Technologies, Enacting Humanness: Cosmetic Plastic Surgery as Example

'The human' and human enhancement are situated in a 'nexus of complex social, political and historical relations, media representations and medical and legal definitions,' Hogle remarks (2005: 696). Judgements about what a human being is, who and what qualifies as human, and what would qualify as enhancement differ among societies and over time. Similarly, the notion of 'species typical/normal functioning' is not a fixed standard; it is rather historically, socially, culturally, and technologically situated, and can therefore be expected to change through time (Bess 2010: 644-645). In this respect, 'John Mackie once said to me that if human genetic engineering had been available in Victorian times, people might have designed their children to be patriotic and pious,' Jonathan Glover recalls (Glover[58], quoted in Bostrom and Roache 2008: 23). Yesterday's values differ from those that prevail today, and technologies are an important component of moral change (Swierstra, Stemerding and Boenink 2009; Verbeek 2011). More generally, as science and technology studies (STS) scholars have forcefully shown, technologies convene and convey values and norms while they are agential and transformative. However, technologically enhancing abilities that are currently regarded as inherently desirable and/or necessary for having a life supposedly worth living in Western societies negates the contingency and situatedness of norms and values. As technologies are conceived as instruments that inscribe and fix the latter in the body of the (post-) huMan, these norms and values become naturalised and essentialised. Against technomoral change, or the evolution of morality with technology (Swierstra et al. 2009), and against the fact that technologies are moral agents, or at least carry morality (Latour 1992; Verbeek 2011), in this delineation of human enhancement – e.g. the aforementioned Buchanan et al. (2000), Savulescu and Kahane (2009), and more generally, the transhumanists –, technologies are conceived as (value-) neutral instruments, as means used to reach human/huMan determined goals.

The current practice of cosmetic plastic surgery – understood here as an enhancement technology – illustrates and materialises not only the normative import and arbitrariness of humanness but also the ways in which it is intertwined and (re-) enacted in the relations between bodies and technology. While feminist scholars have drawn attention to the disciplinary character of this surgical procedure, especially with respect to the making – and normation – of a typically feminine body (e.g. Bartky 1997; Davis 2002; see Hogle 2005), some artists have used cosmetic surgery to emphasise the arbitrary character of norms, the arbitrariness and contingency of what and who counts as human. To the risk of reiterating and re-enacting the dualism between therapy and enhancement I refer here to elective, rather than reconstructive, plastic surgery; the latter being 'performed to correct congenital abnormalities or damage from an injury' while the former is not 'performed ... as treatment of illness' (Hogle 2005: 704).

Thin(ner) noses, a soft skin that shows no sign of age(ing) or cellulites, big(ger) or smal(ler) breasts, tight(er) bellies, skinni(er) tights, well-defined pectoral muscles and buttocks, are some of the items that appear on the menu of plastic cosmetic surgery to attain and obtain the contemporary ideal body. Yet, as Sandra Lee Bartky explains with respect to the desirable and desired – normative – female body,

> *[s]tyles of the female figure vary over time and across cultures: they reflect cultural obsessions and preoccupations... Today, massiveness, power, or abundance in a woman's body is met with distaste. The current body of fashion is taut, small-breasted, narrow-hipped, and of a slimness bordering on emaciation; it is a silhouette that seems more appropriate to an adolescent body or a newly pubescent girl than to an adult woman. Since ordinary women have normally quite different dimensions, they must of course diet (Bartky 1997: 132).*

Or have recourse to cosmetic plastic surgery, one might add. This disciplining and normation of the female body to attain – enact or perform – the ideally "feminine" and putative aesthetically pleasing body, a docile body that conforms to the gendered and racialised norms of humanness, is however historically, culturally, and technologically situated (Bordo 1997: 103).

In this respect, French carnal artist Orlan, exemplifies, or rather incarnates, the arbitrariness of the Western norms of beauty, and ultimately the arbitrariness of putative humanness – who and what counts as human. Orlan has invested herself in the art of 'self-portraiture in the classical sense, but realised through the possibility of technology.'[59] She uses her own body and the procedures of cosmetic surgery to make 'Carnal Art.' In line with postmodernism, its linguistic turn, and the conception of the body as text, 'Carnal Art transforms the body into language, reversing the biblical idea of the word made flesh; the flesh is made word.'[60] In the nine surgical operations that compose 'La réincarnation de Sainte-Orlan' (The Reincarnation of Saint Orlan), a performance that lasted from 1990 until 1993, Orlan has had her body, and especially her face, transformed so that she would incarnate five different – and from different times – Western canons of beauty: Venus, Psyche, Mona Lisa, Europa, and Diana.

Orlan (1993) 'Omnipresence'

Seventh surgical operation performance, New York

58. Glover, Jonathan (2006) Choosing Children: The Ethical Dilemmas of Genetic Intervention. Oxford: Oxford University Press: 98

59. Orlan's Carnal Art Manifesto. Source: http://www.orlan.eu/texts/ [last accessed May 1st, 2013]

60. Orlan's Carnal Art Manifesto. Source: http://www.orlan.eu/texts/ [last accessed May 1st, 2013]

Orlan eventually got the chin of Botticelli's Venus, the nose of Gérôme's Psyche, the forehead of da Vinci's Mona Lisa, the lips of Boucher's Europa, and the eyes of an anonymous depiction of Diana from the school of Fontainebleau; and in one of her 1993 performance-surgeries in New York, Orlan has had two implants – usually used to enhance cheekbones – on either side of her forehead. As Orlan explains it in her Carnal Art Manifesto, 'Carnal Art is not against aesthetic surgery, but against the standards that pervade it, particularly, in relation to the female body, but also to the male body'[61]. That is, while she has been swinging between figuration, disfiguration and re-figuration, her aim has not been to attain a commonly held standard of beauty, but rather to question and criticise it. As Petran Kockelkoren explains, albeit with a critical note,

> *Orlan unmistakably flirts with postmodern eclecticism: her face is turned into a collage of historical stylistic figures without a consistent ideal picture. Rather, she has to do it to challenge the aesthetic ideal image of the woman. She shows how the body is subjected to a cultural visual idiom. To thematise that, she blows up the assault by culture on the body in performances. In doing so, however, she subscribes to the historical inevitability of the fact that the body is inscribed. Nevertheless, she seeks a way out in the Baroque: "Carnal Art loves the baroque, the parodical, the grotesque, and other such styles that have been left behind, because Carnal Art opposes the social pressures that are exerted upon both the human body and the corpus of art" (Kockelkoren 2003: 78-79).*

With her flesh composed of historically different canons of beauty, Orlan exhibits and exposes the arbitrariness of prevailing norms (of beauty, of humanness). She also demonstrates how cosmetic plastic surgery, an enhancement technology, is instrumental in making certain bodies 'normal' or beautiful and in defining who and what counts as human in contemporary Western societies. Nevertheless, as she conceives the body as text and as surface of (cultural) inscription, Orlan tends to reinstate the Cartesian dualism between mind and body (Ibid.: 79-80), where the body is passive matter, a blank slate on which culture or the mind can write without being affected and transformed as well by such inscription.

In their collaboration, Australian artist Lucy McRae and Dutch artist Bart Hess explore human enhancement and also draw attention to the arbitrariness of norms, especially with respect to beauty and human shape. Working with materials such as foam, nylons, and balloons, LucyandBart not only critically expose the 'high-tech' import of human enhancement – as it is discursively framed – but also the type of body and human shape that human enhancement is to bring about.

61. Orlan's Carnal Art Manifesto. Source: http://www.orlan.eu/texts/ [last accessed May 1st, 2013].

LucyandBart (2008) Evolution Project: Germination Day One and Germination Day Eight[62]

LucyandBart (2008) Evolution Project (1 & 2)[63]

62. Source: http://lucyandbart.blogspot.nl/ [Last accessed on December, 13th 2011].
63. Source for the photograph on the left (1): http://lucyandbart.blogspot.nl/ [last accessed May, 1st 2013]. Source for the photograph on the right (2): http://www.tumblr.com/tagged/lucyandbart [last accessed May, 1st 2013]. Interestingly, this photograph (2) of the Evolution silhouette designed by LucyandBart and worn by model Caroline Trentini was taken by Nick Knight to accompany an article published in 2010 in the American Vogue on plastic cosmetic surgery. It occupied a full page. See: http://barthess.nl/portfolio/vogue/ and https://models.com/work/vogue-blow-up-1 [last accessed May, 1st 2013].

LucyandBart's Evolution Project explores the materiality of bodies and technologies, and the potentialities and possibilities offered by technologies – be they low-tech prostheses as much as genetic engineering – in redefining and reconfiguring the body. By exploring the potentialities and possibilities of the intimate relations between technologies and bodies, McRae and Hess not only question the norms and conceptions of humanness that inform human enhancement, but also bring to attention the intertwinement of technologies, bodies and humanness. This intertwinement is however not innocent.

The body, and physical appearance especially, has (had) political and moral significance (Braidotti 2002; Buikema 2007; Hogle 2005; Shildrick 2002). Measurements of body symmetry and proportions have been central to definition of fitness and civilisation in eugenic discourses, and practices of anthropometry have been instrumental in nineteenth-century hygienist discourses classifying criminal types and deviant individuals. They have also been pivotal in racialising and inferiorising non-white people, thereby serving as legitimising grounds for the colonial enterprise. The case of the Hottentot Venus is paradigmatic in that regard. After being brought from South Africa to Europe, Sarah Bartmann, the so-called Hottentot Venus, has been exhibited in fairs, freak shows, colonial exhibitions, and 'human zoos' (Bancel, Blanchard, and Lemaire 2000). Her putative monstrous body displayed her otherness in and for the eyes of white Europeans, until she was dissected in 1816 as a scientific specimen by Georges Cuvier and classified as closer to primates than humans: while white Europeans were conceived, in the prevailing scientific paradigms, as the quintessential humans, Sarah Baartman was excluded from the human species, denied the status of human (Buikema 2007: 73-75).

Whiteness has historically stood for the standard of beauty and civilisation. Humanness and whiteness are in fact closely intertwined, one subsuming the other. In other words, whiteness stood, and is still standing, as the norm of and for what and who counts as human. In this respect, cosmetic surgery has been instrumental in essentialising Western whiteness as the standard of what counts as human beauty. In the early twentieth century in the United States of America, the growing momentum of eugenics combined with a climate of anti-Semitism and racism has had people resorting to cosmetic plastic surgery to minimise and erase ethnic features (Hogle 2005: 704-705). Nowadays too, skin lightening, nose and lip reduction, as well as the removal of eye folds are part of the racialising and essentialising paraphernalia used to conform to a Western appearance. In fact, the body is inscribed in networks of power/knowledge, it is even one of their focal point (Foucault 1976), and technologies are not external to these power structures. Bodies, technologies, humanness and power are intertwined. Extrapolating from the example of plastic cosmetic surgery, human enhancement carries the risk of becoming a very normative and discriminatory endeavour. If unquestioned (i.e. blindly accepted or rejected), it is likely to reproduce and strengthen oppressive racialising/racist and gendering/sexist practices. Therefore, the intertwinement of bodies, technologies, humanness and power has to be acknowledged and investigated in the discussion and context of human enhancement, especially as bodies and technologies are entering into ever more intimate relationships.

Conclusion: Materialising Bodies in Technologies, Enacting Humanness

To conclude, technologies, bodies and humanness are intertwined. In the construction of (the issue of) human enhancement, while enhancement is not questioned, the human and technology are black-boxed categories. As discussed in the previous chapter, technology is envisioned as instrumental or substantive, yet always external to human beings, while any consideration of the human is deadlocked around the question of human nature. In this framework, the materiality of the human – the body – and its intertwinement with normativity – humanness – is silenced or disregarded. In fact, the concepts of human nature and the posthuman, as they are conceptualised by bioconservatives and transhumanists, tend to take place in a vacuum. Oblivious of history, disregardful of the normativity of 'the human,' its exclusive and arbitrary character, dismissive of the political and moral significance of bodies, these concepts tend to reproduce the privileged position of the unmarked. As I critiqued the concept of 'typical species functioning' and the way it operates in the phenomenon of human enhancement, I drew attention to the fact that human enhancement might become an instance of normation. As the norms that inform the phenomenon of human enhancement are neither made explicit nor questioned, enhancement technologies might reproduce and reinforce unmarked and normate bodies as the invisible yet potent norm. Different bodies will remain othered as they are measured and (de-)valued against these normative bodies, the only ones worthy of humanness, even if rebranded as 'species typical functioning.' However, as showed with the case of cosmetic plastic surgery, humanness is arbitrary, what and who counts as human is historically situated and a highly political concept. In fact, while the human together with technologies remain blackboxed in the phenomenon of human enhancement, the exclusions and oppressions that have historically informed modern liberal humanism – and conflated who and what counts as human with Man – are likely to be replicated.

The ways in which the concept of enhancement is apprehended, replete with dualisms, also contributes to making human enhancement an exclusionary phenomenon. Furthermore, hidden dualisms impair the comprehension of what is at stake with human enhancement: the latter is hardly conceived as a configuration of human-technology relations. However, to understand what is at stake in human enhancement and what it means to be human in enhancement technologies, it is crucial to explore and conceptualise the intimate relationships that take place between humans and (enhancement) technologies, between bodies and technologies, between humanness and technologies. As the example of cosmetic surgery has foregrounded, the ways in which technologies are reconfiguring the human, in its bodily materiality and as a normative concept have to be accounted for. By exploring the intimate relationships between bodies and technologies, the issue of human enhancement will gain ground and flesh. A first step in this endeavour is to go beyond a modern liberal humanist framework, this exclusionary and anthropologically flawed conception of humans and technology as it will be further explicated in the next chapter. In fact, as chapter three will show, the posthuman and posthumanism have a different genealogy and reality than the one devised in relation with human enhancement, especially by bioconservatives and transhumanists. Stemming from feminist scholarship, especially feminist studies of technoscience, with the cyborg as sibling, the posthuman and posthumanism ignite a different reality and other – more appropriate – ways of apprehending what it means to be human within enhancement technologies.

Chapter Three
Of Cyborgs and Posthumans: Rewriting Posthumanism

The posthuman, through the phenomenon of human enhancement, has inhabited the first part of this thesis. The prospect of a future populated with technologically enhanced humans has given rise to an opposition between so-called bioconservatives and transhumanists, one that has crystallised into the issue of post/human nature. While deadlocked, the positions of both transhumanists and bioconservatives are rather mirror images than irreconcilable stances insofar as they both predicate their celebration and rejection of the posthuman on the figure of the modern liberal humanist subject. As emphasised in the last two chapters, human nature – or conceptions thereof – is a highly politicised question. Humanity in the guise of the modern liberal humanist subject has historically been exclusive insofar as certain bodies – i.e. non-male, non-heterosexual, non-white, differently-abled, non-privileged – have not been considered fully human but rather closer to nature than culture and/or pathologised, that is, de-huManised and de-humanised. If left uncritically examined the phenomenon of human enhancement, as upheld by transhumanists, is likely to become an instance of normation and devaluation of dis/abilities.

How can we apprehend human enhancement, the posthuman and posthumanism differently? The present chapter – like this entire thesis – is informed by this urgency. As a first step, this chapter offers another genealogy of the posthuman and posthumanism. Within it, the poshuman emerges metamorphosed and posthumanism takes on a radically different meaning from the transhumanist and bioconservative version. Through Donna Haraway's Cyborg Manifesto, both modernity as a (non-necessary) artefact and technoscience as an anti-humanist engine are made apparent, highlighting that modern liberal humanist worldviews are not appropriate, and even become an obstacle, to understand what it means to be human in a technological lifeworld. The posthuman, as well as the cyborg, mark the ignition of posthumanism. Envisioning the human as always already embodied and embedded in the world, as always already situated in power relations and entangled with technologies, posthumanist perspectives not only exhibit the flaws and violence of the modern liberal humanist worldview but also devise ways to account for and be accountable to the ways in which bodies materialise with/in technologies.

While this chapter constitutes a break with the former ones, it also revisits them. More precisely, it opens first of all with (re) locating the posthuman that inhabits the phenomenon of human enhancement within its technoscientific and political context. The assumptions that inform the posthuman and its key technoscientific field – cybernetics – are brought into focus and perspective. Through a review of cybernetics, its posthumanist potentials yet (re)framing within a modern liberal humanist framework, the pedestal and self-evidence of modern liberal humanism shatters. Its artifices, such as the separation between humans and technologies, the correlate conception of technologies as mere bodily appendages, somatophobia and the Cartesian mind/body dualism are made apparent. A modern liberal humanist paradigm emerges as inappropriate for apprehending what it means to be human with/in technology, with/in enhancement technologies.

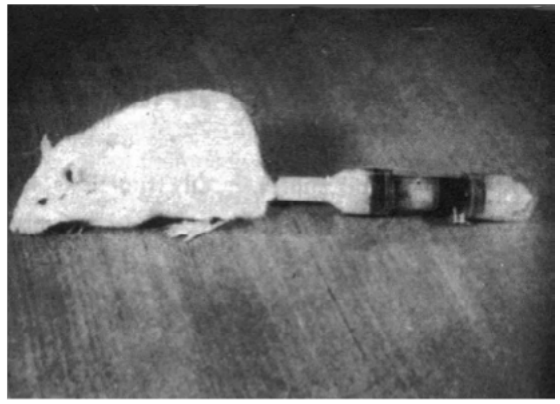
Grounded within cybernetics, this first part resonates with the previous chapters, especially with the transhumanist understandings of the posthuman. Insofar as cybernetics is intrinsically linked to prosthetics, it is also a crucial part for subsequent chapters – prosthetics will be empirically explored in chapters five and six – and this thesis's overall questions concerning how to apprehend and conceptualise the relations between humans and enhancement technologies so as to improve the current discussion on human enhancement. Second of all, the posthuman and cybernetics as apprehended by feminist scholars spark a different – 'critical' – posthumanism. There, the cyborg is identified as human ontology, technoscience is apprehended as intrinsically anti-humanist, and modernity is discerned as a purification process. This a-modern and anti-humanist state of affairs foregrounds the necessity – and urgency thereof – to abandon the oppressive and onto-anthropologically flawed conceptions of humans and technologies convened and conveyed by the human enhancement debate if we are to apprehend what it means to be human with/in enhancement technologies. Third of all, the question of accountability in this endeavour is addressed as the cyborg and posthuman transform into ethico-political figures, namely figures that not only map changing technoscientific and power landscapes but also enact renewed ways of being human. As they expose and decompose the exclusionary patterns of modern liberal humanism while composing, or at least pointing towards liveable, ethical futures, the posthuman and the cyborg emphasise the vital importance of situatedness, relationality and materiality. Fourth of all, it is in light of these dimensions, that (a working conception of) posthumanism is devised. While a posthumanist framework can enable us to account and be accountable for what is at stake with (enhancement) technologies, with bodies, technologies and humanness becoming central dimensions, I finally interrogate how the mundane, intimate relations between humans and technologies have been envisaged in the lineage of the cyborg and the posthuman.

1. Cyborgs and Posthumans, An Ambiguous Genealogy

What do mice have to do with it? Before posthumanity and the posthuman became the dominant and prominent terms to characterise the future of humanity, of a technologically enhanced humanity more precisely, the cyborg was the key word for figuring the human in ever more intimate relations with technology. Historically, the initial posthuman was a nonhuman. The first technologically enhanced being was a rat, one that would take the name of cyborg. The posthuman and its ancestor-sibling the cyborg are ambiguous figures. While they point towards the technological enhancement of human and nonhuman animals, they also incarnate a renewed understanding of being human – a renewed human ontology – through the implosion of categories whose boundaries are foundational for modern liberal humanism, the worldview that informs and is heralded by both transhumanists and bioconservatives. While a particular, technologically enhanced, rodent will open this part, it will be contrasted in the next with another mouse that incarnates our a-modern and posthumanist ontologies in our technoscientific lifeworld. Nonhumans will be guiding figures to map another posthumanism, one that is more appropriate to apprehend what it means to be human with enhancement technologies.

1.1 Posthuman Extensions: The Cyborg and Space

The first technologically enhanced being was a rat (see picture below). More precisely, it was a rat with an osmotic pump inserted in its tail and distributing, at a continuous and controlled pace, i.e. based on biofeedback, a certain dose of drugs or 'biochemically active substances' without further (conscious) attention needed from the organism and apart from the researchers' attention: the latter, while aided with computers, were still setting and monitoring the pump's rate (Clynes and Kline 1960: 74).



(Clynes and Kline 1960: 27)

Although it was the first literal or material, technologically enhanced being, the posthuman idiom did not (yet) apply for this laboratory rat and its osmotic pump. Rather, the two scientists who 'fathered' it coined the term 'cyborg' to characterise it.

Cyborg is the abbreviation chosen by Manfred E. Clynes, then chief research scientist at the Rockland State psychiatric hospital in New York and Nathan S. Kline, a clinical psychiatrist then director of research at Rockland, for 'cybernetic organism.' In 1960, they published a groundbreaking article entitled 'Cyborgs and Space' in the scientific journal Astronautics, in which they envisioned the potentials of altering bodily functions for space travel and explorations, outer space constituting a hostile environment for the human and its organism[64]. For the two scientists, due to the impossibility for humans in space to carry with them their environment, if they are to survive and even live normally in the extraterrestrial environment, the human body must be technologically modified and enhanced[65]. Regulatory devices, such as the osmotic pump or electric stimulation, are to be implanted and to become part of the 'complete space man's kit' so that bodily temperature, radiation tolerance, oxygenation, blood pressure and pulse, among others, can be homeostatically controlled (Clynes and Kline 1960).

64. This article is based on a paper they presented at a symposium on the 'Psychophysiological Aspects of Space Flight, held in May 1960 at the Air Force school of Aviation Medicine in San Antonio, Texas (The United States). This paper was entitled 'Drugs, Space and Cybernetics.'

65. In Clynes and Kline's words, '[i]f man [sic] attempts partial adaptation of space condition, instead of insisting on carrying his whole environment along with him, a number of new possibilities appear. One if then led to think about the incorporation of integral exogeneous devices to bring about the biological changes which might be necessary in man's homeostatic mechanisms to allow him to live in space qua natura' (Clynes and Kline 1960: 27, emphasis in original).

Cyborgs, cybernetic organisms, are couplings of flesh and machine, hybrids of body and technology, they are 'bodies with integrated artificial feedback systems' (Åsberg 2010: 4). In Clynes and Kline's own words,

> *[f]or the artificially extended homeostatic control system functioning unconsciously, one of us (Manfred Clynes) has coined the term Cyborg. The Cyborg deliberately incorporates exogenous components extending the self-regulatory control function of the organism in order to adapt it to new environments (Kline and Clynes 1961: 347-348, quoted in Kline 2009: 331).*

Offspring of the Cold War, the cyborg and its technologically enhanced body transcends the limits of its (human and nonhuman) biology for space survival and world – space – supremacy. Ancestors and siblings of the posthuman and posthumanity, cyborgs – cybernetic organisms – are doubly so: both are not only entities that embody the promise of technological enhancement but they also share a similar conception of (human) bodies, one that is fundamentally indebted to the emergence of cybernetics. It is rather tempting to say that the contemporary fascination with 'posthuman' enhancement and extensions of the body originates with Clynes and Kline's cyborg.

Like human enhancement's posthuman, the cyborg is intrinsically linked to technologies. Cybernetic technologies are as crucial to the cyborg as enhancement technologies stemming from the fields of nanotechnology, biotechnology, information technology, the cognitive sciences, and their convergence are for the posthuman. Osmotic pump and regulatory devices, the technological artefacts that are instrumental in the alteration of the human body (albeit in space) for Clynes and Kline rely upon concepts stemming from the field of cybernetics and its renewed conception of human and animal bodies, machines and their relationship (Kline 2009). If they coined the term cyborg, in attempting to adapt the human to a novel, harsh environment rather than the reverse, Manfred E. Clynes and Nathan S. Kline also applied the principles of cybernetics to the interactions between (human and nonhuman) bodies and technologies (Kline 2009). With references to feedback, control, communication and information, Clynes and Kline convened and implemented cybernetics' central concepts. Indeed, an interdisciplinary field[66] concerned with the investigation and understanding of complex systems, whether living or mechanical, cybernetics has been defined as the 'entire field of control and communication theory, whether in the machine or in the animal' by the American mathematician and engineer Norbert Wiener (1948: 19), one of the founders and leading lights of cybernetics, or as 'a branch of mathematics dealing with problems of control, recursiveness and information' by the British anthropologist Gregory Bateson (quoted in von Foerster 1994). With (positive and negative) feedback as a central concept, cybernetics is the study of communication and control in systems – the latter aspect echoing the Greek origins of cybernetics, kybernetes, which means steersman and is also the roots of government. Few cyborgs (such as Clynes and Kline's technologically enhanced rat) seem however to inhabit the field of cybernetics (Kline 2009). As I shall draw attention to in the next section, while cybernetics had then the potential to radically modify conventional understanding of humans as it blurs their boundaries with other living and non-living systems, it has been recast into acceptable – read modern liberal humanist – limits. In other words, while the cyborg had the potential of renewing our conceptions of human ontology, it has become posthuMan. However, as this chapter will explain, this is only part of its story.

66. Issuing from the Macy Conferences on Cybernetics that took place in New York City from 1946 until 1953, the interdisciplinary field of cybernetics is the result of exchanges between scholars coming from domains as diverse as mathematics, (bio)physics, electronic engineering, information theory, psychiatry, anthropology and even music – among the leading 'cyberneticists', most of them members of the core group of the Macy conferences, Norbert Wiener and John von Neumann were mathematicians, William Ross Ashby and Warren McCulloch were psychiatrists (like Nathan S. Kline), Heinz von Foerster was a biophysicist; Claude Shannon was an electronic engineer, mathematician and founder of information theory; Gregory Bateson and Margaret Mead were anthropologists. Music is a reference to Manfred E. Clynes whose work combined science and music. However, it is Norbert Wiener who is considered the founder of cybernetics. For an overview of the areas of research and practice in cybernetics, from 1940 until 1970 in the United States and Great Britain, refer to Kline 2009 (especially table 1, p. 335).

1.2 Cybernetics, A Frustrated A-Modern and Posthumanist Potential

Cybernetics is about systems, living or mechanical systems, and the concomitant analogy between (human and nonhuman) animals and machines. As previously stated, communication, information and control are key to these (regulated) systems. Information, however, is conceptualised as quantifiable in cybernetics. Based on mathematical logic, and especially on Claude Shannon's 'Mathematical Theory of Communication' (1948), information is a quantity, a probabilistic unit. That is, not only is information detached from its semiotic understanding and its connection to meaning, but it is also dissociated from matter, from materiality (Wiener 1948)[67]. Within cybernetics, information 'is a pattern, not a presence' (Hayles 1999: 18), it is 'just that kind of quantifiable element (unit, basis of unity) which allows universal translation, and so unhindered instrumental power (called effective communication)' (Haraway 1991: 164). With all systems construed as informational, cybernetics thereby conceives of humans (and nonhuman animals) and machines as analogical, namely as information-processing entities.

The Potential for Renewing What it Means to Be Human

The relation between humans and machines becomes a question of information flow, of exchange of signals. That is, communication between humans and machines – construed as analogical informational systems – becomes, no pun intended, a matter of feedback while their stability (homeostasis) one of control. Furthermore, the centrality of feedback and feedback loop renders indistinguishable the limits of the elements of the systems as information also flows from the environment though the system, be it mechanical or organic, a machine or a body. Therefore, as cybernetics focuses on the analogy between human (and nonhuman) animals and machines, it blurs the boundaries not only between human (and nonhuman) animals and machines, between the organic and the inorganic, but also between bodies, technologies, and the environment. As such, cybernetics ignites a renewed understanding of human beings and being human, one that challenges traditional – i.e. modern liberal humanist – conceptions (Tomas 1995; Hayles 1999). On that account, Clynes and Kline's cyborg or cybernetic organism might seem tautological or an inaccurate appellation to the extent that, within a cybernetic frame, any organism or organic system is intrinsically cybernetic, that is, a flow of information interacting, or rather communicating with the environment – and possibly other organisms and machines – through feedback (Kline 2009). As Ronald Kline argues, the technologically enhanced beings – be they human or nonhuman – envisioned by Clynes and Kline are rather to be understood as 'cybernetically enhanced organism[s] – [organisms] extended by means of cybernetic technology' (2009: 333), in this case for the

67. 'Information is information, not matter or energy. No materialism which does not admit this can survive the present day', wrote Norbert Wiener in his ground-breaking Cybernetics or Control and Communication in the Animal and the Machine (1948: 155).

purpose of space travel and exploration. Clynes and Kline have not pursued the ontological implications of cybernetics.

As Hayles explains, by eroding the boundaries between humans and machines, bodies and technologies, the organic and the inorganic, cybernetics has a non-modernist and post-humanist potential, that is, the potential of going beyond the modern liberal humanist conception of the human as autonomous and separated from technology and the world. The ontology of the human is (potentially) radically redefined in cybernetics. Yet, the belief in and upholding of humanist values – e.g. autonomy and individuality – by Wiener, and cyberneticians in general, has contributed to reframe and recast the disruptive understanding of human beings within liberal humanism's acceptable limits and within the Cartesian mind/body dualism (Hayles 1999; Sharon 2011). As Hayles formulates it,

> *[p]laced alongside his human brother ... the cybernetic machine was to be designed so that it did not threaten the autonomous, self-regulating subject of liberal humanism. On the contrary, it was to extend that self into the realm of the machine (Hayles 1999: 86).*

On the one hand, while he now also extends himself into the realm of the technology, the huMan, with his autonomy and individuality, is positioned back at the centre of the world. On the other hand, with/in cybernetics, the body becomes information flow – thereby marking the birth of the informational view of the body[68], the body becoming a text to be read, a code to be deciphered (Haraway 1991) – and dematerialises, enabling the huMan to fulfil the (Cartesian) dream of a bodiless or disembodied mind. This is the modern liberal humanist version of cybernetics that informs the posthuMan of transhumanist visions. According to Hayles, this informational posthuMan is highly toxic: this conception delineates 'the posthuman in its more nefarious forms ... as an informational pattern that happens to be instantiated in a biological substrate' (Hayles 2006: 160-161, quoted in Sharon 2011: 51). The body becomes disposable meat. As embodiment and materiality become optional, as the self is a flow of information, the Cartesian mind/body dualism is reaffirmed. Cyborg and posthuman (as it appears in the human enhancement debate) mirror each other.

The Making of Cyborgs into Modern Liberal Humanist Individuals

In this respect, in a relatively recent interview, Clynes expressed his belief that cybernetically enhancing humans with technology would not affect what it means to be human, or rather would not change human nature[69] (Gray 1995: 47). Despite their close interaction with the organism, based on the information-communication-control triad, cybernetic technologies are thus mere appendages or lose attachments, maybe even accessories to the body. Like Wiener before and the transhumanists after them with enhancement technologies, the troubling potential of cybernetics is recast into acceptable limits. Clynes and Kline's argue that,

68. Such a view has become dominant in conceiving of the (human) body in science and culture (Haraway 1991; 1997; Hayles 1999). The conception of the body as information as it originates in cybernetics has also become the dominant view of the body in the life science. While the molecular view conceives of the body as information, in its most reductionist form, the gene becomes the code of life. A text to be read and a code to be deciphered, the informational body upheld by cybernetics and the molecular life sciences is (technoscientifically) manipulable. On the molecular conception of the body, see Rose 2001, 2007. On the fetishism of the gene, see Haraway 1997: 141-148.

69. Interviewed by Chris Hable Gray (1995) and asked about his 1960 'Cyborg and Space' article, Manfred E. Clynes indeed asserts that the enhancement of the human-in-space would 'make it possible to exist, qua man [sic], as man, not changing his nature, his human nature, his human nature that evolved here [on earth].'

> *[i]f man in space must constantly be checking on things and making adjustments merely in order to keep himself alive, he becomes a slave to the machine. The purpose of the Cyborg ... is to provide an organisational system, in which such robot-like problems are taken care automatically, leaving man free to explore, to create, to think, and to feel (Clynes and Kline 1960: 31)*

While the organism is intimately connected to technology, while the body receives electrical stimulation or chemicals whose intensity and dosage is regulated by (computer-aided) bio-feedback, human nature remains unaffected, untouched, unaltered. As Ian Hacking phrases it,

> *[t]he 'human nature' that is left unchanged is mental stuff, the product of evolution, for sure, but quite distinct from the body that is incorporated in the feedback loop. ... [The cyborg idea] was dualist. The body was modified so it could live in alien environment, while the human mind went on creating, exploring, thinking (Hacking 1998: 209-210).*

The body is transformed but man, the self, remains the same. Cartesian dualism crystallises. In Clynes and Kline's design of the cyborg, the interaction between humans and technologies – notwithstanding their conception as cybernetic systems – does not entail a subversion of the human, or rather of the huMan. Conceived as appendages or add-ons, technologies extend or enhance the human (to survive in space or in hostile environments), but do not fundamentally or essentially decompose and recompose it differently. As for the body, it is merely instrumental.

From Cyborgs to PosthuMans

Kevin Warwick's experimentations with cybernetic (and enhancement) technologies are exemplary of such understanding of technology as bodily appendage, as bodily prosthesis. Professor of Cybernetics at Reading University (United Kingdom), in I, Cyborg (2004)[70], Warwick recounts and reflects on the experiments he conducted on himself in the Cyborg projects. As already introduced in chapter one, in the project Cyborg 1.0 conducted in 1998, he had a silicon chip transponder (or Radio Frequency Identification, RFID) implanted in his forearm. As the chip emitted a unique signal, doors would open and lights would switch on when his presence was detected[71]. The Cyborg 2.0 project started on the 14th of March 2002 when Warwick's left arm was surgically implanted with a micro-electrode array consisting of a hundred electrodes. The implant could send signals back and forth between Warwick's nervous system and a computer. As a consequence, the neural interface enabled him to operate an electric wheelchair as well as an artificial hand located in Reading while he was in New York and to receive feedback from sensors in his fingertips. Warwick and his wife also had a silicon chip implanted in their arm, above the elbow, that enabled them to link and transmit signals between their nervous systems. Reflecting on these experiments, Warwick asserts that

70. See also http://www.kevinwarwick.com.

71. This project can also be seen as precursor to increasingly popular projects about 'smart' and 'programmable' cities, where the body via implanted and wearable technologies becomes a central nexus in the city as an information system where 'smart' sensors proliferate. See for instance Amsterdam Smart City Project (http://amsterdamsmartcity.com/projects), the MIT 'Smart Cities' project and its research on electronic and social networks (http://cities.media.mit.edu/).

> *[i]n the short term – the next ten years – it is evident that the medical world will benefit enormously from the form of implanted technology we employed, linking to the nervous system and brain. There is no question that for those with a break in the nervous system it would be possible, with more research, to first control body functions that presently cannot be controlled, and second, to hand back control of those functions to the individual. … But what we have done is, in many ways, more far-reaching. It was evident from our results that an individual with an implant in their nervous system can control their environment and the technology around them. With brain implants, it would appear to be possible for this to happen in a well-defined way in the next few years (Warwick 2004: 264).*

In his experiment and its envisioned future implications, against his (own feeling of) exceptionality, Warwick is similar to Clynes and Kline's rodent. Or rather, like Clynes and Kline's conception of the cybernetically enhanced rat (and human) in outer-space, while Warwick's body is (to be) implanted with and affected by a whole paraphernalia of brain implants and sensors – 'extra-memory, clip-on maths ability and multi-dimensional processing would all appear to be there for the taking, as indeed are numerous extra-sensory powers' (Ibid.) – he himself is not and will not be impacted. The body-self remains intact. Even more, these implanted technologies are to give the individual control not only over his/her own body but also his/her environment and surrounding technologies. Cartesian dualism and the autonomous, self-contained and bounded individual who is not only the uncreated creator and actor of his own life but also the master of his environment prevail while being technologically reinvigorated. Anthropocentrism and human exceptionalism dazzle. Furthermore, Warwick

> *believe[s] that we are about to see the biggest change of all. Human communication is on the verge of a complete overhaul. We will shortly make much more use of the technology that can send and receive millions of messages, in parallel, with zero error. We will interface with machines through thought signals. We will become nodes on a techno-network. We will be able to communicate with other humans merely by thinking to each other. Speech, as we know it, may well become obsolete. … Of course, it doesn't mean everyone has to be a cyborg. If you are happy with your state as a human then so be it, you can remain as you are. But be warned – just as humans split from our chimpanzee cousins years ago, so cyborgs will split from humans. Those who remain as mere humans are likely to become a sub-species. They will, effectively, be the chimpanzees of the future (Warwick 2004: 3-4).*

The transhumanist discourse and worldview permeates Warwick's profession. The disembodied subject, the huMan or, in its technologically enhanced version, the posthuMan still reigns with the cyborg. Evolution of the human species, which has become the new grand narrative, is what becomes transformed, unquestionably improved. With Warwick, the cyborg is therefore a 'retrofitted human' (Hayles 1999:119): while the body is an (expendable and disposable) instrument, (implanted) technologies are mere appendages, transparent bodily prostheses.

Bodily appendages, technologies in their relation(s) to human beings have been conceived, in modern frameworks, as intrinsically linked to the body. Linked indeed, but ontologically separated. In this conception, bodies and technologies, humans and technological artefacts remain impermeable to each other, in a situation of 'supplemental prostheticity'[72] (Sharon 2011: 86). Boundedness of the entity entering in relation with technology and the latter's un-ability to alter the former are the distinctive characteristics of supplemental prostheticity for Sharon[73]. Even though they might extend the body beyond its human morphology and abilities, technological artefacts are not transformative. They are bodily appendages – 'supplemental prostheses' – through which the 'bounded, self-contained, self-moving individual' is secured (Hacking 2010: 386). The huMan, with its en/closed and hygienist body, remains the locus of agency, unspoilt by but in control of technologies and his environment. Cyborg becomes posthuMan. This conception, and the informational body more generally, is not without recalling the Cartesian view of the body. Both are inscribed in and reinscribe the mind/body dualism whereby the self resides in the disembodied, immaterial mind, whereby the modern liberal humanist subject prevails. Both the Cartesian and the posthuMan body are technology, or rather, they are conceived in technological, even machinic, terms. While such a conception of the body qua technology has been the dominant one in Western philosophy (Canguilhem 2008 [1952]), it is also symptomatic of its 'profound somatophobia' (Grosz 1994: 5).

Haunting Somatophobia and Daunting Cartesianism

Somatophobia, the aversion toward and devaluation of the body, has historically found expression in a mechanistic view of the body. Construed in mechanical terms, the body becomes incarnate technology, a mechanism. Such is the early Modern conception of the body, one that is informed by and conveys dualisms, of which the mind/body split figures at the forefront. Indeed, as both epitome and emblem of such a view, René Descartes establishes a distinction between res extensa, the body (and matter in general), and res cogitans, the mind, both of them constituting mutually exclusive and antagonistic substances (Grosz 1994: 6-7). Reminiscent of the disembodied Christian soul, the (modern) self's true essence resides in, or rather is, the mind: res cogitans, as encapsulated in Descartes's (in)famous formula 'Cogito, ergo sum' (Descartes 1637: 22). Yet, this mind is imprisoned in the body, res extensa, which is associated with (the laws of) nature. In Descartes's words,

72. If prostheticity and the notion of technology as prosthesis have found incarnation in the phenomenon of human enhancement, especially in the way it has been construed by transhumanists and proponents of enhancement, it has also become a dominant trope for conceiving of any and every relation between humans and technology and, more generally, our technologised lifeworld. As I will show later, if this conception has regained vitality with the growing fascination with posthuman extension of the body, it has also become cornerstone in views and conceptualisations of bodies and technologies, of humans and machine as ontologically intertwined. As human's 'cyborg ontology,' in Donna Haraway's words (1991), or their 'originary technicity,' in Stiegler's (1994), was foregrounded in both philosophical conceptualisations and technoscientific practices, the concept of prostheticity, alongside the cyborg, have become cornerstone. Tropes encapsulating material-discursive entities and realities, the cyborg and prostheticity have however become over/used and abused metaphors. As they lost their material grounds and materiality, the cyborg and prostheticity have had their potentiality undermined for devising anthropologically appropriate, non-modernist frameworks to understand human-technology relations, and the human in relation to its lifeworld more generally.

73. Sharon characterises 'supplemental prostheticity' as the type of relationship between humans and technology that inhabits modern liberal humanism. Technology is understood 'as something that is ontologically distinct from nature, life, the human body and self, and is then "added on," acting as a supplement, as an appendage to these, extending their power' (Sharon 2011: 86, emphasis in original). She contrasts this notion with that of 'original prostheticity,' which she borrows from Bernard Stiegler (1994), and that will be addressed in chapter four.

> *I certainly do possess a body with which I am very closely conjoined; nevertheless, because, on the one hand, I have a clear and distinct idea of myself, in as far as I am only a thinking and unextended thing, and as, on the other hand, I possess a distinct idea of body, in as far as it is only an extended and unthinking thing, it is certain that I, [that is, my mind, by which I am what I am], is entirely and truly distinct from my body, and may exist without it (Descartes 1647: np, my emphasis).*

The Cartesian mind/body dualism, with its valorisation of the former over the latter, is rather vividly rendered by Descartes in this passage of his Meditations. His belief, rooted in dualist thinking, in a disincarnated and disembodied mind ruling over, yet absolutely not in need of, the body finds uncanny echoes in some transhumanist dreams of free-floating minds (Moravec 1988)[74] and more generally the utopia of an immaterial body.

If the all-powerful Cartesian mind – one of Modernity's most enduring emblems – is ruling over the body, such a relationship is however – quite ironically – not straight(forward). It is rather technologically mediated. More precisely, Descartes's conceptions of both the mind and the body, and of their relation, rely upon the contemporary (emerging) technologies (Canguilhem 2008 [1952]: 80). Indeed, it is a machine and more precisely the automaton as it materialises in clocks, windmills and artificial fountains which is the model of the human body. In fact, while the body has traditionally been deprecated and regarded as tainted materiality – as opposed to the transcendent immateriality of the soul-spirit in Antiquity's ethos – the body becomes mechanism with Descartes (Ihde 2005). In this mechanistic view, the body is not only reduced to organs, the latter functioning like the pieces of a clock, but it is also mechanised and obeys the mind like the movement of a clock.

> *These men [sic] will be composed, as we are, of a soul and a body, and I must first separately describe for you the body; then, also separately, the soul; and finally I must show you how these two natures would have to be joined and united to constitute men resembling us. I assume their body to be but a statue, an earthen machine formed intentionally by God to be as much as possible like us. Thus not only does he give it externally the shapes and colours of all the parts of our bodies; He also places inside it all the pieces required to make it walk, eat, breathe, and imitate whichever of our own functions can be imagined to proceed from mere matter and to depend entirely on the arrangement of our organs. We see clocks, artificial fountains, mills, and similar machines which, though made entirely by man, lack not the power to move, of themselves, in various ways. And I think you will agree that the present machine could have even more sorts of movements than I have imagined and more ingenuity than I have assigned, for our supposition is that it was created by God (Descartes 1664, quoted in Canguilhem 2008: 84).*

This extract taken from the beginning of his 1664 Treatise of Man not only clearly encapsulates the mechanisation of the body operated by Descartes – and the mind/body dualism underlying this process – but also resonates with the posthuMan body as a set of functions and functionalities (see chapter one). Yet, if the body is conceived through the prism of the machine, a technological automaton whose different parts fulfil specific and definite functions, it is also evaluated against it, against machinic perfection[75]. That is, even though it is conceived as a mechanical device, the body is also measured against the ideal of the automaton and occupies yet again the negatively valued and deprecated, hence inferior, position. Set and assessed against the mind and the machine, the body has no intrinsic value but is rather discarded and relegated, like women, into the realm of nature and mere matter (Grosz 1994), rendered lifeless or technological meat. In this regard, as feminist scholars have forcefully demonstrated and criticised, women and their bodies – women as body – are always already entangled with and assimilated to nature while men are associated with the sovereign mind and reason (Alaimo 2008; 2010; Braidotti 2002; Grosz 1994; Haraway 1991). Dualism's collateral damages abound. The body, matter, nature, Woman[76], all occupy the neglected and undervalued pole in some of the West's most pervasive and durable dualisms, against mind, soul, culture and Man.

However, the relationship between the dualistic poles is not as simple and direct as it could be expected. As previously indicated, the Cartesian mind/body dualism is mediated by technology. While in Descartes the body is construed in mechanistic terms and based on the automaton and/or the clock, the mind is similarly modelled on a technological artefact, namely the camera obscura. In fact, Descartes's conception of the mind is informed by his theory of optics: with the body being mechanical, the mind in early Modernity becomes the actor and is incarnated in the figure of the homonculus. In analogy with the camera obscura, from his [sic] privileged central position behind the ocular globes, the homonculus-subject is made the sole observer of the outside world (Ihde 2005; Kockelkoren 2003; Panofsky 1996). The Cartesian framework epitomises representationalism and its correlated fiction of the ontological and epistemological – hence foundational – existence of an outside world to be discovered by the inner and independent world of the subject, i.e. the mind as independent observer[77].

This technologically mediated – at the conceptual level – early Modern view of the human, which reigned over Modernity and still permeates our contemporary times and the human enhancement debate with striking intensity is that of the disembodied autonomous subject. While the body is moved by the mind, like the movements of a clock, 'I, [that is, my mind, by which I am what I am], is entirely and truly distinct from my body, and may exist without it,' as Descartes ponders (1647: np). Therefore, the body is, to a certain extent, in a prosthetic relationship with the mind[78]. Embodiment is a totally foreign concept to this early modern view: the thinking subject, encapsulated in the immaterial mind and imprisoned in the machinic body, is a disembodied, disincarnated subject. This Cartesian apprehension of the body as technology, as machine, which not only relies on the mind/body dualism but also

74. For a well-informed critique of such approaches and an enlightening account of the erasure and denial of embodiment that inform cybernetics in general, see Hayles 1999.

75. As it will be seen in chapter six, this evaluation of the human body against the perfection of the machine is still remarkably present with respect to prostheses, and all the more so with regard to female bodies (Sharp 2011).

76. Woman with a capital letter refers to the generic category woman and its set of associated stereotypes in contrast to actual women and their diversity.

77. In Grosz's words, 'the body is a self-moving machine, a mechanical device, functioning according to causal laws and the laws of nature. The mind, the thinking substance, the soul, or consciousness, has no place in the natural world. The exclusion of the soul from nature, this evacuation of consciousness from the world, is the prerequisite for founding a knowledge, or better, a science, of the governing principles of nature, a science which excludes and is indifferent to considerations of the subject. ... From that time until the present, subject or consciousness is separated from and can reflect on the world of the body, objects, qualities' (Grosz 1994: 6).

78. The relationship between the body and technology mirrors that between the soul/mind and the body. Informed by dualisms – among which the mind/body split figures prominently – such a conception can be traced back to Aristotle, for whom the body is the soul's tool. Tools, on the other hand, are construed as inanimate slaves – and conversely, slaves are considered to be animate tools. As Aristotle expresses it in his Eudemian Ethics, 'the body is the soul's natural tool, while the slave is as it were a part and detachable tool of the master, the tool being a sort of inanimate slaves' (Aristotle, quoted in Sharon 2011: 80). For Aristotle then, while the body is the soul's appendix, tools and technology are an extension of the body. As such, in Aristotle, the body's prosthetic relation with the soul is mirrored by the tool's prosthetic relation with the body.

creates and disseminates the fiction of an inner subjective world independent from the outside world, hencegenerates and propagates the fiction of the disembodied autonomous subject has been and, as I have showed,still is a very pervasive conception. As I have indicated, it still pervades the cybernetically-informed transhumanist accounts of the posthuman.

Conclusion

Cyborgs and cybernetics appear as both ancestors and siblings of the posthum(M)an and human enhancement. However, as this section has showed, cybernetics and cyborgs are not intrinsically modern liberal humanist creatures. Rather, their a-modern and posthumanist potential have been recast within a modern liberal humanist framework, thereby safeguarding the autonomous and self-contained individual who uses technologies – here cybernetics – but is not impacted by them. Somatophobia and Cartesian mind/body dualism still pervade. The cyborg becomes posthuMan. This re-reading of the posthuman through the cyborg highlights the artifices on which modern liberal humanist conceptions of humans and technologies are constructed. The becoming posthuMan of the cyborg is, however, only one branch of the cyborg's (and posthuman's) genealogy. The tension already present in cybernetics between modern liberal humanism and a-modern posthumanism crystallises and amplifies with the posthuman. In the next part, rodents, cyborgs, cybernetics and posthumans are coming back. But they are returning with a vengeance. Metamorphosed, they do not recognise the modern liberal humanist worldview but rather expose and destabilise it. While modernity, liberal humanism, and the modern liberal subject have been a constant in this thesis, thus far they have only been implicitly defined. This second part, guided by a revamped cyborg, will attend to this task. More precisely, it will address the implosion of putative ontological boundaries in technoscience and initiate a redefinition of posthumanism – one that is poles apart from its transhumanist and bioconservative acceptation as mapped in chapter one.

2. The Cyborg as Redefining Human Ontology and Igniting A-Modern Posthumanism

In 1985, Donna Haraway's 'A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth-Century' was published in the Socialist Review. Since then, this article has become a canonical text in feminist theory certainly, but also in critical studies in general as well as in science and technology studies (STS) and philosophy of technology (Munnik 2001). Nowadays, it is also regarded as the foundational piece for post-humanism (Åsberg 2010; Åsberg et al. 2011a; Herbrechter 2012 and 2013; Wolfe 2010). As she reads differently, even diffractively, cybernetics and technoscience in general, Haraway introduces the cyborg as a trickster figure, one that not only exposes and decomposes the modern liberal humanist worldview but also composes and poses as a (post-humanist) guide for 'earthly survival' (Haraway 1991: 212; 2004: 77). This is encapsulated in one of Haraway's most quoted passages:

> *[b]y the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short we are cyborgs. The cyborg is our ontology; it gives us our politics (Haraway 1991: 150).*

While the cyborg, which blurs the boundaries between bodies and technologies, humans and nonhumans, the material and the immaterial, amounts to human ontology in a technological lifeworld, as a manifesto it also embodies a subversive and emancipatory ethico-political potential, one that not only seals the death of the huMan but also instigates renewed ways of being human while being accountable for them and the worlds we are creating and becoming with. These aspects are crucial for understanding a-modernism and post-humanism and will be dealt with in the following sections.

More precisely, I will introduce firstly how Haraway's cyborg departs from its previous conceptualisation (by e.g. Clynes and Kline) by emphasising not only the ways in which it blurs foundational boundaries (for modern liberal humanism) but also how it compels us to rethink human ontology. Secondly, the rupture initiated by the cyborg from aforementioned modern liberal humanist conceptions of the cyborg and the posthuman will become particularly clear when the cyborg will found incarnation in a mouse, OncoMouse™. Thirdly, I will show how the latter and the cyborg more generally are symptomatic and even materialise the contemporary anti-humanist and non-modernist doings of technoscience wherein hybrids proliferate. Against this backdrop, fourthly and finally, modernity and the modern liberal humanist worldview will be identified as a process of purification whereby the complexity of the world is ordered into the artifice of dualist categories. As I will conclude as a result of this inroad into the genealogy and ontology of the cyborg as devised by Haraway, a modern liberal humanist framework appears as completely inappropriate for apprehending what is at stake with (enhancement) technologies and what it means to be human with the latter.

2.1 The Cyborg as Human Ontology

The Cyborg Manifesto is an ironic political myth, one that revolves around an ironic and blasphemous figure, the cyborg – a trickster. Haraway's cyborg is kin with Clynes and Kline's – it is 'a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction' (Haraway 1991: 149), but already not the same. Unlike the latter, Haraway's cyborg pursues, incarnates even, the (ontological) implications of cybernetics. The cyborg is an impure figure, neither purely technological nor organic, neither purely factual or (techno-) scientific nor fictional. It is both. It is transgressing and transgressed boundaries. But it is also more. Or rather, while like Clynes and Kline's cyborg and like the bionic creatures populating science-fiction, the cyborg is an hybrid of body and technology, of flesh and machine, it is also a being whose lifeworld is technological, whose perceptions and imagination, actions and relations are permeated by technology and technological artefacts, whose very being and existence are entangled with technology. Haraway's previously mentioned words resonate again: an implosion of boundaries, Haraway's cyborg is also the nature of our being. Thus, it enacts a rupture with the modern liberal humanist conception of humans and technologies as hermetically separated entities, as addressed in the previous section and chapters. Technologies are not mere appendages to the body but are constitutive of the human. Humans and technologies are no longer ontologically separated: their fusion is our ontology. As René Munnik explains it, this

> *marks a fundamental turning point in philosophical anthropology. Philosophical anthropology is generally conceived as anthropo-ontology; it reflects the ways of being human. But by the end of the twentieth century, these ways of being are inextricably involved with technology: anthropo-technology is cyborg-ontology (Munnik 2001: 102).*

This redefinition is one of the ways Haraway's cyborg departs from and disrupts Clynes and Kline's cyborg and modern liberal humanist conception of bodies and technologies in general.

The cyborg materialises where foundational – as concerns modern liberal humanism – boundaries break down. Haraway identifies three major fractured distinctions, all of them originating in technoscience; technoscience is, in fact, the engine/er of these boundary breakdowns and hybridisation (Haraway 1991: 151-154). The first breached boundary is the boundary between human and animal. It is brought about by biology and evolutionary theory. Xeno-transplants, the mapping of human and animal genomes, the recognition of viruses as transferring genetic material, amongst others, contribute to blurring the line between humans and animals. Alongside these human-animal couplings, the second leaky distinction concerns the organism (animal and/or human) and the machine. Cybernetics is pivotal in this breakdown, where the autonomisation of technology – technologies are self-regulating and self-moving – renders 'thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines. Our machines are disturbingly lively, and we ourselves are frighteningly inert' (Ibid.: 152). The third eroding boundary is between the physical and the non-physical. With cybernetics and nanotechnology, technologies are miniaturised and become information. They are almost immaterial. Their power, in fact, lies in their invisibility and intangibility as they become (both materially and politically) harder to control. Rather than a technologically enhanced being with super-hum(M)an abilities, the cyborg thrives on and incarnates the leaky distinctions between e.g. human and animal, machine and organism, the physical and the non-physical generated by technoscience. Clynes and Kline's rat implanted with an osmotic pump, which materialises the technological enhancement of the organism, gives way to OncoMouse™[79] (Haraway 1997).

2.2 The Troubling Figure of OncoMouse™

Assuredly, OncoMouse™ is not yet present in the Cyborg Manifesto, but it incarnates the blurred, or rather imploded, boundaries between human and animal, organism and machine, physical and nonphysical, nature and artefact, metaphor and materiality, biology and economy encapsulated by the cyborg: it constitutes a materialisation of the cyborg. OncoMouse™ is a technoscientific creation whose genetic make-up has been altered to carry a human oncogene, one that necessarily results in breast cancer[80]. S/he dies so that women – and men – can live. Neither human nor animal, or both human and animal, OncoMouse™ is natural and artefactual, organism and machine. Indeed, a living being, s/he is also an invention, one for which the company DuPont de Nemours holds a patent. Materially yet invisibly carrying a human oncogene in her genetic composition, OncoMouse™ is a living organism who/that is 'a kind of machine tool for manufacturing other knowledge-building instruments in technoscience, … [s/he] is a scientific instrument for sale like many other laboratory devices' (Ibid.: 79). S/he is a commodity. As OncoMouse™ disintegrates, collapses into each other, or implodes foundational modern categories, s/he is both an archetype of technoscience and a troubling creature of and for modern liberal humanism. As concerns the latter, it is all the more so that the patented mouse disrupts and subverts the modern liberal humanist – and Judeo-Christian – (nuclear) family and its (pure) bloodline, the very conception of kinship. For Haraway, 'OncoMouse™ is my sibling, and more properly, male or female, s/he is my sister' (Ibid.). She continues,

> *[o]ur bodies share substance; we are kin. … The action in technoscience mixes up all the actors; miscegenation between and among humans and nonhumans is the norm. The family is a mess. There is hardly a bell curve in sight. Racial purity; purity of all kinds, the great white hope of heliocentric enlightenment for a truly autochthonous Europe, the self-birthing dream of Man, the ultimate control of natural others for the good of the one – all dashed by a bastard mouse' (Haraway 1997: 120-121).*

While kin with Clynes and Kline's cyborg-rat, OncoMouse™ is also in rupture with it. A technological creation, s/he does not incarnate technological enhancement nor the modern liberal humanist subject and its hermetic separation from the world, technology and more generally human and nonhuman others. Rather, she is an impure mixture. Cyborg, she incarnates the a-modernism and anti-humanism of technoscience.

79. Haraway does not only use the figure of the cyborg to characterise OncoMouse™ but also the figure of the vampire. Like the vampire, the patented mouse by DuPont belongs to 'the realms of the undead' while its essence is 'the pollution of natural kinds' (Haraway 1997: 79-80). As OncoMouse™ subverts the order of kinship and troubles the purity of lineage – and as such can be encapsulated by the figure of the vampire – Haraway also refers to OncoMouse™ as her 'sibling species, a breast endowed cyborg like [herself]' (Ibid.: 113). OncoMouse™ as incarnating the figure of the cyborg is all the more fitting considering Haraway's focus on biology and its intertwinement with technoscience.

80. Five versions of OncoMouse™ have been created, each carrying a different oncogene, but three engendering breast cancer. In Haraway's words, 'Oncomice can get many kinds of cancer but breast cancer has been semiotically most potent in news stories and in the original patent' (Haraway 1997: 80). The boundary between materiality and discourse collapses.

2.3 The A-Modernism and Anti-Humanism of Technoscience

Technoscience is the thriving progenitor of the boundary collapses that the cyborg materialises (and OncoMouse™ incarnates). Technoscience, in fact, embodies up to its spelling the evaporation of the boundary between science and technology – provided it has ever existed (Graham 2002; Haraway 1997; Harding 1998). Or as Donna Haraway phrases it,

> *[l]ike all the other chimerical, condensed word forms that are cobbled up together without-benefit-of hyphen … the word technoscience communicates the promiscuously fused and transgenic quality of its domains by a kind of visual onomatopoeia (Haraway 1997: 4).*

But technoscience not only crystallises the erosion of boundaries between science and technology, but also between science (and technology) and society. In fact, Haraway traces back the term to Bruno Latour's Science in Action (1987) where he argued that 'the inside of that powerful and world-changing site called the laboratory constitutes itself by extending its reach "outside" through the mobilization and reconfiguration of resources of all kinds'[81] (Haraway 1997: 279). Furthermore, she showed too, like science and technology studies (STS) scholars, how (techno-) scientists are embedded in and (re-) producing social and cultural values, norms, and patterns of exclusion, how 'the culture of no culture' can also be 'gender- and race-in-the-making' while 'all the world is in the sacred image of the Same' (Ibid.: 19; 35). In other words, (techno-) science is not a neutral endeavour but is rather value-laden and embedded in social and power relations[82].

However, the technoscientific endeavour is utterly anti-humanist and non-modernist due to its proficiency in eroding boundaries and its power to make chimeras and hybrids proliferate. Human exceptionalism evaporates. Technoscience and biotechnology in particular have been singled out by scholars and commentators – of whom bioconservatives have stood at the forefront (see chapter one) – for its ability to manipulate life, including the life of the human organism. Although the technological manipulation of living organisms is ancient, as exemplified by the centuries-old cutting, breeding and hybridisation of plants and animals (e.g. mules), the molecularisation of the life sciences that has accompanied the turn of millennium has not merely entailed a change of scale or a reduction of life span in the alteration of life, but truly an epistemological shift. A threshold has been crossed from the clinical – or molar – to the clinical gaze, from the organism and the species to DNA molecules and genes (Haraway 1991, 1997; Rose 2001, 2007). The latter is not only able to alter, reproduce, or clone life, but also to create and engineer it. In an echo to the phenomenon and question of human enhancement, Rose states in The Politics of Life Itself that 'where interventions are scaled at the molecular level, biology is not destiny but opportunity … To put it crudely, biology has become imbued with dreams of technological reformation' (Rose 2007: 51). The study and investigation of the life sciences and molecular biology in particular have confirmed Haraway's conception of the cyborg and technoscience. It has been shown that the 'biologisation' or vitalisation of technology is accompanied by or matched with an analogous 'technologisation' of biology (Bensaude-Vincent 2009; Hayles 1999; Thacker 2003). That is, biology is increasingly becoming technology: while on the one hand living organisms and systems are being construed in informational and communicational, even mechanical, terms, thus open to (re-) engineering, on the other hand the life sciences are transforming into a (bio-) technological field, and in Sarah Franklin's words, '[t]he biological increasingly refers to mixtures of the biological and the technical, as is ubiquitously signified by the vaguely potent prefix produce "bio-", as in the biosciences, biomedicine, biopolitics … bioethics' or bionics and biomimicry (Franklin 2003: 63). Reciprocally, technology is increasingly becoming biology insofar as biology and life are being regarded as models to be followed for designing technologies, the latter being more and more endowed with life-like attributes such as self-reproduction or self-assembly.

Boundary breakdowns and hybridisation are technoscience's hallmark, or dare I say, trademark. For the alliance between knowledge and capitalism is strengthening. Technoscience is a growing industry (Rudolph and McIntire 1996: vi; Stiegler 2008: 69-70). In the Cyborg Manifesto, Haraway already draws attention to technoscience being a vast complex of biotech companies – she even lists some multinationals she collected from Science, such as Tech-Knowledge, Genentech, Hybritech, Repligen, Micro-Angelo Corp., or Cyborg Corp. (Haraway 1991: 245, note 4). Likewise, as Rose explains with respect to biotechnology,

> *conducted at a molecular level, biology and medicine require long periods of investment, the purchase of expensive equipment, the maintenance of well-staffed laboratories, a multiplication of clinical trials, financial commitments for measures required to meet regulatory hurdles. … Increasingly such investment comes from venture capital provided to private corporations. … These biotech companies do not merely "apply" or "market" scientific discoveries: the laboratory and the factory are intrinsically interlinked – the pharmaceutical industry has been central to research on neurochemistry, the biotech industry to research on cloning, genetech firms to the sequencing of the human genome (Rose 2007: 31, my emphasis).*

Even universities, increasingly dependent on external (public and/or private) sources of funding, now create their own start-up companies and patenting offices. In advanced capitalism, post-modernism and knowledge-based societies (Jasanoff 2005: 6) – at least in the Occident – biotechnology is therefore a bioeconomy, an 'economy of vitality' with capitalism increasingly bearing the seal of biocapitalism: life becomes biocapital, biovalue[83] (Cooper 2008; Rose 2001, 2007; Waldby and Mitchell 2006).

81. 'I will use the word "technoscience" from now on to describe all the elements tied to the scientific contents no matter how dirty, unexpected or foreign they seem,' wrote Latour (1974, quoted in Haraway 1997: 280). For Haraway, it is what counts as "science" and as "society" that was being criticised by Latour when he coined technoscience.

82. In Haraway's words, '[t]echnologies and scientific discourses can be partially understood as formalisations, i.e. as frozen moments, of the fluid social interactions constituting them, but they should also be viewed as instruments for enforcing meanings. The boundary is permeable between tool and myth, instrument and concept, historical systems of social relations and historical anatomies of possible bodies, including objects of knowledge. Indeed, myth and tool mutually constitute each other' (Haraway 1991: 164).

83. At first developed in the environmental sciences in the 1990s, the term bioeconomy originally referred to the project of applying to the economic sphere in general and waste management in particular the attributes of recombinant biotechnology – i.e., the biologisation of petrochemical and pharmaceutical production through the use of modified bacterium and micro-organisms. It was however proposed as a new concept by the Organisation of Economic Cooperation and Development (OECD) in 2005 for fomenting and promoting 'the possible alliances between biological productivity and the extraction of surplus-value: the bioeconomy is defined as that part of economic activities "which captures the latent value in biological processes and renewable bioresources to produce improved health and sustainable growth and renewable bioresources"' (Cooper 2008: 45). Alongside bioeconomy and the possible patenting of living organisms – at least in the United States – biovalue refers to the ways in which the biology of the human body – its blood, tissues, cells, etc. – has become source of (economic) value (Waldby and Mitchell 2006: 32). As explained by Nikolas Rose, '[e]nergized by the search for biovalue, novel links have formed between truth and capitalization, the demands for shareholder value and the human value invested in the hope for cure and optimality. A new economic space has been delineated – the bioeconomy – and a new form of capital – biocapital. Old actors such as pharmaceutical corporations have been transformed in their relation with science on the one hand and stock markets on the other. New actors such as biotech start-ups and spin-outs have taken shape… Life itself has been made amenable in these new economic relations, as vitality is decomposed into a series of distinct and discrete objects – that can be isolated, delimited, stored, accumulated,

Finally, in the lineage of cybernetics, at the joining of technoscience, advanced capitalism and informatics, bodies and life become codes, (flux of) information and texts. Boundary breakdowns abound.

This cartography of technoscience strikingly differs from the sleek and linear portrait of humans and (enhancement) technologies that is depicted by bioconservatives and transhumanist and that more generally informs human enhancement. Contra the hermetic separation of humans and technologies, hybrids proliferate within technoscientific practices. As exposed by Haraway, we are cyborgs. In this context, the conceptions of humans and technologies convened and conveyed by human enhancement and the debate thereof appear as hygienic and antiseptic – as flawed. They are, as I shall address in the next section, the result of a purification process: they are a modern artefact.

2.4 Purification as a Modern Artefact – An A-Modern Worldview

Haraway's conception of the cyborg and technoscience as imploding modern categories and boundaries resonates with Bruno Latour's seminal account of a-/modernity. Nous n'avons jamais été modernes [We have never been modern], claims Latour (1997 [1991]). The subject-object, nature-culture divide is a modern artefact for the French sociologist, anthropologist and philosopher of science and technology. The separation between the natural/hard sciences and the social/soft sciences, between natural and social phenomena, between subjects and objects, between things and people, between matter and meaning results from the disciplining of knowledge which stems from the dualist thinking typical of modernity. Modernity is, in fact, a process of purification.

In the modern worldview, the subject – who pertains to the cultural and social realm – is the one who acts and knows the object – which pertains to the realm of nature. Things and matter are the objects of the natural sciences, and therefore expelled from the social sciences, while people and meaning are the objects of the latter, and are thus evacuated from the natural sciences. Meanwhile, their separation is hermetic, and those who dare infringing it are disqualified as premodern. As a consequence, in the 'modern Constitution,' the body – and the study thereof – becomes the property of the natural sciences, especially biology and medicine, while the social sciences address the cultural and social meanings ascribed to and inscribed in it. In any case, the hygienic/ist body of the post/huMan and its separation from technology are at home in modernity as purification. Yet, practices tell and make a different story. The social and the natural, nature and culture, subjects and objects are intertwined, and hybrids proliferate. This in-between and entanglement is however unthinkable with/in the modern Constitution, with/in a modern worldview and its impermeable divides and categories. Ironically, such modern unthinkability is directly proportional to the proliferation of hybrids. In Latour's words,

> *les modernes ont été victimes de leur succès. C'est une explication grossière, je l'admets, et pourtant tout se passe comme si l'ampleur de la mobilisation des collectifs avait fini par multiplier les hybrides au point que le cadre constitutionnel qui en nie mais qui en permet l'existence ne pouvait plus les tenir en place. La Constitution moderne s'est effondrée sous son propre poids, noyée par les mixtes dont elle permettait l'expérimentation, parce qu'elle en dissimulait les conséquences sur la fabrique de la société. Le tiers état finit par être trop nombreux pour se sentir fidèlement représenté par l'ordre des objets et par celui des sujets (Latour 1997 [1991]: 71-72)*[84].

mobilized, and exchanged, accorded a discrete value, traded across time, space, species, contexts, enterprises – in the service of many distinct objectives' (Rose 2007: 6-7).

84. '[T]he moderns have been victims of their own success. It is a crude explanation, I admit, yet it would appear that the scope of the mobilization of collectives had ended up multiplying hybrids to such an extent that the constitutional framework which both denies and permits their existence would no longer keep them in place. The modern Constitution has collapsed under its own weight, submerged by the mixtures that it tolerated as material for experimentation because it simultaneously dissimulated their impact upon the fabric of society. The third estate ends up being too numerous to feel that it is faithfully represented either by the order of objects or by the order of subjects' (Latour, Bruno. 1993. We Have Never Been Modern. Translated by Catherine Porter. Cambridge: Harvard University Press: 49).

Modernity is a process of purification, yet hybrids – e.g. 'frozen embryos, expert systems, digital machines, sensor-equipped robots, hybrid corn, data banks, psychotropic drugs, whales outfitted with radar sounding devices, gene synthesizers, audience analyzers, and so on' (Ibid.: 72; 1993: 49-50)[85] – thrive in practice. Latour and Haraway meet in the un/doings of technoscience. In practice, the divide between subject and object, between science and society, between nature and culture cannot be upheld. Subjects and objects are but one option, 'the poles of a spectrum, which have many quasi-subjects and quasi objects, mixtures, in-between them' (Mol 2002: 31). As such, Latour writes, modernity never started, and ultimately, we have never been modern (Latour 1997 [1991]: 68).

Therefore, an a-modern worldview contributes to decentre humans and 'the huMan' – its unmarked privileged position being intrinsically linked to the modern self-other dualism – as sole actors. Agency is no longer the property of humans/the huMan but is distributed amongst humans and nonhumans. Technologies are no longer neutral tools to be handled by an active human while remaining passive; they are not mere bodily appendages. Rather, technologies are agential. In Haraway's words,

> *the amodern refers to a view of the history of science as culture that insists on the absence of beginnings, enlightenments, and endings; the world has always been in the middle of things, in unruly and practical conversation, full of action and structured by a startling array of actants and of networking and unequal collectives. … The shape of my amodern history will have a different geometry, not of progress, but of permanent and multi-patterned interaction through which lives and worlds get built, human and unhuman (Haraway 2004: 77).*

Haraway's and Latour's accounts constitute a fundamental rupture with the modern liberal humanist frameworks addressed in the first two chapters of this thesis, especially as they expose the latter's onto-anthropological inaccuracy and dualist ontology. Ontological intertwinements and hybrids of bodies and technologies are what defines and constitutes our contemporary lifeworld. Therefore, rather than retaining and upholding an oppressive and onto-anthropologically flawed understanding of humans and technology, any exploration of humans with/in enhancement technology shall take stock and of acknowledge this a-modern state of affairs. However, while a necessary step, it is not a sufficient one to be able to provide a satisfactory account of what it means to be human with enhancement technologies. It is also, as I shall address in the next part, a matter of accountability.

85. '[D]es embryons surgelés, des systèmes experts, des machines numériques, des robots à capteurs, des maïs hybrides, des banques de données, des psychotropes délivrés sur ordonnance, des baleines équipées de radiossondes, des synthétiseurs de gènes, des analyseurs d'audience' (Latour 1997 [1991]: 72).

3. The Cyborg and the Posthuman as Ethico-Political Figures and the Matter of Accountability

While Haraway's cyborg, its fleshy incanation OncoMouse™ and her conception of technoscience resonate with Latour's account of modernity, they also depart from it. As previously said, the cyborg is a highly political figure. In her book Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncouMouse™, the question that implicitly underlies the cyborg figure as well as the Cyborg Manifesto is made explicit. Cui bono?[86] As Haraway explains it,

> *[i]n Susan Leigh Star's terms, I believe it less epistemologically, politically, and emotionally powerful to see that there are startling hybrids of the human and nonhuman in technoscience – although I admit to no small amount of fascination – than to ask for whom and how these hybrids work (Haraway 1997: 269, my emphasis).*

Gently tackling Latour, Haraway argues that if disclosing the process of purification inherent in modernity, making visible the existence and proliferation of hybrids, and following them in practice is a valuable enterprise, it is not the most powerful and relevant endeavour. Exposing and interrogating the normative underpinnings and genealogy of hybrids such as the cyborg and the OncoMouse™ and offering oppositional affirmative scenarios and figures – 'earthly survival' – is what is crucial, even vital for Haraway.

As I shall address in the first section, the cyborg is also about locations in power relations. A-modern, it is also posthumanist insofar as it not only exposes and decomposes the modern liberal humanist subject and its exclusionary mechanisms but also advocates and embodies accountability for the worlds, humans and nonhumans we are creating and becoming with. The cyborg and the posthuman are about liveable presents and futures or as Haraway phrases it 'earthly survival.' It is an ethico-political figure. This will be discussed more particularly in the second section where the cyborg and the posthuman compose and incarnate new – relational, embodied, non-anthropocentric, accountable – modes of being human.

3.1 The Cyborg and the Posthuman as Figures and Cartographies of Power

In the Cyborg Manifesto, Haraway re-members – recalls and rearticulates – the cyborg as the American offspring of both Cold and Star Wars. Offspring and sibling of Clynes and Kline's cyborg, and as such the product of the militarised multi-million-dollar 'space-race' opposing the United States of America to the Soviet Union, Haraway's cyborg is also the product of the multi-billion-dollar 'Strategic Defence Initiative,' aka 'Star Wars' that was initiated by United States President Ronald Reagan and that was still on-going at the time Haraway writes her Manifesto. The product and engine of extra-terrestrial space colonisation, the cyborg is also the outcome of technoscience, advanced capitalism and the 'informatics of domination.' As previously discussed, the cyborg materialises where the boundaries between human and animal, machine and organism, physical and non-physical break down; it thrives on the leaky distinctions and proliferation of hybrids generated by technoscience. A cybernetic organism, the cyborg is 'a hybrid of machine and organism' (Haraway 1991: 149); it is a non-modernist figure. OncoMouse™, the patented mouse whose genetic make-up has been altered to carry a human oncogene that consistently results in breast cancer, is kin with the cyborg of Haraway's Manifesto. OncoMouse™ is a cyborg. But for Haraway, 'women in the integrated circuit' (Ibid.: 170) are also cyborgs. In the – 'our' – technological lifeworld, intertwined with advanced capitalism, women, and humans in general, are cyborgs. Haraway, who attempts to reinvigorate socialist feminism, is indeed concerned with women's changed working and living conditions as they are ever more entwined with science and technology. In this respect, if the cyborg is our ontology and gives us our politics, one must notice that imploded boundaries and proliferating hybrids do not amount to the explosion of structures of domination and the unleashing of freedom. The flourishing of differences that are untied to modern dualism (and dear to postmodern scholars) is not innocent.

Differences and Power Relations

Fundamentally, for Haraway, in the 'present-day large-scale techno-scientific remappings of the world' (Lykke and Braidotti 1996: 6), old patterns of domination, hegemony, and oppression do not disappear. They have mutated.

> *[W]e are living through a movement from an organic, industrial society to a polymorphous, information system – from all work to all play, a deadly game … from the comfortable old hierarchical dominations to the scary new networks I have called the informatics of domination (Haraway 1991: 161).*

Haraway does not lose from sight the militarised origins of the cyborg and the 'translation of the world into a problem of coding' that is generated by cybernetics – and more generally the technologies of information and communication – and molecular biology. Underpinned by 'C3I, command-control-communication-intelligence,' the informatics of domination replaces 'white capitalist patriarchy,' where the boundary between text and the body collapses in the material-semiotic practices of molecular biology, genomics and bioinformatics, the prevailing technoscientific fields[87] (Ibid.: 150-162).

In the informatics of domination, old patterns of domination are being reactivated, albeit revamped. With the exposition and implosion of modern dualist categories, differences proliferate. Yet,

86. 'It is both more analytically interesting and more politically just to begin with the question, cui bono? than to begin with a celebration of the fact of human/non-human mingling' (Star, Susan Leigh. 1991. 'Power, Technologies and the Phenomenology of Conventions: On Being Allergic to Onions.' In John Law. Ed. A Sociology of Monsters: Essays on Power, Technology and Domination. London and New York: Routledge: 43).

87. In Donna Haraway's chart, while 'informatics of domination' replaces 'white capitalist patriarchy,' 'simulation' replaces 'representation'; 'science fiction and post-modernism' replace 'bourgeois novel and realism'; 'biotic component,' 'organism'; 'surface and boundary,' 'depth and integrity'; 'noise,' 'heat.' 'Biology as inscription' replaces 'biology as clinical practice' while 'communication engineering' supplants 'physiology'; 'subsystem,' 'small group'; 'optimisation,' 'perfection'; 'population control,' 'eugenics'; 'obsolescence and Future Shock,' 'Decadence and Magic Mountain'; 'stress management,' 'hygiene'; 'immunology and AIDS,' 'microbiology and tuberculosis'; 'ergonomics/cybernetics of labour,' 'organic division of labour'; 'modular construction,' 'functional specialisation'; 'replication,' 'reproduction'; 'optimal genetic strategies,' 'organic sex role specialisation'; 'evolutionary inertia and constraints,' 'biological determinism'; 'ecosystem,' 'community ecology'; 'neo-imperialism and United Nation humanism,' 'racial chain of being'; 'global factory/electronic cottage,' 'scientific management in home/factory'; 'women in the integrated circuit,' 'family/market/factory'; 'comparable worth,' 'family wage'; 'cyborg citizenship,' 'public/private'; 'fields of difference,' 'nature/culture'; 'communication enhancement,' 'cooperation'; 'Lacan,' 'Freud'; 'genetic engineering,' 'sex'; 'robotics,' 'labour'; 'artificial intelligence,' 'mind'; and finally 'Star Wars' replaces 'World War II' (Haraway 1991: 161-162).

they are capitalised upon, 'turned into and constructed as marketable, consumable and tradable "others"' (Braidotti 2002: 175). Furthermore, if differences do explode, they are reinscribed and encrypted elsewhere. In technoscience, gender, race, class, sexuality, able-bodiedness, and other 'old' axes of difference and discrimination are displaced, re-coded, and re-branded, like life itself – but certainly do not vanish (Franklin et al. 2000; Haraway 1991, 1997; Levina 2009). In fact, as Rosi Braidotti states it, '[t]he potentially innovative, de-territorializing impact of the new technologies is hampered and tuned down by the reassertion of the gravitational pull of old and established values' (Braidotti 2006: 2). This is what Haraway has showed in her work, in which (molecular) biology is her playground, her fieldwork. In immunology, for instance, where the body is text(ualised), disease has become 'information malfunction or communications pathology,' viruses are invaders that corrupt information (flow) and try to re-code the body, while stress like auto-immune diseases is 'communication breakdown' (Haraway 1991: 204-230). Yet, the colonial tropes of defence and invasion are reactivated as the body is conceived as a strategic system. In fact, 'the immune system is a plan for meaningful action to construct and maintain the boundaries of what may count as self and other in the crucial realms of the normal and the pathological' (Ibid.: 204). Similarly, Haraway (1997) also pays attention to the ways in which technoscientific discourses (and practices) invest the foetus, the genome, and life itself, all the while recoding – and reinstating – race and whiteness. Technoscience within advanced capitalism does not so much diffract axes of difference, hegemony and oppression, as it displaces them elsewhere, encrypted into new configurations. Hence, appearances can be deceiving; the game might be changing but the (modern, liberal humanist) rules tend to remain the same. This particularly resonates with the phenomenon of human enhancement as presented in the first two chapters. Similarly to the potential of cybernetics being recast within the exclusionary frame of modern liberal humanism, the potential of emerging technologies rather than being explored is narrowly conceived as a linear enhancement wherein the post/huMan still dominates. Human enhancement reinstates the figure of the normate – it becomes normation.

Politics of Location

In this context, the cyborg is a figure that points to cartographies of power. Situatedness, embodiment and embeddedness are key to the cyborg, which transgresses the Christian origins of figuration. In fact, a figure for Haraway is

> *geometrical and rhetorical; topics and tropes are both spatial concepts. … [F]igurations can be condensed maps of contestable worlds. … I emphasize figuration to make explicit and inescapable the tropic quality of all-material-semiotic processes, especially in technoscience (Haraway 1997: 11, my emphasis).*

Figures and figurations not only foreground the intertwinement of the material and the semiotic, of matter and meaning, but also emphasises one's location in networks of power. The cyborg's genealogy and situation in technoscience, globalised advanced capitalism, militarism, and the informatics of domination – as previously showed – testifies to the topological, and not only tropological, quality of figures and figurations. This commitment to locations is once again a call for accountability – accountability for the worlds we are embedded in and creating, for earthly survival and liveable futures. Figurations and figures resonate with Adrienne Rich's (1987) politics of location that informs feminist theory and Haraway's (1991) 'situated knowledges.'

Against modern or post-Newtonian science that epitomises the Cartesian mind/body split, that underpins the (endurance of the) modern liberal humanist subject, that is allegedly grounded in rationalist thought and that assumes the exteriority of reality – a reality that can only be discovered by a putative neutral, value-free mind that rigorously uses sensory experiences and scientific methods, whereby produces objective, true, verifiable, general and ultimately universal knowledge (McLaughlin 2003: 7), feminist scholars have objected and forcefully demonstrated that even though it presents itself as the truth discourse of science and objectivity, it is actually a particular vision of the latter. In fact, invisibility, neutrality and transcendence of the researcher tend to stand for unacknowledged androcentric, heterosexist and ethnocentric worldviews. What passes as universal true knowledge is historically, socially and culturally located for it is generally a Western white heterosexist standpoint. As Sandra Harding argues, it is 'the vision available to rulers' (Harding 1991: 120) while in Haraway's words, it is the

> *gaze [that] signifies the unmarked positions of Man and White, one of the many nasty tones of the word objectivity to feminist ears in scientific and technological, late industrial, militarized, racist and male dominant society (Haraway 1991: 188).*

It is contra such 'god-trick' that relies on the 'conquering gaze from nowhere' (Ibid.: 189) that Haraway has proposed the concept of 'situated knowledges,' namely, embedded and embodied accountable knowledge. As Haraway explains it,

> *our problem is to have simultaneously an account of radical historical contingency for all knowledge claims and knowing subjects … and a no-nonsense commitment to faithful accounts of the "real" world (Ibid.: 187, emphasis in original)*[88].

In the legacy of Rich's 'politics of location' (1987), Haraway calls for critical positioning, partial and embodied perspectives, all key for the production of accountable knowledge (Haraway 188-191). Regarding such endeavour, as Braidotti points out,

> *a "location" … is not a self-appointed and self-designated subject position. It is a collectively shared and constructed, jointly occupied spatio-temporal territory. … "Politics of location" are cartographies of power which rest on a form of self-criticism, a critical, genealogical self-narrative (Braidotti 2002: 12).*

88. Indeed, when modern science tends to totalisation, postmodernism tends to relativism, and both are 'perfect mirror twin[s] … in the ideology of objectivity; both deny the stakes of location, embodiment, partial perspective; both make it impossible to see well. Relativism and totalization are both "god-tricks" promising vision from everywhere and nowhere equally and fully, common myths in rhetorics surrounding Science' (Haraway 1991: 191). In fact, in an attempt of (re)conciliation between the feminist commitment to the materiality of oppression and experiences (central in feminist standpoint theory) and, on the other hand, the rejection of master-narratives and the recognition of the self as not unified but multiple, shifting and fragmented (key to postmodern theory), Haraway offers an alternative: that of 'situated knowledges' which builds upon the metaphor of vision – always embodied vision – and reconceptualises objectivity while being attentive to the entanglement of matter and meaning.

Politics of location is not about identity categories or checks, even though they may be telling vis-à-vis one's embeddedness in power relations since 'there is often a conflation between vectors of discrimination and difference and identity groupings' (Yuval-Davis 2006: 203). It is rather a matter of answering Haraway's query as she states that:

> *vision is always a question of the power to see – and perhaps the violence implicit in our visualizing practices. With whose blood my eyes were ever crafted? (Haraway 1991: 192, my emphasis).*

Like vision, reading, analysis and interpretation are not innocent practices. They are the result of one's historical, political, social and cultural embeddedness; they are the product of power/knowledge knots to use a Foucauldian terminology.

The cyborg incarnates the blurring of boundaries between humans and machines, between bodies and technologies and more generally the proliferation of differences and hybrids within technoscience. It is an a-modern figure. However, while rejecting and decomposing modern liberal humanist frameworks, the cyborg also points towards existing and changing power locations. The cyborg and the posthuman as feminist a-modern and post-humanist figures incarnate this situatedness and location in power relations – they are, after all, cartographies of power. As such, informed by the question 'Cui bono?' they enable – and indeed retrospectively enabled me – to draw attention to the ways in which the posthuMan and the huMan that materialises in transhumanist and bioconservative discourses, and more generally in the debate about human enhancement, are embedded in and participate in the reproduction of patterns of exclusion and domination (see chapters one and two). The cyborg and the posthuman qua posthumanist figures do not however stop with the exposition and decomposition of modern liberal humanist framework. Embedded in power relations, they are tricksters. As I shall tackle in the next section, they enable the emergence of new – ethical and accountable[89] – embodied subjectivities.

3.2 The Cyborg and the Posthuman as Posthumanist Figures for Liveable Futures

A-modernist, the cyborg also seals the demise of the huMan and as such is utterly anti-humanist. However, it does not stop at/with the exposure and deconstruction of both modernity and the huMan. The cyborg is about post-humanist ways of being human. In fact, the product of technoscience, advanced capitalism, militarism, and the informatics of domination, the cyborg, is insubordinate and has definitely lost its innocence. In Haraway's famous prose,

89. This affirmative and ethical dimension is already present in the concept of figure. Rosi Braidotti who has made use of figurations and cartographies of power as conceptual and methodological tools (e.g. Braidotti 2002; 2006; 2011) explains it in these terms: '[f]igurations are not metaphors, but rather markers of more concretely situated historical positions. A figuration is the expression of one's specific positioning in both space and time. It marks certain territorial or geopolitical coordinates, but it also points out one's sense of genealogy or historical inscription. Figurations deterritorialise and destabilise the certainty of the subject and allow for a proliferation of situated or 'micro' narratives of self and others' (Braidotti 2006: 90).

> *[u]nlike the hopes of Frankenstein's monster, the cyborg does not expect its father to save it through a restoration of the garden; that is, through the fabrication of a heterosexual mate, through its completion in a finished whole, a city and cosmos. The cyborg does not dream of community on the model of the organic family, this time without the oedipal project. The cyborg would not recognize the Garden of Eden; it is not made of mud and cannot dream of returning to dust. …. Cyborgs are nor reverent; they do not re-member the cosmos. They are wary of holism, but needy for connection – they seem to have a natural feel for united front politics, but without the vanguard party. The main trouble with cyborgs, of course, is that they are the illegitimate offspring of militarism and patriarchal capitalism, not to mention state socialism. But illegitimate offspring are often exceedingly unfaithful to their origins. Their fathers, after all, are inessential (Haraway 1991: 151).*

Judeo-Christian heteronormative conceptions, the Freudian consecration of and salvation through the law of the Father, modern liberal humanist dreams of bounded wholeness and unity, which all participate in the consecration and reproduction of the huMan, even the socialist apparatus are not recognised by the cyborg.

Accountability and Earthly Survival

Rather, the cyborg is about connections and relations, about liveable worlds and futures that do not abide to modern and liberal humanist worldviews and their share of exclusions. 'One is too few, and two is only one possibility' writes Haraway (180). The cyborg is not about the bounded liberal humanist subject and its paraphernalia of dualisms, but about fractured, fluid and relational subjects. In fact, the cyborg is an ambiguous boundary figure with which to live and create (political) alliances when modern categories and identities – e.g. feminism's Woman' – are disrupted, fractured, imploded. In contrast to – and against – the essentialism and romanticism of ecofeminism that, in the face of technology and technoscience, advocates a return to holism, organiscism and nature – whose naturalness Woman is deemed to be closer to – the cyborg both embraces and is wary of technoscience. Haraway does not forget Heidegger's cautions about Technology, which

> *empties – resources – everything, … [B]ut I want to complicate them and put them into contradiction with the lively, unfixed, and unfixing practices of technoscience. Because I think that the surprises just might be good ones and that the established disorder without the hope of surprises can take away our ability to stay epistemologically, emotionally, and politically alive (Haraway 1997: 279-280, note 1).*

Neither techno-optimism nor techno-pessimism is appropriate for apprehending how technologies are remaking bodies and humanness. Rather, contemporary practices involving bodies and technologies must be accounted for. It is a matter of responsibility and accountability for the presents and futures we are creating and becoming with (and involving humans and nonhumans). As expressed in the posthumanist figure of the cyborg, it is about 'earthly survival' – rather than anthropocentric human survivals.

This urgency is also shared by N. Katherine Hayles (1999) who has become another, if not the other, foundational posthumanist scholar. In her study of cybernetics, as she identifies its

(aforementioned) a-modernist and post-humanist potential for human ontology and critiques both its recasting within modern liberal humanist limits and the nefarious form taken by the posthuman (posthuMan) in transhumanist discourses, she also envisions an oppositional and affirmative posthuman. As she explains,

> *[t]o the extent that the posthuman constructs embodiment as the instantiation of thought/information, it continues the liberal tradition rather than disrupts it [...] I see the deconstruction of the liberal humanist subject [by cybernetics] as an opportunity to put back into the picture the flesh that continues to be erased in contemporary discussions about cybernetic subjects. ... If my nightmare is a culture inhabited by posthumans who regard their bodies as fashion accessories rather than the ground of being, my dream is a version of the posthuman that embraces the possibilities of information technologies without being seduced by fantasies of unlimited power and disembodied immortality, that recognizes and celebrates finitude as a condition of human being, and that understands human life is embedded in a material world of great complexity, one on which we depend for our continued survival (Hayles 1999: 5).*

Like Haraway's cyborg, the posthuman becomes a matter of survival. Nefarious, especially for his designated (human, nonhuman, always less than huMan) Others when it is moulded into the modern liberal humanist subject, the posthuman can ignite renewed, inclusive and ethical, ways of being human.

That is, like the cyborg, the posthuman – the posthuman as human ontology – is recognised as always already constituted in relation with other humans and nonhumans. Rather than fixed and hermetically bounded, its ontology is relational. The posthuman does not abide nor dreams of dualisms, but recognises that it is part of the material world while being itself a material – embodied, fleshy, corporeal – being. Matter, the devalued other of the mind, is no longer erased, but acknowledged as vital. The posthuman is neither fixed nor unitary but always already becoming with/in technologies, as well as human and nonhuman, living and non-living, material and discursive entities. In Hayles's words, 'the posthuman subject is an amalgam, a collection of heterogeneous components, a material-informational entity whose boundaries undergo continuous construction and reconstruction' (1999: 3). In fact, for Rosi Braidotti who, unlike Haraway, embraces the posthumanist epithet and etiquette, those 'techno-monsters,' i.e. both the cyborg and the posthuman as redefined by Haraway and Hayles,

> *contain enthralling promises of possible re-embodiments and actualised differences. Multiple, heterogeneous, uncivilised, they show the way to multiple virtual possibilities. The cyborg, the monster, the animal – the classical "other than" the human – are thus emancipated from the category of pejorative difference and shown in an altogether more positive light (Braidotti 2002: 243; 2011: 68).*

The cyborg and the posthuman are highly political and ethical figures. A-modern and post-humanist, they are promising figures for liveable worlds and futures. Earthly survivals are at stake for the cyborg and the posthuman who foreground matters of accountability.

Posthumanist Humans

While Haraway's cyborg points to human ontology being intertwined with technology in a technological lifeworld – and her work more generally evidences the material-semiotic entanglement of bodies and technoscience – Hayles's posthuman indicates new understandings of human ontology in cybernetics. Both the cyborg and the posthuman demonstrate the entwinement of bodies and technologies, or humans and machines in our lifeworld and contemporary technoscience. They especially draw attention to technologies and technoscience as discourses and practices shaping and reshaping bodily humans, while emphasising that these (re) shaping can issue into an exclusive and excluding human subject, namely the modern liberal humanist subject, or into a-modern and non-humanist human subjects, be they Haraway's cyborg as trickster or Hayles's embodied posthuman. The posthuman, in fact, has rather become about post-humanist human subject(ivity) than actual couplings between bodies and technologies, machines and organisms.

> *[I]t is important to recognise that the construction of the posthuman does not require the subject to be a literal cyborg. Whether or not interventions have been made on the body, new models of subjectivity emerging from such fields as cognitive science and artificial life imply that even a biologically unaltered Homo Sapiens counts as posthuman. The defining characteristics involve the construction of subjectivity, not the presence of nonbiological components (Hayles 1999: 4).*

Resonating with Hayles, while criticising in passing the transhumanist posthuman, Jack (Judith) Halberstam and Ira Livingston write in Posthuman Bodies that

> *[t]he posthuman does not necessitate the obsolescence of the human; it does not represent an evolution or devolution of the human. Rather it participates in re-distributions of difference and identity. The human functions to domesticate and hierarchize difference within the human (whether according to race, class, gender) and to absolutize difference between the human and the nonhuman. The posthuman does not reduce difference-from-others to difference-from-self, but rather emerges in the pattern of resonance and interference between the two' (Halberstam and Livingston 1995: 10).*

The posthuman becomes the a-modern post-humanist human. The dualist ordering of differences, whereby one category becomes the hegemonic norm as it denigrates, devalues and others what is dissimilar, is a purification process, an artefact of modernity. This 'metaphysical cannibalism' (Braidotti 2002: 175) of difference is also cornerstone in the maintenance of the huMan, the liberal humanist subject – as the human enhancement also vividly examplifies. Distributed agency, relationality and embodiment replace the autonomous will, bounded exceptionality, and the mastering mind. In fact, while Latour showed how dualisms are an artefact of modernity and its purification process, and insisted that we have never been modern, the posthuman exposes that we have never been human – in its modern liberal humanist acceptation – but that 'we have always been posthuman' (Hayles 1999: 291).

The posthuman therefore appears not only as a historical necessity to be able to account for and be accountable to technoscience – which is both a-modern and anti-humanist – and its implications for what it means to be human, but also as an ethico-political figure that incarnates a metamorphosed human

– an embodied, non-anthropocentric, relational being that does not abide by nor recognises the norms, injunctions, and exclusions of modern liberal humanism. However, the cyborg and the posthuman have exceeded their technological or technoscientific origins. One can assume that neither the posthuman nor the cyborg would mind however. As political and ethical trickster figures, they are, after all, 'exceedingly unfaithful to their origins' (Haraway 1991: 151). The posthuman and the cyborg have become thriving, even iconic, critical figures in academia, and particularly in cultural studies[90]. Because the cyborg and the posthuman as devised in feminist scholarship constitute a radical rethinking of human ontology, Sharon (2011) designates them as a 'radical posthumanism.' Radical posthumanism 'views the posthuman as providing a means of political resistance against the metanarratives of modernity and as having the potential to usher in a … post-anthropocentric era' (Sharon 2011: 6). Certainly Haraway does not use the term posthuman and relinquishes the posthumanist epithet, but her cyborg and her work in general have sparked research that takes seriously the ontological intertwinement of bodies and technologies and its potentiality for renewed ways of being human (Herbrechter 2013).

Material-discursive figures stemming from technoscience and incarnating the a-modern proliferation of differences and hybrids, the cyborg and the posthuman emphasise embodiment, situatedness and embeddedness in networks of power. The cyborg and the posthuman are our ontology. Hybrid and relational, contingent and situated, humans are beings whose 'nature' is everything but natural and fixed. They are not in a separate yet privileged, exclusive yet exceptional, in short central position in the world. They are however cartographies of power concerned with the question 'Cui bono?' As such, the cyborg and the posthuman have become oppositional yet affirmative subject(ivitie)s indicating other – posthumanist – ways of being human. They are promising figures for apprehending the human in (enhancement) technologies. In fact, posthumanism is a necessary framework in order to account for the human qua material and normative reality, i.e. as body and humanness, as it materialises and is enacted in intimate relations with technologies. In this different genealogy, the cyborg and the posthuman are poles apart from their human enhancement variant. Therefore, with this ingrained ambiguity, how are we to formalise (a working conception of) posthumanism?

90. A abundance of work in literary and cultural studies has emerged following Haraway's (1991 [1985]) 'Cyborg Manifesto' and Hayles's (1999) How We Became Posthuman. Ironically however, while the cyborg is a material-semiotic figure, one that concentrates matter – after all, Haraway refers to the cyborg as embodying and embedded in imploded boundaries, where '[a]n implosion, in contrast to an explosion, concentrates matter,' recalls Cecilia Åsberg (2010: 15) – and while the posthuman re-members the centrality of embodiment as informational conceptions of the body are gaining prominence, they have both tended to dissolve into linguistic and/or metaphorical entities (Jain 1999; Sobchack 2006). This last aspect will be addressed in more length in the next section.

4. From Posthuman to Posthumanism: Materiality, Normativity and Intimacy of Bodies and Technologies

From the transhumanist posthuMan to Hayles's posthuman, references to posthumanism and modern liberal humanism have been constant. While I just asserted that posthumanist frameworks are needed for understanding how technologies are materially and discursively reconfiguring bodies, the posthumanism I envisage is at odds, to say the least, with the posthumanism extolled by transhumanists and abhorred by bioconservatives – even though bioconservatives and transhumanists would probably neither recognise nor agree with the posthumanism upheld here. Posthumanism is a rather ambivalent and ambiguous notion, if only because it adds to the plethora of 'post-' conditions that have become the usual, if not the (only) authorised way to account for the present-day situation in the Western world – e.g. between others, postindustrial, postcolonial, postsovietic, and the all too famous postmodern condition (see also Braidotti 2011: 7). While in this part I will firstly offer a tentative formalisation of posthumanism, secondly I will explore how it has been pursued to understand the intimate relationships between bodies and technology and interrogate its potential for understanding what it means to be human with intimate technologies (i.e. enhancement technologies).

4.1 Posthumanism as Apprehending Humans Beyond Modern Liberal Humanism

A composite term, posthumanism encompasses both discourses on (and of) the posthuman (and the prospect thereof) and discourses in rupture with the (modern liberal) humanist tradition. This tension is made explicit by Stefan Herbrechter and Ivan Callus when they explain that

> *[p]osthumanism … suggests an episteme that comes "after" humanism ("post-humanism") or even after the human itself ("post-human-ism"). Implicit in both these articulations is a sense of the supplanting operations wrought by time, and of the obsolescence in question affecting not only humanism as displaced episteme but also, more radically, the notion and nature of the human as fact and idea (Herbrechter and Callus 2003: np).*

Therefore, the term posthumanism encompasses discourses that may be informed by and that convey opposite views with respect to the legacy and future of the liberal humanist subject – the huMan. Likewise, Don Ihde (2008: 43-57) expresses this tension when he asks 'Of which human are we post?' Post-human-ist discourses – i.e. those of transhumanists and bioconservatives – concern the future of the human as species, yet neither obsolesce nor jeopardise but rather sacralise the huMan. Post-humanism, however, is concerned with the human as it materialises in modern liberal humanism, or rather it critically withdraws from modern liberal humanist frameworks. This ambivalence of posthumanism is particularly perceptible in the similar dual reading of posthumanism offered by Bart Simon (2003) and Eugene Thacker (2003) who divide it into two main threads, namely and respectively, popular and critical posthumanism, and extropianism and critical posthumanism. In both acceptations, popular posthumanism or extropianism refers to transhumanist perspectives on human-technology interactions that construe, predict, and long for the posthuman as the next evolutionary phase. On the other hand,

(critical) post-humanism indeed takes issue with bioconservatives' defence of modern liberal humanism and transhumanists' hyper-humanism – their 'antiseptic posthumanism,' as Ansell-Pearson (1997:35) nicknamed it, that brings 'Western narcissism and humanism' to its apex (see e.g. Braidotti 2002; Hayles 1999; Thacker 2003). In this respect, Hayles indicates that

> *the posthuman does not really mean the end of humanity. It signals instead the end of a certain conception of the human, a conception that may have applied, at best, to that fraction of humanity who had the wealth, power and leisure to conceptualise themselves as autonomous beings exercising their will through individual agency and choice. What is lethal is not the posthuman [the informational posthuman] as such but the grafting of the posthuman onto a liberal humanist view of the self (Hayles 1999: 287).*

When dealing with the issue of the human in (enhancement) technologies for instance, (critical) post-humanism would not rely upon an already individuated, bounded, and autonomous being, but rather would attend to the ways in which humans and technologies get constituted within their (intimate) relations. Post-humanism is predicated and enacts the post-huMan human. If post-humanism is situated in the legacy of Latour's a-modernism and Haraway's cyborg ontology, it is also indebted to feminist (post-structuralist) critiques of the modern liberal humanist subject. Or, in Simon's words, it is 'an interdisciplinary perspective informed by academic poststructuralism, postmodernism, feminist and postcolonial studies, and science and technology studies' (Simon 2003: 3). As such, with regard to the relationships between humans and technology, critical posthumanism adopts a critical stance vis-à-vis (modern liberal) humanism.

Posthumanism and Modern Liberal Humanism

Assuredly, humanism, even in its modern liberal form, is not monolithic. Martin Halliwell and Andy Mousley (2003) list eight types of humanisms, namely 'romantic,' 'existential,' 'dialogic,' 'civic,' 'spiritual,' 'pagan,' 'pragmatic,' and 'technological,' while Kate Soper not only points out that humanism has a different meaning in the Anglo-American and continental tradition – humanism being associated with secularism in the former and with the idea of an essential and universal humanity in the latter – but also identifies three types of humanism based on their (degree of) anthropocentrism – an 'instrumentalist' humanism wherein humans are separate from an external reality and mastering nature for their own ends, an 'idealist' humanism wherein the world exists insofar as it is a reflection and a conceptualisation of the huMan's thought, and a 'dialectical' humanism wherein world and humanity co-shape each other (Soper[91], in Sharon 2011: 38). If anthropocentrism is a central feature of humanism, Halliwell and Mousley indicate that critical engagements with humanism – i.e. anti-humanism – enacted a certain version of humanism. In their own words, they 'are not simply suggesting that critical theory's version of humanism is a pure invention, but that humanism has been tidied up, packaged and streamlined by some anti-humanists in such a way as to negate its actual diversity' (Halliwell and Mousley 2003: 3). While anti-humanism, which is usually encapsulated in Foucault's (1966) announcement of the 'death of Man,' is generally linked to the work of poststructuralist scholars who, following Nietzsche, have rejected Cartesianism and its dualisms as well as critiqued and deconstructed the unitary, autonomous subject, it has also, by doing so, produced a certain version of humanism. This version of humanism – modern liberal humanism – has subsequently informed posthumanism. As Sharon explains it,

> *the greater part of posthumanist discourse converses with only one account of humanism (albeit from different positions): that form of classical or liberal humanism that Soper has defined as appealing to the notion "of a core humanity or common essential features in terms of which human beings can be defined and understood" (1986: 11-12), based on a model of the human inherited from the Cartesian subject of the Cogito, the Kantian "community of rational beings" and the Lockean subject as property-owner and rights-holder. The humanism that the "post-" of posthumanism refers to then is the tradition which has upheld the subject as a free, autonomous, self-contained being with clear boundaries that is detached from the empirical world, or ... from its technologies. ... This notion of the human, of the subject in the modern sense, requires an explicit act of separation that distances humans from their world (Sharon 2011: 42, emphasis in original).*

Modern liberal humanism refers to this liberal version of humanism that also relies upon the purification process – e.g. between the social and the natural – typical of modernity.

Posthumanism and Anti-Humanism: Materiality, Anthropocentrism and Normativity at Stake

In this context, where posthumanism is situated in the legacy of anti-humanist poststructuralist thought, there exists the temptation and a tendency, as Herbrechter (2012) points out, to conceive of posthumanism as the addition of technology to poststructuralism. While Herbrechter takes issue with what he perceives as a technological determinism permeating posthumanism (or the aforementioned conception), I would tend not only to argue that this is a questionable observation, but also that it is informed by a certain nostalgia for the linguistic turn on the part of the cultural theory scholar. Recognising the ontological intertwinement of humans and technologies – cf. Haraway's cyborg ontology and Hayles's posthuman – does not amount to conceiving of technology as the motor of history. Rather, it is about understanding the practicalities of the intimate relationships between humans and technology, how bodies are reconfigured with/in technology, and what it means to be human in relation to technology. As he discards technology in order to avoid a (wrongly perceived) technological determinism, Herbrechter throws the baby with the bathwater while he re-centres posthumanism within the linguistic turn and literary deconstruction and explores posthumanist traces in existing literary work. Such endeavour misses precisely the matter of posthumanism.

Poststructuralism, situated in the linguistic turn[92], shows how human bodies and subjectivities are the product of discursive practices (Barad 2007: 171). Its anti-humanism resides in its objection 'to the liberal humanist prejudice that positions the subject as fully constituted before its engagement in social practices,' as Barad (Ibid.: 168) puts it, as well as in the fact that 'poststructuralism thrives on fragments and discontinuities without falling into the indulgence of relativism, the hysteria of panic or the dubious luxury of melancholia,' as Braidotti (2002: 185) describes it. Discursively constructed, the human subject is also fragmented. While posthumanism recognises the human as never fully constituted and never

91. Soper, Kate. 1986. Humanism and Anti-Humanism. London: Hutchinson.

92. Braidotti would however nuance this assertion. For her, it is in the United States, or more generally in the Anglo-Saxon philosophical tradition that poststructuralism is associated with the linguistic turn. Her strand of poststructuralism – and posthumanism – is rather associated with the work of Deleuze (and Guattari) that belongs to what refers to as 'the tradition of "enchanted materialism"' (Braidotti 2011: 5).

unitary, it however does not comply with the poststructuralist (almost exclusive) focus on language and its anthropocentrism. As Barad rather provocatively yet appositely puts it concerning poststructuralism,

> *[l]anguage has been granted too much power. The linguistic turn, the semiotic turn, the interpretative turn, the cultural turn: it seems that at every turn lately every "thing" – even materiality – is turned into a matter of language… Language matters. Discourse matters. Culture matters. There is an important sense in which the only thing that doesn't seem to matter anymore is matter (Barad 2007: 132).*

Posthumanism, in fact, brings materiality, its agency and centrality into focus. If technology tends to crystallise and subsume materiality – hence the temptation to perceive 'posthumanism = poststructuralist theory + technics' (Herbrechter 2012: 328) – Haraway's bodies as material-semiotic generative nodes and Hayles's vision of the posthuman as not discarding materiality but as always embodied foreground a broader understanding of matter. Against the somatophobia of philosophy and the reduction of the human to its disembodied mind, posthumanism insists on the materiality of the human, on its material-discursive construction. Thus, for Braidotti, if posthumanism is inscribed in the legacy of antihumanism, it also 'bring[s] us back to the organic reality of "real bodies." After so much emphasis on the linguistic and cultural turn, an ontology of presence replaces textual and other deconstruction' (2011:32). If materiality – the materiality of bodies, of technological artefacts – is accounted for in analyses, posthumanism does not however dismiss the importance of discourses, but discourses are no longer the sole element that matters. Materiality also does matter.

Posthumanism also takes distance with poststructuralism insofar as the latter is anthropocentric. Following Haraway's and Hayles's demonstration of the porosity of putative foundational categories – e.g. humans and machines, bodies and technologies, humans and animals, nature and culture – and their relational constitution – i.e. relations are prior to entities – the human is no longer at the centre of posthumanism. Despite humanity's three narcissistic wounds, as enunciated by Sigmund Freud in 1917, namely its dislodgement from the centre of the universe by Nicolaus Copernicus, the shattering of its pretension to a unique and privileged position in creation by Charles Darwin, and the coup de grâce given to its ego by Freud himself when he emphasised the dominant role of the unconscious in human behaviour, and despite Foucault's announcement of the death of Man, poststructuralism, even if anti-humanist, still held onto the human as the centre of the world. For Barad (2007: 428, note 6), this is linked to the distinction between culture and nature, the human and the nonhuman still being understood as given in poststructuralism. The human was still at the centre of poststructuralist analyses – even if it was to crush the huMan's universality, unity, and autonomy. If the huMan's Others were coming back with a vengeance in poststructuralism, they were always human, never nonhuman: the modern distinction between the objects proper to the natural and social sciences still held. Yet, as Barad explains it,

> *[r]efusing the anthropocentrisms of humanism and antihumanism, post-humanism marks the practice of accounting for the boundary-making practices by which the "human" and its others are differentially delineated and defined. … Posthumanism … is not calibrated to the human; on the contrary, it is about taking issue with human exceptionalism while being accountable for the role we play in the differential constitution and the differential positioning of the human among other creatures (both living and nonliving) (Ibid.: 136).*

Posthumanism does not mean removing humans from the analysis however. As Carry Wolfe (2010) argues, a posthumanist perspective enables not only to attend to the human with greater specificity but also to describe the specificity of the human. Once anti-/humanist lenses and their 'ontologically closed domain of consciousness, reason, reflection, and so on' (Ibid.: xxv) are removed, the human as always already material and entangled with technology can be addressed. With respect to the relations between humans and (enhancement) technologies, posthumanism therefore enables to account for and be accountable not only to the ways in which bodies materialise with/in technology but also to account for and be accountable to whose and which bodies matter in these processes.

In fact, if posthumanism breaks away from poststructuralism, it neither forgets its feminist roots nor the lessons learnt from postcolonial, gay and lesbian, queer and disability scholars about (the issue of) difference and othering processes. References to humans and nonhumans (e.g. Latour 1997 [1991]) can flatten reality insofar as they erase their normative import, reality and implications. Adopting a posthumanist worldview does not mean that patterns of exclusion and oppression cease to matter, but it

> *reminds "us" that we have never been human as humanism tried to make us believe. The myth of one humanity, based on universal values, an essential human "nature" and human exceptionalism with regard to nonhuman others, has always worked to exclude some humans that didn't correspond to the ideal that tacitly underlies the apparent universalism (Herbrechter 2013: 6).*

As it discards human exceptionalism and attends to materiality, posthumanism enables to open the human as blackbox, to use a central term in Science and Technology Studies. Humans as bodies and the 'human' as normative can be attended to with/in technology. When living in a technological lifeworld and when enhancement technologies are gaining momentum, it is no longer question of safeguarding the modern liberal humanist subject, its autonomy and bounded unity, but about understanding the relations that take place between humans and technologies and the kinds of bodies that materialise – come to exist and come to count – as human with/in these (intimate) technologies.

4.2 Prosthetic Beings as the Posthumanist Answer to the Intimacy of Human-Technology Relations?

The cyborg and the posthuman, insofar as they have become figures incarnating our ontology in a technological lifeworld and renewed dominant conceptions of the human, have ignited posthumanism. The latter, which breaks with modern liberal humanism, rejects human exceptionalism and foregrounds situatedness, relationality, materiality and normativity proposes to account for and be accountable not only to the ways in which bodies materialise with/in technology but also to account for and be accountable to whose and which bodies matter in these processes. This is a matter all the more urgent and vital that enhancement technologies are growing momentum. In fact, the ignition of posthumanism has generated a profusion of scholarly work on technologies and their relation with human beings.

More particularly, Haraway's (1991) announcement of the human's cyborg ontology and following Hayles's (1999) claim that we have already become posthuman, technological artefacts and systems have increasingly, if not overwhelmingly, been conceived as bodily prostheses and humans as prosthetic beings. Prostheticity has become the all-encompassing term and dominant narrative for each and every encounter between bodies and technology. As I will discuss, following Vivian Sobchack (2006: 20), when technology as bodily prosthesis becomes the dominant trope, a 'metaphorical displacement and generalization' takes place whereby bodies and technologies are naturalised. Contra the ambition of posthumanism, modern dualisms and liberal humanist exclusions return through the back door. As I shall argue, taking materiality seriously becomes a crucial issue for posthumanism. Contemporary times or, as Braidotti has it,

> *[t]he historical era of postmodernity is marked by a new and perversely fruitful alliance with technology which stresses the proximity, familiarity and increased intimacy of the relation between the human and the technological universe (Braidotti 2002: 221, my emphasis).*

If our lifeworld is technological insofar as it is permeated by technologies, the latter are also becoming more pervasive and closer. They are us. To convey this 'proximity, familiarity and increased intimacy,' prosthesis and the prosthetic have become the authorised terms. After all, touching and attached to one's body – one's breast(s), leg(s), arm(s), face –, prostheses rather readily crystallise and convey closeness; they soon become the symbol of our intimate relationships with technologies in our technological lifeworld. 'Prosthesis becomes a fundamental category for understanding our most intimate selves,' writes Haraway (1991: 249, note 7). Prosthesis comes to materially and metaphorically stand for intimacy, but not only.

Prosthesis has historically had a dual meaning, one that is reminiscent of its grammatical and medical, or philological and orthopaedic, origins. Prosthesis navigates between addition – the addition of a letter or syllable to the beginning of a word – and replacement – the replacement of an amputated limb or missing part of the body (Wills 1995: 132-133). Thus, together with closeness and intimacy, prosthesis also embodies and signifies replacement and addition. For everyday – familiar and close – technologies to be construed as prostheses, as bodily replacements and additions is less than a step away. And indeed, computers become prosthetic memory, the camera a prosthetic eye, the oven a prosthetic stomach, but as Sharon Betcher (2001), Sarah S. Jain (1999), Steven L. Kurzman (2001), Katherine Ott (2002), and Vivian Sobchack (2006) have observed, culture too is read as prosthetic, as well as territories, architecture, consciousness, the aesthetic, processes (of ageing), assembly lines, the subaltern, electronic media, as well as our lives (e.g. respectively, Lury 1998; Brahm and Driscoll 1995; Wigley 1991; Wilson 1995; Morra and Smith 2002; Gray and Mentor 1995; Seltzer 1992; Nelson 2001 and Wright 2001; Stone 1994; Smith and Morra 2006). Prosthesis can even be supplemental or originary (Sharon 2011). In fact, each and every encounter between bodies and technologies is encapsulated and subsumed in prosthesis and the prosthetic. The human becomes a prosthetic being, a 'prosthetic God' (Freud, quoted in Smith and Morra 2006: 1).

Notwithstanding its hermeneutic value, the prosthetic trope has fallen victim of its own success. Overused, it has become clichéd. In fact, prosthesis and the prosthetic flatten and reduce the myriad human-technology relations to a single all-embracing and amorphous term. Moreover, and all the more problematically, by doing so they not only do not account for the specificities of intimate relations with technologies such as, ironically, prostheses but they also utilise and deny, objectify and suppress literal prostheses and the people who live with them. Jain, for whom 'the disavowal and simultaneous objectification of the disabled body is at stake in the use of the term "prosthesis"' (1999: 33) indeed indicates that

> *so many authors use it as an introductory point – a general premise underpinning their work about the ways in which technoscience and bodies interact. … [T]he metaphors of prosthetic extension are presented as if they are equivalent in some way, form typewriters to automobiles, hearing aids to silicone implants, allowing each of us to extend in the world of the liberal premise of free choice. … Both the prosthesis and the body are generalized in a form that denies how bodies can and do "take up" technologies of all kinds (Ibid.: 33, 39).*

For her, as technologies and bodies dematerialise, prosthesis has become 'a tempting theoretical gadget with which to examine the porous places of bodies and tools' (Ibid.: 49), while David T. Mitchell and Sharon L. Snyder speak of 'metaphorical opportunism' (1997[93], quoted in Smith and Morra 2006: 2; see also Mitchell and Snyder 2000: 47), and Sobchack of 'a scandal' (2006: 21). At issue, is the disconnection between the literal – material and lived – ground of prosthesis and its metaphorical use.

> *[T]he scandal of the metaphor is that it has become a fetishized and "unfleshed-out" catchword that function vaguely as the ungrounded and "floating signifier" for a broad and variegated critical discourse on technoculture that includes little of these prosthetic realities. That is, the metaphor (and imagination) is too often less expansive than it is reductive, and its figuration is less complex and dynamic in aspect and function than the object and relations from whence it was – dare I say – amputated (Sobchack 2006: 21).*

For Sobchack, if prosthesis and the prosthetic as tropes intend to condense the intimacy of bodies and technologies, insofar as they operate a 'metaphorical displacement and generalisation' (Ibid.) they erase, not to say cannibalise, their literal and material ground. Interestingly – and tellingly – these critiques are issued by disability scholars and/or scholars who, like Sobchack, live with a prosthesis (e.g. Betcher 2001; Kurzman 2001; Mitchell and Snyder 1997 & 2000; Ott 2002).

While technology as prosthesis and the prosthetic trope stem from scholarly work that grounds itself in/as the legacy of Haraway's Cyborg Manifesto, the (vital) emphasis put on situatedness by the figure of the cyborg is, quite ironically, lost. The intimate relationships between people living with prosthesis and that very prosthesis are silenced. When, however, people living with prostheses are mentioned, it is not for the particularity of their experience, but rather as a generalizable illustration – of both the intimacy and porous edges and boundaries between bodies and technologies. In this respect, both Jain (1999) and Kurzman (2001) take issue with Allucquére Rosanne Stone's (1995) account of Stephen Hawking, his body, his prostheses.

> *And there is Hawking. Sitting, as he always does, in his wheelchair, utterly motionless, except for his fingers on the joystick of the laptop; and on the floor to one side of him is the PA system microphone, nuzzling into the Vortrax's tiny loud-speaker. And a thing happens in my head. Exactly where, I say to myself, is Hawking? Am I any closer to him now than I*

93. Mitchell, David T. and Sharon L. Snyder. Eds. 1997. The Body and Physical Difference: Discourses of Disability. Ann Arbor: University of Michigan Press

> *was outside? Who is doing the talking up there on stage? In an important sense, Hawking doesn't stop being Hawking at the edge of his visible body. There is the obvious physical Hawking, vividly outlined by the way our social conditioning teaches us to see a person as a person. But a serious part of Hawking extends into the box in his lap. In mirror image, a serious part of that silicon and plastic assemblage in his lap extends into him as well. … No box, no discourse; in the absence of the prosthetic, Hawking's intellect becomes a tree falling in the forest with nobody around to hear it. On the other hand, with the box his voice is auditory and simultaneously electric, in a radically different way from that of a person speaking into a microphone. Where does he stop? Where are his edges? The issues his person and his communication prostheses raise are boundary debates, borderland/frontera questions (Stone 1995: 5, quoted in Jain 1999: 40 and Kurzman 2001: 383-384, my emphasis).*

For Kurzman, Stone's impression and rendering of Hawking's body is illustrative of scholars' fascination with impaired bodies insofar as they incarnate the blurred boundaries between bodies and technologies. Hawking's body and his intimacy with prostheses are however not explored for themselves, for their 'own quite extraordinarily complex, literal (and logical) ground,' to use Sobchack's (2006: 21) words, but to 'raise boundary debates, borderland/frontera questions' (Stone 1995: 5). Similarly, Jain argues that in Stone (1995) 'one finds an oddly constructed – or perhaps underconstructed and overobjectified – disabled body standing in for questions about bodies, selves, agency and technology' (1999: 41). In this regard, linking the prosthetic back to Haraway's Cyborg Manifesto, Sharon Betcher (2001) draws attention to the fact that it is not the lives and experiences of people with disabilities and in intimate relations with prostheses that inform her cyborg figure but rather more attractive science-fiction characters or the aesthetically pleasing creatures inhabiting Lynn Randolph's art works (see Haraway 1991 & 1997). Furthermore, joining Jain's, Kurzman's and Sobchack's previous observations and cautions, Betcher points out that even though Haraway recognises that people with disabilities intensely experience complex hybridisation and intimacy with technology and actual prostheses (Haraway 1991: 178), they are not allowed to 'speak up' but are rather 'made to figuratively to speak for a cyborgian existence' (Betcher 2001: 38).

In fact, within the prosthetic trope, people with disabilities resonate with Gayatri C. Spivak's subaltern subjects: they become subaltern subjects. To the question 'Can the Subaltern Speak?' Spivak (1988) answered that in (post-) colonialism, the subaltern cannot speak for herself but is spoken for. As she addresses the Hindu practice of sati – the self-immolation of widows on their dead husband's pyre – in India under British colonial rule, Spivak remarks that on the one hand, these Hindu women, the 'sacrificed widows,' are spoken for by the British colonial power that sees them as powerless victims of ancient – obscure and primitive – practices, and on the other hand, they are spoken for by the indigenous male elite who regard them as courageous and emphasise their free choice. In both cases, however, women did not speak for themselves, but were spoken for. In this process, Spivak argues, the one who speaks for an (O) ther preserves himself as subject, while the other who is spoken for becomes a subaltern subject. With respect to the impaired body whose intimacy with technology is spoken for in the prosthetic trope, it is subjected to a subaltern position. In considerations of boundaries and edges between the impaired body and its prostheses, the impaired body disappears. It is invisibilised. Or rather, it is displaced elsewhere. Its presence lies in a figurative value that no longer concerns it. Stone, according to Jain and Kurzman, is therefore guilty of metaphorical displacement and generalisation.

Furthermore, as Sobchack (2006: 22) argues, within the prosthetic trope, when prostheses replace or extend bodily parts and/or functions, they enact a certain body, namely the body as deficient and insufficient that strives for (originary) wholeness. Insofar as it needs prosthetic replacement and addition, the body is conceived as lacking. Yet, in the prosthetic trope, the worthy body is always already an able body, one that is able to enter freely in prosthetic relations with technology and whom prosthetic extensions will enable 'to extend in the world of the liberal premise of free choice' (Jain 1999: 39). Consequently, for Jain, within the prosthetic trope prostheses do not 'fill a gap,' or a lack, when replacing or extending bodily parts and/or functions, but rather supply the deficiency – create the body as deficient and provide, for a price, the technological commodity (Ibid.: 43-44). Moreover, when in an echo to Haraway's cyborg, technology as prosthetic is regarded as disrupting the body's boundaries, edges and limits (e.g. Stone 1995), the underlying body is, again, an able body. Kurzman explains that in the lives of amputees, technologies and prostheses do not act as disrupters but as normalisers of the body, 'they reinforce our publicly perceived normalcy and humanity. …[A]rtificial limbs and prosthesis only disrupt … what is commonly considered to be the naturally whole and abled Body' (2001: 380-381). Likewise, Betcher contends that prostheses are predicated upon, (re-) enact and (re-) enforce 'compulsory bipedism' (2001: 41). Therefore, at issue for these disability scholars is whose bodies are in/visibilised, talked about and spoken for in the prosthetic trope. The latter, it appears, heralds able bodies as 'the' body, while amputees' bodies, disabled bodies, are othered. Contra Haraway's cyborg and Hayles's posthuman, the modern liberal humanist exclusionary dynamics and valuation of free(-floating) choice pervade the prosthetic trope, while the reconfigurations of bodies and subjectivities through literal material prostheses as well as the ways in which bodies and technologies enter and are in intimate relations are neither envisioned nor accounted for.

Finally, the displacement and generalisation that occur with the prosthetic trope and go hand in hand with the invisibilisation of impaired bodies also tend to vitalise prostheses and technologies qua prostheses while the embodied humans are deprived agency, as Kurzman (2001) and Sobchack (2006) argue. For Sobchack, the focus on technology as prosthesis is informed by a certain fascination for posthuman extensions of the body and a considerable dose of techno-fetischism and -fantasy.

> *As an effect of the prosthetic's amputation and displacement from the mundane context, the animate and volitional human beings who use prosthetic technology disappear into the background – passive, if not completely invisible – and the prosthetic is seen to have a will and a life of its own (Sobchack 2006: 23).*

As previously said, when prostheses become metaphors, (impaired) bodies are invisibilised and silenced; they are rendered passive. Simultaneously, once detached from their material ground, technologies qua prostheses or technologies as prosthetic take on a life of their own; they become active. As displacement, the prosthetic trope also displaces agency. Once bodies are no longer conceived as lived bodies but as deficient all the while their prosthetic extensions constitute their salvation, namely their completion into wholeness, technologies qua prostheses are given extraordinary – and not only metaphorical and linguistic – power. When the prosthetic encompasses almost everything, from consciousness to assembly lines, from culture to architecture, from memory to our lives, including (and especially) the human, it becomes endowed with the power to do almost everything. Sobchack (2006: 23-24), for instance, reminisces about and finds the prosthetic trope reminiscent of some cinematic renditions of

prostheses[94] where prosthetic hands and legs, endowed with agency and life, come back to haunt us with a vengeance. Similarly, reacting on Nelson's 2001 article, Kurzman envisions the 'modest collection of below-knee prosthetic legs' that he keeps in a box in his basement 'develop[ing] a collective consciousness of oppression, realis[ing] that [he has] been using them to complete [his] identity, and march[ing] upstairs to have a word with [him] about this' (2001: 380). Within the prosthetic trope, if life is breathed into prostheses, it is breathed out of bodies: prostheses and technologies qua prostheses become lively, alive while the subject, whose body is invisibilised and objectified, appears rather inanimate, lifeless, 'dead meat.' For Sobchack (2006: 23), this technofetishism, and technoanimism even, is symptomatic of the technophilia that informs the prosthetic trope.

Yet, it can also revert into technophobia, or at least the fear of bodies and humans becoming technology's prostheses, monstrous organic outgrowth of the technological original.

> *The point when prostheses are introduced at a deeper level, when they are so completely internalized that they infiltrate the anonymous and the micro molecular core of the body, when they impose themselves upon the body itself as the body's "original" model, burning out all subsequent symbolic circuits in such a way that every body is now nothing but an invariant reproduction of the prosthesis: this point means the end of the body, the end of its history, the end of its vicissitude. It means that the individual is now nothing but a cancerous metastasis of his basic formula (Baudrillard[95], quoted in Smith and Morra 2006: 6).*

As technologies become more pervasive, more familiar, more intimate, they are no longer bodily prostheses but become the body's original model. The body is nothing but a copy, a simulacrum, of the technological standard. With the intimacy of bodies and technologies, the technologisation of the body issues in its prostheticisation. Technology as bodily prosthesis gives way to the body as technological outgrowth. Becoming technological code or text, the body de-materialises. As such, Baudrillard's view of the body is consonant with the informational post/human.

To recall Hayles, this 'posthuman view thinks of the body as the original prosthesis we all learn to manipulate, so that extending or replacing the body with other prostheses becomes a continuation of a process that began before we were born' (1999: 3). In other words, those of Kathleen Woodward more specifically, the process of prostheticisation of the body – its replacement and extension with/in technologies – 'culminates in the very immateriality of the body itself. In this view technology serves fundamentally as a prosthesis of the human body, one that ultimately displaces the material body' (Woodward, quoted in Sobchack 2004: 174). As such, for Sobchack, at issue in the prosthetic trope and its technophilia – and technophobia – is not the agentialisation and agency of technology – unless it transforms into technoanimism – but rather the erasure of the body's agency and materiality.

> *What many surgeries and my prosthetic experience have really taught me is that, if we are to survive into the next century, we must counter the millennial discourses that would decontextualize our flesh into insensate sign … Prosthetically enabled I am, nonetheless, not a cyborg. Unlike Baudrillard, I have not forgotten finitude and the naked capacities of my flesh, nor, more importantly, do I desire to escape them (Sobchack 1995: 209).*

94. E.g. Thomas Ava Edison's 1908 The Thieving Hand, Stanley Kubrick's 1964 Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb, Michael Powell and Emeric Pressburger's 1948 The Red Shoes.
95. Baudrillard, Jean. 1993. The Transparency of Evil. Translated by James Benedict. London Verso: 119

Sobchack's comments resonate with Hayles's vision for the posthuman who, while it welcomes the possibilities of information – and prosthetic – technologies, does not extol the erasure and immateriality of the body, but rather recognises one's embodiment and material embeddedness in the world. For Sobchack and Hayles, this is a matter of earthly survival. What must be accounted for are the ways in which one intimately lives with/in technology and the ways in which one's body is experienced with/in technology. The prosthetic trope is too limited – too reductive and generalising – and exclusive for this endeavour. If grounded in the legacy of the cyborg Manifesto, in which the cyborg as a material-semiotic figure as well as the situatedness and embeddedness of figures in cartographies of power are central, the prosthetic trope surrenders material grounds to language games. Furthermore, as it naturalises bodies, technologies, and their relations, modern dualisms and liberal humanist conceptions return.

The prosthetic trope, even though it derives from an a-modern post-humanist worldview, bears some resemblance with the conception of technology as bodily appendage that convenes and conveys, relies on and enacts the modern liberal humanist subject with its boundedness and sacrosanct individual autonomy. Assuredly, conceiving technological artefacts as prostheses connotes intimacy between bodies and technologies. However, with the growing momentum of enhancement technologies that literally get closer to the skin, and even deeper into the body, the prosthetic trope defeats its purpose insofar as any and every encounter with technology becomes an intimate relation and a matter of prostheticity. As such, it does not enable to understand what is at stake neither in the intimate – literally – relations with technologies, such as upper and lower-prostheses and (implanted) neuromodulation technologies – i.e. the technologies that will later ground my empirical exploration – nor with what it means to be human with these technologies that are also considered to be enhancement technologies (see chapter one). Not only excluding, cannibalising even, the bodies and realities of people living with prostheses – hence reproducing the suppressive and oppressive patterns put forward by transhumanists – but also making material grounds and materiality in general evaporate, technology qua prosthesis is both too reductive and too generalising to constitute an appropriate lens through which to apprehend the particularities of these (enhancement) technologies and the singularities of the close, proximate, intimate relations humans compose with them. A posthumanist understanding of the intimate relations between humans and technologies, namely of the kinds of bodies that materialises and what it means to be human when living in intimate relation with technology, is still needed.

Conclusion

Cyborgs and cybernetics blur the boundaries between humans and machines, between bodies and technologies. Yet, repackaged and recoded within the acceptable limits of modern liberal humanism, cybernetics – from Clynes and Kline to Warwick and the transhumanists – have reproduced and reinstated the privileged position of the huMan, his sacrosanct separation from the world, his boundedness and autonomy. As this re-reading of the posthuman through the cyborg demonstrated, within the informational conception of the posthuman, the huMan is back at the centre of the analysis while technologies become mere bodily appendages: even through the body is hooked into and interacting with (cybernetic) technology, the mind remains untouched, hence the huMan perseveres unchanged. This view, which is underpinned by somatophobia and mind/body dualism, does not tell anything about the ways in which technologies and bodies interact, transform each other, and affect what it means to be human.

With the cyborg (manifesto) and the posthuman as they are devised by feminist posthumanist scholars, their emphasis on situatedness and embodiment, the ontological implications of cybernetics have been acknowledged. The cyborg and the posthuman incarnate the intimacy of bodies and technology while they renew dominant conceptions of the human. Always intertwined with technology, humans are always embodied and becoming with/in technologies, nonhumans, humans, the world. In fact, while dualist categories are an artefact of modernity and its purification process, as Latour (1997) has showed, technoscience is utterly a-modernist and anti-humanist. It is an engine/er of boundary breakdowns and it exposes with renewed urgency and intensity that modern liberal humanism cannot constitute an appropriate framework to account for bodies and technologies, for understanding the re-configurations that take place between and amongst bodies and technologies. Haraway (1991), who pursues the ontological implications of cybernetics, devises the figure of the cyborg as incarnating boundary breakdowns and as the materialisation of the ontology of humans in a technological lifeworld or in a world permeated by technoscience. The cyborg and Hayles's (1999) posthuman are also ethico-political figures. They show how the human within modern liberal humanist frameworks is an exclusive figure. In chapter two, I addressed how discussions about human enhancement reinstate and re-enact the huMan – the normate – as the measure of all things and continue the excluding and oppressive logics of modern liberal humanism. The cyborg and the posthuman are figurations that point to cartographies of power and our embeddedness in power relations. Technologies do not exist outside of power. Technoscience, if subversive and transgressive for the huMan, can also reinstate patterns of exclusion and oppression.

However, they are also tricksters that foreground a metamorphosed human – an embodied, non-anthropocentric, relational being that does not abide by nor recognises the norms, injunctions, and exclusions of modern liberal humanism. The cyborg and the posthuman are ethico-political figures for earthly survival: they are posthuMan humans that ignite post-humanist worldviews and indicate liveable futures. They are not however the final feminist or post-humanist answer to subjectivity in a technological lifeworld (Åsberg 2010: 20). Rather, the cyborg is about the (re-) configurations of bodies with/in technology, but not only. It is also about accounting for and being accountable to these (re-) configurations. The end of human exceptionalism, materiality, normativity and accountability become critical issues within posthumanism.

While implanted technologies and prostheses characterise cyborgs and the posthuman, the practicalities and the transformations occurring in their intimate relationships with bodies have been overlooked. Not only was Haraway more concerned with the (epistemological) intimacy of bodies and technoscience – which, without careful attention, tends to become the new transcendental Technology – than with the (lived) intimacy of bodies and particular technological artefacts, be they handleable, implantable, or prosthetic, but it is also biology, its changing discourses, its intervention at the level of 'life itself,' and implications for what it means to be human that have been investigated (e.g. Haraway 1991; 1997; 2004; Åsberg 2010b; Braidotti 2002; Rose 2001; 2007; Sharon 2011). Assuredly, this is a critical matter, especially when biology has been used – and is still used (see chapter one) – to justify and legitimate the devalorisation and inferiorisation of the huMan's Others. Nevertheless, the intimate relationships between humans and technologies (be they prosthetic or implanted) need to be accounted for, especially as it is becoming an ever more pressing matter with the growing momentum of enhancement technologies. In this respect, conceiving of (every and any) technological artefact in terms of prostheticity and conceiving of human beings in terms of prosthetic beings does not constitute an appropriate direction. Prostheticity has tended to become the accepted trope to encapsulate the intimacy of bodies and technologies within our technological lifeworld. Not only it has lost its material grounds hence flattens the diversity and richness of human-technology relations, but also instrumentalises and invisibilises differently-abled people and their bodily experiences with prostheses. Materiality stops mattering. Other concepts are needed to apprehend the intimacy of humans and technologies as material and normative realities without reviving modern liberal humanism. An attempt at devising such a conceptual tool will be undertaken in the next chapter.

Chapter Four
Somatechnologies and The Intimate Relations of Humans and Technologies

This chapter is an attempt at addressing the intimacy of humans and technologies. With transhumanists and bioconservatives, the latter is subsumed in the phenomenon of human enhancement, itself framed within the – exclusive and anthropologically flawed – limits of modern liberal humanism. With the cyborg and the posthuman – as understood by (feminist) posthumanism – the intimacy between humans and technologies is conceived not only at a general, macro, level but also as a contextual change while the focus that is ultimately on the field of biology rather than technological artefacts has eventually resulted in the evaporation of materiality with the prosthetic trope becoming all-encompassing. In this state of affairs, how to account for the increasingly intimate relations between humans and technologies (and associated transformations of humans with/in technologies), especially as putatively enhancement technologies are growing momentum? How to do so while acknowledging the entanglement of bodies, technologies and humanness within these intimate relations? Indeed, as addressed in the previous chapters, especially chapters two and three, such an endeavour cannot do without taking into account and account for the materiality and normativity of both humans and technologies. Humans and technologies are not abstractions but material and normative realities. They are bodies and technological artefacts; they are embedded in values and norms and entangled in the enactment of who and what counts as human.

As previously said and as Elizabeth Grosz has compellingly argued, 'a profound somatophobia' underpins Western philosophy (Grosz 1994: 5). From the establishment of the discipline in Ancient Greece, through the Enlightenment, and until contemporary mainstream philosophical accounts, the body has been construed as inert and passive matter, as brute biology, hence raw nature imprisoning the mind, the soul, reason, the self. Relying upon mind/body dualism, subjectivity can only originate from and be situated in the non-corporeal: devalued half of one of the most pervasive and enduring binaries, the body, res extensa, is an impingement on Man's true essence insofar as he is a thinking substance, res cogitans, a mind (Grosz 1994; Shildrick 1997; Shildrick and Price 1998; Sullivan and Murray 2009). Philosophy's somatophobia – the aversion toward and devaluation, even rejection, of the body – is an obstacle to apprehend humans qua material beings in their relation with technology. Yet, this is a crucial matter insofar (human) bodies are not only entering into ever more intimate relations with technology but are also confronted by technologies, from tissue engineering to prosthetics, that propose and/or promise to enhance it. It is in fact my contention that by engaging with the body, or rather bodies in technology – 'the body' does not exist, only bodies do, as Grosz (1994) remarked – it is possible to account for and be accountable to what it means to be human with/in potentially enhancing yet assuredly intimate technologies. Bodies become both a focal and nodal point in the relations between humans and technology, one that can no longer be conceptually ignored and silenced for it is precisely bodies with which and in which these technologies – e.g. neuromodulation and prosthetics, but more generally so-called enhancement technologies – interact and intervene. Assuredly, the scholarship of the body has remarkably grown in the last two decades, especially within feminist theory, but permeated by the

linguistic turn, it has tended to reduce the body to a discursive, not to say solely linguistic, construct(ion) or surface of inscription of social and cultural meanings (Alaimo and Hekman 2008). As exemplified in the prosthetic trope, bodies' materiality – i.e., 'lived, material bodies and evolving corporeal practices' (Ibid.: 3) – has tended to evaporate.

Interestingly enough, in philosophical anthropology, when dealing with technology, the body has never been lost of sight. Rather, it has occupied a privileged position. As such, philosophical anthropology, insofar as it has conceived of (bodily) humans in relation with technology, will constitute an entry point through which to examine the intimacy of humans and technologies. At stake in this chapter is to devise a heuristic tool that can enable to think and apprehend the increasing intimacy between humans and technologies, hence help understanding (what is at stake in) putatively enhancement technologies without clinging onto nor revising modern liberal humanism. Such tool shall be informed by posthumanism; it shall be posthumanist.

It is in this frame that I will re-read philosophical anthropology. Firstly, I will show how technologies and bodies have been conceptualised as being in a particular and particularly close relationship within classical philosophical anthropology. Technologies have been apprehended in bodily terms, as organ projection and extension especially. Unfortunately, while resonating with the issue of human enhancement, these conceptions are pervaded by latent modern liberal humanist worldviews and an unproblematised yet highly problematic body. Secondly, I will interrogate the heuristic potential of conceiving of technologies as anthropotechnologies, especially as this conception meets with formerly introduced a-modern post-humanist views. More specifically, after reinstating the onto-anthropological entanglement of bodies and technologies, emphasis will be put on their corporeal intertwinement. On this basis, thirdly, I will propose that if (enhancement) technologies can be understood as anthropotechnologies (Goffette 2006; Hottois 2002; Sloterdijk 2000), they must also and above all be regarded as somatechnologies. In fact, I will devise somatechnologies as a posthumanist conceptual, especially heuristic, tool to help us think the intimate relationships between humans and technologies.

1. Philosophical Anthropology – The Organicity of Technology

With the phenomenon of human enhancement, the intimacy of bodies and technologies is brought to the fore with acute intensity. Interestingly, bodies and technologies have had a shared history within philosophical anthropology. Or rather, the body in its relation with technology has figured quite extensively in the latter with technologies envisaged in bodily terms. This view however retains modern liberal humanism as its horizon; addressing it has a preventive value insofar as it enables the analysis not to reproduce its flaws.

In his Grundlinien einer Philosophie der Technik first published in 1877, Kapp not only introduces the notion of technological artefacts as kinds of organs, but also the expression philosophy of technology. While a mechanistic conception of the human body and (nonhuman) living beings in general informs Cartesianism, nonhumans and the body being construed as machines or automata hence animated tools, with Kapp's 'biological philosophy of technique,' such a notion is to some extent reversed (Canguilhem 2008 [1952]: 94; Hacking 1998: 204-205). Kapp inaugurates the view of technology as a projection of the (human) body. More precisely, for the German philosopher, tools and machines are 'organ projections.' In fact, what Kapp intends to do in his 'philosophy of the axe, the hammer, the screw and the steam engine' (Chamayou 2007: 21, my translation) is to retrace the genesis of technological artefacts.

In his 'organological' conception of technology, artefacts are created following a morphological and a functional principle, which are the two aspects of organ projection. That is, on the one hand, the technological artefact replicates the form or shape of a (human) organ (morphological dimension) and, on the other hand, it extends and increases the function of this organ (functional dimension), while technical progress is measured by higher handleability, namely 'the match, felt by the worker, between the tool and his active limbs at work' (Kapp 2007 [1877]: 128, my translation). Therefore, in this framework in which the organism is central, the hammer is a metamorphosed hand, the functional and morphological projection of the hand. In Kapp's words,

> *[s]ince the organ whose utility and power is to be increased is the controlling factor, the appropriate form of a tool can be derived only from that organ. A wealth of intellectual creations thus springs from hand, arm and teeth. The bent finger becomes a hook, the hollow of the hand a bowl; in the sword, spear, oar, shovel, rake, plough and space, one observes the sundry positions of arm, hand and fingers*[96] *(Kapp 1877, quoted in Sharon 2011: 80).*

The first tools (e.g. hammers, axes, chisels) and measuring units are projections of the human hands and feet, while the railway and telegraphic networks are projections of the vascular and nervous systems.

If organ projection is an exteriorisation of human organs and organic functions, an exteriorisation of man, a reverse movement also takes place between technological artefacts and the human body, one in which the former, especially their mechanisms, are used to understand the latter, namely how the organism works. As Kapp[97] formulates it,

96. This organ projection is not conscious however. Chamayou talks about a 'ruse of organic reason,' whereby technological artefacts are 'the unconscious transposition of something bodily towards the exterior' (Chamayou 2007: 26-27, my translation). This connects to the notion that no technological shape can exist outside of the organism (see below).
97. Kapp, Ernst. 1877. 'Selbstanzeige,' In Vierteljahrsschrift für wissenschaftliche Philosophie. Leipzig: Fue's

> *[t]he production of mechanism according to an organic model, as well as the understanding of the organism by means of mechanic apparatuses, receives the name organ projection (quoted in Chamayou 2007: 23, my translation).*

Thus, the movements of the skeleton for instance come to be understood through the mechanisms of technological artefacts such as levers, hinges, screws, or axles, while the heart comes to be apprehended as a pump. In fact, organic rules and relations, once externalised and formalised into technological artefacts, become mechanical laws (Kapp 1877: 95). In this 'retrospective relation,' as Kapp names it, the organism is still the necessary a priori, the model, while the technological artefact is a copy or replication. Grégoire Chamayou comments that,

> *[w]hen this retrospective relation takes place in the mode of amalgam, folding up the mechanical order on the organic order while negating the latter's specificity, it gives rise to the mechanistic conception of the living [a "blatant, if not unacceptable mistake" in Kapp's words (125)]. But, while respecting the distinction between the two orders of phenomena, this relation also enables science to be guided on morphological correspondences to discover by analogy the explanation of certain physiological phenomena (Chamayou 2007: 32, my translation and emphasis).*

Contra Descartes's mechanistic conception of the body, Kapp underlines the specificity of the living organism[98] and condemns the amalgam(ation) of the mechanical and the organic, their (epistemological) relation being one of analogy. As I will discuss later, this does not however amount to a condemnation or reversal of Cartesianism or modern liberal humanism.

In the lineage of Kapp, a century later, Arnold Gehlen also conceives of technological artefacts as organ projections. In fact, he takes as his starting point a comment made but not developed by Kapp (2007 [1877]: 94)[99], namely that humans come into the world as imperfect or impaired beings but have compensated their organic shortcomings – that is, their unadaptation to their environment as opposed to animals – with their inventive intelligence, which expresses itself in the fabrication of tools (Gehlen 2003 [1983]: 213; Scharff and Dusek 2003: 208). This state of affairs constitutes the human condition, human nature even, and the basis of his conception of technology. For Gehlen (and Kapp to a lesser extent), philosophy of technology is philosophical anthropology, technology being key for what it means to be human.

Due to the limitations of their physical potential then, human beings have developed tools and technology as artificial bodily extensions for coping with the world. Echoing Kapp, technological artefacts are also organ projections[100] for Gehlen who builds upon another principle, that of organic substitution,

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98. According to Chamayou, this retrospective relation between the (human) organism and technological artefacts, between the model and the replica, indicates that Kapp's philosophy of technology is also, indissociably, a philosophy of biology. On this aspect, for a discussion of tools and technological artefacts as part of life from a biological perspective, see Canguilhem 2008, especially his fourth chapter 'Machine and Organism' (pp. 75-97).

99. Kapp quotes an extract of Adolph Bastian's Die Rechtsverhältnisse bei verschiedenen Völkern der Erde, that reads as '[n]o animal is born as deprived as man [sic]. Nature, while bringing him into the world, did not give him the means to support his existence. In order to win his fight with the environment, he has to dedicate himself to art, to the inventive activity of the spirit' (2007 [1877]: 94, my translation). The fabrication of weapons to fish and hunt is the example given by Bastian.

100. Organ projection in Gehlen is however limited to Kapp's first movement, namely the functional extension of the human organ(ism) with technological artefacts and the latter's morphological replication of the human organ(ism). The second movement of the theory of organ projection through which the organism is understood via technological artefacts and their mechanism is not included in Gehlen's framework.

to construct a taxonomy of human-technology relations. The principle of organic substitution indicates the tendency of substituting technological artefacts for organic matter. In this framework, tools can be used as replacement techniques, strengthening techniques, and facilitation techniques (Gehlen 2003 [1983]: 213). As Gehlen explains it,

> *[f]rom the beginning [the] principle of organ substitution operated along with that of organ strengthening: The stone grabbed to hit with is much more effective than the bare fist. Thus, next to replacement techniques that allow us to perform beyond the potentials of our organs, we find strengthening techniques that extended the performance of our bodily equipment – the hammer, the microscope, and the telephone reinforces natural abilities. Finally there are facilitation techniques operating to relieve the burden upon organs, to disengage them, and finally to save effort – as when use of a wheeled vehicle replaces the dragging of weights by hand (Gehlen 1980: 3, emphasis in original).*

While substituting for organs, for the body, technological artefacts extend and magnify the human's bodily powers. Through the replacement, strengthening and facilitation of organic functions, technologies become bodily prostheses. Gehlen, however, is suspicious of this growing exteriorisation of the human (body) – and of technological development in general – which he sees as 'an increasing existential dependence of the individual' (Gehlen 2003 [1983]: 218), a potential alienation.

There, Gehlen draws upon another German philosopher, Hermann Schmidt, who devised three stages in the development of technology that are concurrently three stages in the increasing objectification of the human. Schmidt's first stage, the tool, resonates with Kapp and Gehlen's organ projection and the latter's organ substitution. In this phase, both human physical power and intelligence are needed to utilise the tool. The second stage is that of 'work and power machinery,' wherein humans, or rather human intelligence is needed to operate the machine that, in contrast to the tool, powers itself. Therefore, for Schmidt, with the machine comes 'the technological objectification of human physical power' (Ibid.: 215). The third and last stage of technological development – 'our' stage in Schmidt's understanding – corresponds to the automaton. With it, human intelligence and physical powers, and ultimately human beings per se, become redundant. As the automaton is 'both physically and intellectually self-reliant … even the intellectual contribution of the human is dispensed with by technological means' (Ibid.). The technological objectification of humans is complete.

As Gehlen adopts and endorses Schmidt's (technologically deterministic) framework, he heralds an ambivalent view of technology. With statements such as '[t]echniques is as old as man himself [sic], for when we deal with fossil remains it is only when we come upon traces of the use of fabricated tools that we feel sure we are dealing with men' (1980: 2), Gehlen emphasises that the world of human beings is a world of technical artefacts. This may even be interpreted as hinting at a certain ontological intertwinement, or at least at some permeability between humans and technologies. However, as the organic is increasingly being replaced by the inorganic (technological) – i.e. Gehlen's substitution principle – humans are being objectified by the progressive autonomisation of technology and technological development. They are at risk from alienation. If technology is a necessity for humans and is even part of their nature as impaired, physically deficient beings – with somatophobia being latent in this conception – in an echo to Heidegger's romantic conception of technology (see chapter one) it however carries an alienating,

dominating and eventually dehumanising potential[101]. If technological artefacts, tools, are (initially) bodily extensions or projections, it is feared that the human is ultimately becoming an organic outgrowth of technology. Technological artefacts remain, and have to remain in this ambivalent worldview, external to the bounded body qua organism. In fact, Gehlen's conception, like Kapp's, remains within the limits of modern liberal humanism, underpinned by the Cartesian dualism between mind and body and human exceptionalism.

In these philosophical anthropological accounts of technology as bodily extension, the body is conceived as deficient but it is also reduced to a set of functions. The counterpoint of technology as organ projection is a functionalist, and at worst instrumentalist, view of the body: the body becomes a tool or a set of tools, it is extended by technological artefacts at the functional level, as a functional entity. While Kapp contests the mechanistic view of the body, he remains however against any 'mechanical intrusion in the organism' (Ibid.: 29). Humans and technologies are (to be) kept ontologically separated. In fact, Kapp's retrospective relation is epistemologically bound. It concerns the function(ing) of the organism rather than the ontological intertwinement of the machine and the organism. If technological artefacts and technological development are undeniably naturalised with the notions of organ projection and handleability, they remain separate from the body, from the human. In the retrospective relation, like the technological artefacts it has exteriorised and in a mirroring process, the body qua organism is a form (morphology) and a set of functional organs. As an unchanging entity with fixed deficiencies – more explicitly in Gehlen's – the body is located outside history and culture, impermeable to technologies and the practices technological artefacts set in motion. The body, in Kapp and Gehlen's functional conception, is a bounded organism that uses technology but is not transformed by it – it could even be seen as an organic set of functions that is actuated by the mind. The body is generic and inconsequential. It is erased, or rather, material bodies are silenced. The self qua mind directs the use and handling of the technological artefacts it created. As a matter of fact, the mind/body split is expressed and recreated in Gehlen's appropriation of Schmidt's technological stages and his separation between physical and cognitive abilities.

Moreover, modern prejudices also pervade Kapp's and Gehlen's conceptions insofar as while technological artefacts amplify and magnify – enhance – human abilities, it is not only for the human to survive but also to remain at the centre and in charge of its (his) environment, to alter and master nature. It can be noted that even though Kapp and Gehlen focused on tools, machines, and automatons, the conception of technology as projection and extension has been revitalised with the phenomenon of human enhancement. As previously shown, transhumanist conceptions especially draw upon and reinstate this modernistic view, wherein technology is naturalised as projection or extension of the organism: enhancement of the body becomes a logical, natural step forward. In the modern liberal humanist worldview that underpins Kapp's and Gehlen's philosophical-anthropological accounts, separated from yet central in the world, not only is the human an exclusive figure but 'he' is unaffected by the technologies he uses to master his environment. Like Descartes's conception of the body as technology, the view of technologies as organ projections and extensions – or as mere bodily appendages – only safeguard and sanctify the huMan. Finally, the thesis of organ projection relies upon and reinstates a strong anthropocentrism. Technologies are organically determined – both functionally and morphologically. Technological artefacts are reproductions, copies, imitations of their model, the human organism. As a matter of fact, no shape of technologies can exist outside of the human organism (Kapp 2007 [1877]: 150).

> *[E]very imitation of the living is … a fortiori an imitation of man [sic]. The theory of organ projection is a theory of the unique model, a radical anthropocentrism (Chamayou 2007: 27, my translation).*

This radical anthropocentrism, as Chamayou identifies it, is pervaded by anthropomorphism and human exceptionalism. Typical of modern liberal humanism, the latter materialise too in Gehlen's ambivalence towards technology and technological development, the human being at risk of losing its position as central subject and autonomous actor.

In Kapp's and Gehlen's philosophical-anthropological accounts of the relations between technologies and bodies, both are blackboxed, or rather technology navigates between a functional and a substantivist view – technological artefacts are conceived as functionally projecting or extending the body while carrying a dehumanising potential – whilst the body is an organic and functional entity, one that is fixed and bounded – and always already deficient. Furthermore, to the extent that, in any case, technologies are (pre-determined) organic projections or extensions and do not transform bodies, it is hardly possible to speak of intimate – or of any – relations between bodies and technologies. Modern prejudices and liberal humanism, underpinned by the mind/body dualism and human exceptionalism, pervade and prevail. In a nutshell, these philosophical-anthropological frameworks are not appropriate for understanding (what is at stake in) the intimate relationships between humans and technologies.

101. With respect to technology objectifying and dehumanising human beings, a note on the context in which both Gehlen and Schmidt are writing has to be made. Taylorism and Fordism, the systems of production where mechanisation and automation are central, were in place. Their consequences, especially in terms of deskilling and fragmentation of labour and of the body, were highly criticised. In Canguilhem's words, Taylorism consists in 'the rationalisation of workers' movements [wherein] we see the human organism aligned, so to speak, with the functioning of the machine. Properly speaking, rationalisation is a mechanisation of the organism, inasmuch as it aims to eliminate movements that appear useless because they are seen solely from the viewpoint of output, considered as a mathematical function of certain factors' (Canguilhem 2008 [1952]: 96). In this respect, Taylorism and its formulation by Canguilhem echoes Heidegger's caution of human becoming standing-reserve in the Gestell (see chapter one). One can also recall here Karl Marx who, in his Capital, wrote that in the manufacture of the capitalist system of production, '[n]ot only is the detail work distributed to the different individuals, but the individual himself is made the automatic motor of a fractional operation, and the absurd fable of Menenius Agrippa, which makes man a mere fragment of his own body, becomes realised' (2010 [1867]: 245). Marx also refers to the way Douglas Stewart describes manufacturing labourers, namely as 'living automatons … employed in the details of the work' (quoted in Ibid., note 40: 253). Gehlen and Schmidt's conceptions of technology are inseparable from (a critique of) these modes of production. Furthermore, what this detour through Taylorism, Fordism, and the Marxian understanding of capitalism makes clear is that neither (theoretical) conceptualisations nor humans nor technologies take place in a vacuum.

2. Anthropotechnologies as/and Somatechnologies

Recalling the former chapter, subsequent to Haraway's foregrounding of (contemporary) humans' cyborg ontology, the prosthetic trope has gained prominence with each and every technological artefact eventually conceived as bodily prosthesis, entering in an intimate relation with the body as it extends it. Kapp's and Gehlen's philosophical-anthropological conceptions of technological artefacts as organ projections and organ extensions tend to resonate with this view. However, prostheticity has had another trajectory through the concept of 'originary prostheticity' or, better, 'originary technicity' (Stiegler 1998) which foregrounds human ontology as being always already entangled with technology. In fact, in her thesis, Sharon (2011) distinguishes between accounts that conceive of technology as an instance of 'supplementary prostheticity' or 'originary prostheticity.' The former belongs to a modern liberal humanist apprehension of human-technology relations wherein technologies and humans are ontologically separated. That is, even though technological artefacts constitute an extension or enhancement, they nevertheless do not transform humans. While aforementioned philosophical-anthropological frameworks are variations of supplementary prostheticity, Kevin Warwick's experimentations epitomise the latter (see chapter 3). In contrast, originary prostheticity refers to technology as being always already part of what it means to be human: human nature is intrinsically technological. This approach constitutes a promising entry for apprehending the intimate relations between humans and (enhancement) technologies insofar as while the intertwinement between humans and technologies is ontological, it is also tackled as a bodily entanglement. That is, if technologies are anthropotechnologies, they are first and foremost somatechnologies – and all the more so as they enter into ever more intimate relations with humans.

2.1 Originary Technicity, Biotechnogenesis and Corporeal Intertwinement

Resonating with Haraway's cyborg ontology, Bernard Stiegler (1998) coined the term 'originary technicity' to draw attention to technology as the human's originary condition. Anthropology is technology for Stiegler, who builds upon the work of paleoanthropologist André Leroi-Gourhan (1993 [1964]). As he reflects on the origin of the human, Stiegler takes issue with modern metaphysics that not only conceives of the human as separated and opposed to technology but also assumes that it is the human who is inventing the technical. Rather, he not merely questions whether the relation is inverted – the 'what' or the technical inventing the 'who' or the human – but whether there is an ontological difference between the human and the technical. For Stiegler, influenced by the Derridean notion of différance, humans and technologies are co-constituted. One does not pre-exist nor conditions the other; they co-emerge, coincide and compose with each other. Building upon the prosthetic idiom to encapsulate this profound – 'originary' – intimacy between humans and technologies, he asserts that

> *[t]he prosthesis is not a mere extension of the human body; it is the constitution of this body qua "human"... It is not a "means" for the human but its end (Stiegler 1998: 152-153).*

Contra Rousseau, the human has no original state or state of nature, but s/he is always already entangled and becoming with technology. In fact, hominization – or anthropogenesis – takes place through technological artefacts. Furthermore, the emergence of the technical does not stem from the brain and human intelligence. Rather, 'everything begins with the feet' (Ibid.: 142).

Stiegler's statement encapsulates Leroi-Gourhan's (1993 [1964]) thesis. While the French paleoanthropologist draws attention to the fact that tool making is not the sole property of humans, thereby replacing the human within the zoological realm and challenging the boundaries between humans and animals, he also indicates that tool making stems from the progressive unfolding of an erect posture. With bipedalism, hands and face were liberated: the former were freed from their supporting role in mobility while the latter was freed from its grasping function. With the liberation of the hand came the possibility for new modes of contact, the capacity to gesture and to grasp, the ability to make and manipulate tools and instruments. As for the liberation of the face, it enabled language. '[T]ools for the hand, language for the face, are twin poles of the same apparatus,' Leroi-Gourhan (1993 [1964]: 20) points out, while the feet, or bipedalism, but not cerebral development, are the primordial element in the emergence of humans and technologies. While cerebral development is linked to the emergence of the first artefacts – Stiegler will speak of 'a double emergence of cortex and flint, a convention of the two, an arche-determination that would surpass them' (1998: 155) – liberation (of the hand and the face) also becomes exteriorisation. In fact, Leroi-Gourhan argues, '[t]he whole of our evolution has been oriented toward placing outside ourselves what in the rest of the animal world is achieved inside by species adaptation' (1993 [1964]: 179). Tool use corresponds to an externalisation of the body, or in Stiegler's apprehension, to an exteriorisation of its memory.

'As a "process of exteriorization," technics is the pursuit of life by means other than life,' explains Stiegler (1998: 17). Hominisation – and human evolution – is predicated upon technologies. Human evolution has a techno-organic nature; it is a bio-techno-genesis. While the human develops tools and technologies, technologies in return contribute to shape the human in its bodily form and existence. Besides indicating that tool use relies upon the human's kinetic and bodily dispositions – e.g. bipedalism and freed hands – Leroi-Gourhan also emphasises the centrality of gesture. While the manipulation of artefacts depends on specific sequences of movements, tools and tool use also 'provide opportunities for some operating chains ... to emerge' (Noland 2009: 100). They initiate new gestures and transform human bodies. In this respect, albeit contemporaneously, while the use of the mobile phone's texting function has contributed to change human morphology, even if only by strengthening the thumb, Nicolas Nova, Katherine Miyake, Walton Chiu and Nancy Kwon (2012) have drawn attention to – and listed – the emergence of new gestures with information and digital technologies. The 'angry monkey' gesture, namely the calibration of an iPhone's digital compass that requires the user to move the iPhone through a figure-8 pattern within a vertical plane, or the 'security pass hip-bump' – and 'bag swiping' variant – which 'occurs when someone carries their RFID[102]-enabled security pass [or transportation card] in their bag, and approaching a sensor, lifts the hip to angle the bag towards the sensor, creating a hands-free connection and activating the lock' (Nova et al. 2012: 22-23) are present-day examples of the gestures that emerge and sediment with information technologies. Our bodies, what they do and can do change in interaction with technology.

Human bodies co-evolve with technology. The ontological intertwinement of humans and technology is a highly corporeal matter. While Leroi-Gourhan's point on the centrality of gesture with/in technologies is not developed in Stiegler's work, the latter build upon technological artefacts constituting a third kind of memory. Technological artefacts are a 'mnemotechnics' for Stiegler (1998: 212). In addition to the humans' germinal memory – that is, the memory of the species (human and animal) qua the

102. RFID is the acronym for Radio-Frequency Identification.

genetic information that resides in the individual organism and is passed on to his/her offspring – and somatic memory – namely, epi-memory or the memory of the individual which is neurological and dissolves with the individual's death – technological artefacts constitute another type of memory, an 'epiphylogenetic memory … a recapitulating, dynamic, and morphogenetic (phylo-genetic) accumulation of individual experience (epi)' (Ibid.: 177; see also Stiegler 2008: 30-31). It is in the exteriorisation and materialisation of memory in (removable and detachable) technological artefacts that the human's originary technicity resides.

> *The movement inherent in this process of exteriorisation is paradoxical: Leroi-Gourhan in fact says that it is the tool, that is, tekhné, that invents the human, not the human who invents the technical. Or again, the human invents himself [sic] in the technical by inventing the tool – by becoming exteriorised techno-logically. But here the human is the interior: there is no exteriorisation that does not point to a movement from interior to exterior. Nevertheless, the interior is inverted in this movement; it can therefore not precede it. Interior and exterior are consequently constituted in a movement that invents both one and the other: a moment in which they invent each other respectively, as if there were a technological maieutic of what is called humanity (Stiegler 1998: 141-142, my emphasis).*

The human – 'organic organised matter' – and its relationship with the environment – matter, be it organic or inorganic – is constituted and transformed, namely mediated, by the technical – 'organised but inorganic matter,' itself created by the human (Ibid.: 177). Neither the technical nor the human pre-exists the other, they co-constitute each other. If Stiegler focuses on the mnemonic quality of the technical – technologies are mnemotechnologies – this shall not be abstracted from materiality, especially bodily materiality. Originary technicity is a corporeal intertwinement of humans and technologies.

Leroi-Gourhan's and Stiegler's account of the bio-techno-genesis of the human radically undermines the claims that technology is dehumanising – e.g. Heidegger, bioconservatives, and more generally substantive conceptions of technology (see chapter one) – or that there exists a fixed human nature. Their thesis as concerns the exteriorisation of the human in the technological resonates with Helmuth Plessner (1928)[103] who, inaugurating philosophies of (technical) mediation, has highlighted the onto-anthropological ex-centricity of human beings: humans are artificial by nature, they have no direct relation to the world. Rather, for Plessner, their relation to the world is not only mediated by their corporeality but also by technological and cultural artefacts (de Mul 2003; Kockelkoren 2010). Consequently and fundamentally, humans and technology are not ontologically separated, but rather intertwined and co-shaping each other. Technologies hence do matter in the making, shaping, and meaning of embodied humans. Bodies are always already 'bodies in technologies,' as Don Ihde (2002: 138) insists.

Others have also emphasised the technological genesis and fabric of the human and urged scholars to start from and account for this onto-anthropological feature. Marquard Smith and Joanne Morra (2006: 3) have indicating for instance that 'the promise of the "posthuman" … is already found in the human' due to its entanglement with technology, while David Wills has asserted that in our time, with the growing momentum of enhancement technologies and with technologies becoming biotechnologies (see chapter three, especially the section on the anti-humanism of technoscience), hence

> *[a]t a moment in which the human appears to be moving inexorably forward toward a biotechnological future, it is strategically important to recognize – to be cognizant in return of – the fact of a relation between bios and tekhne so complex and so historic that any presumption of the priority of one over the other can be sustained only by means of an appeal to a metaphysics of creation (Wills 2008: 5, emphasis in original).*

Assuredly, like the human's cyborg ontology, its originary technicity and the techno-organic nature of its evolution undermine, if not invalidate, the transhumanist and bioconservative framing of the phenomenon of human enhancement – their conception of humans and technologies as separate is a Modern liberal humanist purification. The human and the technological are ontologically intertwined. In fact, originary prostheticity questions traditional views of (human) evolution. Leroi-Gourhan and Stiegler already emphasised that humans belong to the zoological realm, that technics is not the sole property of humans but that their distinctive characteristics lies in the extent to which they have exteriorised themselves – their memory qua the memory of the species – in technological artefacts. However, while the notion of originary technicity, like prostheticity, carries the risks of metaphorisation and simultaneous instrumentalisation and invisibilisation of the lived experiences of people living with prostheses addressed in the previous chapter[104], thereby raising an issue of accountability and especially the question 'cui bono?,' it also remains at a rather general level. Even though promising for apprehending the intimate relations between humans and technologies (and associated transformations of humans with/in technologies) – especially Leroi-Gourhan's focus on gestures – these theses are concerned with either the origins (or lack thereof) of human beings and their evolution or their onto-anthropological intertwinement with technology rather than with the mundane interactions between bodies and technologies. Likewise, while some scholars have pursued the a-modern and posthumanist potential of originary technicity – of the lack or excess of origins of the human insofar as it is always already technological – by further questioning the origin and exceptionality of humans, lived intimate relations between bodies and technologies have remained unaddressed.

'Like it or not, our origins are in slime,' claims Keith Ansell-Pearson (1997: 124, emphasis in original) as he draws upon the work of biologist Lynn Margulis. Like Rosi Braidotti (2002) and Luciana Parisi (2008), Ansell-Pearson (1997) queries and debunks the anthropocentrism inherent in traditional – linear – views of evolution. While one cannot speak of a purely biological evolution insofar as evolution is always already entangled with technology, these scholars further examine the 'bio' of the human's bio-techno-genesis. Bios, as Braidotti (2002: 132) argues, connotes intelligent or self-reflexive, distinctively human, life. Yet, life and in an evolutionary perspective the reproduction and continuation of life are not so much about bios as about zoe. Zoe is 'the generative vitality of non- or pre-human or animal life,' that carries on with and without the human (Ibid.: 37). With the identification of bacterial and viroid life as crucial for the making of genetic material and lineages, the linear Darwinian model of evolution – which has generated the oppressive colonial and organic image of the tree model of evolution wherein the human sits on the higher branch – is seriously challenged (Ansell-Pearson 1997: 130-131). Evolution should rather be conceived as creating rhizomes (Ibid.: 130) and as 'proceeding by contagion rather than filiation' (Parisi 2008: 23). Genes can be transmitted by other means than through sex(ual reproduction). Indeed, in her theory of endosymbiosis, biologist Margulis has shown how bacteria merge and infect one

103 Plessner, Helmuth. 1975 [1928]. Die Stufen des Organischen und der Mensch: Einleitung in die Philosophische Anthropologie. Vol. IV, Gesammelte Schriften. Frankfurt: Suhrkamp.

104. Certainly, Stiegler's endeavour is historical, archaeological even insofar as it questions 'the origins' – or lack thereof – of the human. However, as originary technicity or prostheticity becomes an onto-anthropological condition, the dangers of over-generalisation and concurrent exploitation and invisibilisation of bodies with prostheses still exist.

another, thereby creating symbioses that result in the emergence of new genetic material (Ansell-Pearson 1997: 124; Parisi 2008: 15-16). Bacteria are however not the only life forms that contribute to symbioses and transversal genetic lineages, viruses also play a critical role (Ansell-Pearson 1997: 132-134). In this state of affairs – or shall I say matter? – human evolution, ontology, and bodies stem from 'the unholy marriage of bios and zoe with technos,' to use Braidotti's (2002: 170) words. With its originary technicity combined with bacterial and viroid life, the human has neither an exceptional nor a fixed position in the realm of life. Anthropocentrism and human exceptionalism dissolve. Bio-techno-genesis, always already a zoe-techno-genesis, points to the human as not only entangled in a web of technological, corporeal, bacterial as well as social, cultural, and political forces but also as itself a technological, corporeal, bacterial, social, cultural, and political ecology.

However, while these notions contribute to redefine what it means to be human (with technology), hence open the human – especially its bodily dimension – as blackbox, they still remain at a rather general level – e.g. the evolution of the species or the human's onto-anthropological condition – and do not address the intimate, and to a certain extent more mundane, relations between humans and technologies. Furthermore, a central interrogation arises when one repositions the human's 'originary technicity' – its ontological and corporeal becoming with technology – and its zoe-techno-genesis in the context and phenomenon of enhancement technologies. If technology and human corporeal evolution are intrinsically intertwined, if technics is 'the pursuit of life by means other than life' to borrow once again Stiegler's (1998: 17) words, does it mean that transhumanist pleas for human enhancement and a posthuman future are thereby substantiated, or at least unproblematic and benign? Said otherwise, does it mean that having recourse to enhancement technologies and ever more intimate technologies does not bring about any new challenges insofar as the difference between these technologies and familiar technological artefacts is not so much a different of nature as a difference of degree – technologies in the context of human enhancement and in the current technoscientific landscape no longer referring to artefacts that can be used and removed but to intimate and incorporated technologies? It does not. What originary technicity and zoe-techno-genesis make clear is the human's relationality and indeterminate becoming with (human and nonhuman as well as living and nonliving matter). In contrast to transhumanist pleas for a posthuMan condition, originary prostheticity and zoe-techno-genesis invite us to critically examine and ponder over the kind of non-huMan humans we are becoming with (enhancement) technologies, that is, when technologies are deemed to become literal anthropotechnologies, i.e. technologies that (re-) make human beings (Sloterdijk 2009).

2.2 Anthropotechnologies and Rules for the Human Zoo

Anthropotechnologies is the name given to enhancement technologies, especially of the genetic kind, by Peter Sloterdijk (2000 [1999]) in Rules for the Human Zoo. In this essay, the German philosopher re-reads and re-writes Heidegger's 1947 'Letter on Humanism.' In this letter, Heidegger rejects humanism insofar as it conceives the human in continuity with the zoological and biological realm albeit with distinctive – exceptional – qualities. For instance, the human is apprehended as an animal endowed with rationality, spirituality and/or speech (Sloterdijk 2000 [1999]: 28). In Heidegger's words, humanism 'thinks of the human from animalitas and does not think toward humanitas' (Heidegger 1947[105], quoted in Verbeek 2011: 29). In short, humanism is not huManist enough. For Heidegger, the human is ontologically different from the zoological – and vegetal – realm insofar as it does not inhabit an environment but has a world and is in the world. In fact, the human is thrown into or given over to being; it has ek-sistence. The human is, in fact, 'the shepherd and the neighbour of Being' (Ibid., quoted in Goffette 2006: 22, my translation), s/he lets Being reveal itself. If the human is the space of Being, the 'clearing,' it is through language and through speech that Being manifests itself. Language is critical insofar as it is 'the house of Being' (Ibid., quoted in Sloterdijk 2000 [1999]: 29, my translation[106]). Heidegger's abandonment of humanism is in fact eminently logocentric.

From Taming to Breeding Humans, Posthumanism and the Question of Anthropotechnologies

While Sloterdijk remarks that Heidegger's vision is unrealistic[107], he proposes to actually explore the conditions and process necessary for the human to come to ek-sistence, to the clearing, and to become the shepherd of being. Contra Heidegger, in the Rules for the Human Zoo 'the human' does not (pre-) exist as such but must be produced. Sloterdijk's piece is an inquiry into the becoming-human of the human – its hominization – and necessary taming practices. If the human is an animal, s/he is also a 'creature that failed in its being-animal and remaining-animal' (Sloterdijk 2000 [1999]: 38). The human comes-into-the world and is-in-the-world not only through the physical act of birth but also through language. S/he is the product of a 'hyper-birth,' s/he is brought and exposed to the world in the same movement[108]. It is precisely the physical – corporeal – and the lingual aspects of coming-into and being-in-the-world that will interest Sloterdijk while Heidegger only considered language.

With respect to language, Sloterdijk remarks that not only Heidegger's 'Letter on Humanism' but also humanism in general is logocentric. Humanism consists in the literary cultivation of the human, its taming through letters. By means of schooling and education, humans are domesticated. In fact, in humanism, humans are 'animals under influence' (Sloterdijk 2000 [1999]: 20). What matters is their subjection to the right kind of (literary) influence, the humanist being 'convinced of a necessary link between reading, sitting, and taming' (Ibid.: 44). However, as Sloterdijk notices, modern humanism and

105. Heidegger, Martin. 1947 [1976]. 'Brief über den Humanismus.' In Wegmarken, complete edition. Frankfurt am Main: Klostermann: 313-364.
106. All the quotations from Sloterdijk (2000 [1999]) that are used in this chapter have been translated by me.
107. Heidegger's vision, due to its emphasis on thought and language, is unrealistic for Sloterdijk insofar as it requires of humans qua authentic humans, namely shepherds and neighbours of being, an ascetic attitude of mediation. This attitude is more demanding and constraining than the lectures of classical humanism, but it is the one that enables to go closer to Being and thus beyond humanism.
108. 'If the human is in the world, it is because s/he belongs to a movement that brought her/him to the world and set her/him in it. S/he is the product of a hyper-birth that from a nursling [Saügling] created a worlding [Weltling]' (Sloterdijk 2000 [1999]: 38, my translation).

its literary model for society is obsolescing and fading, letters and texts are subsiding in favour of new means of communication, i.e., 'new media of political-cultural telecommunication' (Ibid.: 17). No longer modern humanist, societies are becoming posthumanist. In this context, Sloterdijk recalls Heiddeger's rumination on humanism insofar as it has the merit to pose the question of

> *[w]hat can still tame the human when humanism has failed in its role of taming humanity? … What can tame the human when, after all previous experiments to grow the species up, it remains unclear what it is to be a grown-up? Or, is it no longer possible to pose the question of the human's cultivation and formation in the framework of theories of taming and education? (Ibid.: 36).*

The context has changed; it is no longer a matter of thinking humans/ism after fascism and Nazism, but of thinking the becoming-human when literary societies are withering and new media are growing momentum. However, the last question is particularly relevant for Sloterdijk. If, as previously mentioned, humans are brought in and exposed to the world in the same movement, hence experiencing a 'hyper-birth,' it is precisely the material, corporeal coming-into-the-world that is transformed in posthumanist societies. Recalling Nietzsche, Sloterdijk emphasises that humans are cultivated in both the material and spiritual senses of the term: not only are they tamed but they are also bred.

The growing field of genetics qua enhancement technology brings the latter aspect, the breeding of humans, to the fore. As Verbeek phrases it, '[n]ot only the "lections" of the humanists help to shape humanitas but also the "se-lections" of the growers of humans that we have always been and that we will be ever more explicitly now that we have biotechnology' (Verbeek 2011: 35). The affair Sloterdijk could be born as German intellectuals perceived flirtations with eugenics and Nazism in references to breeding combined to Nietzsche's Zarathustra (Michaud 2006: 19; Verbeek 2011: 33). With genetic technologies and the possibility to select for genetic traits (see chapter one), the role of anthropotechnologies in making – taming and breeding, lection and selection – of the human is made manifest. Sloterdijk indeed explains that

> *[t]he domestication of the human being constitutes the great unthinkable from which humanism has, from Antiquity to the present, averted its eyes – recognising it suffices to plunge us into deep waters. And in those deep waters, we are flooded with the realisation that at no time was it, or will it be, possible to accomplish the taming and the creation of friendly, educational, links with letters alone. Certainly, reading was a great power for the education of the human – and it still is today, albeit to a lesser extent. But selection, whatever form it may have taken, has always been present, like a power behind power (Sloterdijk 2000 [1999]: 48).*

For Sloterdijk, even in the literary taming of humans, a (brutal) selection process is taking place wherein a gap is created between those who are literate and those who are not, between those who educate and those who are educated. With the possibility of genetically tinkering with the human – breeding him/her – the prospect of a distinction between those who breed and those who are bred opens. Posthumanist societies are becoming a human zoo. As humans are increasingly, rather voluntarily, participating in this breeding selection, they are becoming (literal) shepherds. Having to make decisions regarding the characteristics of the species, humans are endowed with a pastoral role. In this context, it will soon become impossible not to formulate a code of anthropotechnologies or rules for the human zoo (Ibid.: 51-52). Promising, especially in light of the previous chapters and posthumanism in particular, anthropotechnologies pose the question of accountability.

Anthropotechnologies and the Question of Accountability

For Verbeek, the value – or at least the most interesting part – of Sloterdijk's piece does not reside in such rules, but in the 'ambition to think about ethics and technology beyond humanism' (2011: 36), the latter transpiring in Sloterdijk's attempt to apprehend the human in its materiality. I concur with Verbeek concerning the first yet not the second part of this statement. With the notion of anthropotechnologies and the fact that they are becoming ever more literal and inscribed in a conscious, voluntary process with biotechnologies, Sloterdijk invites us to think about the kind of human beings we want to become – our liveable present and future, our earthly survival. With the human and its becoming conceived as open and indeterminate – notwithstanding Sloterdijk's (too) great optimism regarding the outcome – the posthuMan celebrated by transhumanists need not materialise. Rather, openness and indeterminacy calls upon accountability for the humans we are to become. When huMan**i**ty – i.e. modern liberal humanist humanity – is exclusive and composed of bounded individuals, posthumanity might result into (normative) inclusivity and relationality. However, relationality need not include only humans. As previously expressed through the distinction between bios and zoe, the human does not exhaust life. The evaluation of anthropotechnologies in light of humans' becoming is and should be non-anthropocentric. In this respect, like Verbeek, I would contend that Sloterdijk's invitation to think about ethics, technology, and humans' becoming beyond humanism is the most compelling aspect of his call for rules rather than the rules themselves[109].

However, I would tend to disagree with Verbeek regarding Sloterdijk's apprehension of human beings in their materiality. Through selection, Sloterdijk seems to implicitly acknowledge the human as a material and normative reality with its sets and patterns of exclusions. Yet, rather disappointingly, he does not explore these vital issues but rather remains at the level of the species. In this regard, even though Sloterdijk distances himself from humanism that posits the human as always already there, as he endeavours to show that the human does not exist but is the result of a taming and breeding – i.e. the product of more or less conscious and voluntary anthropotechnologies – he nevertheless still remains confined within a reductive conception of materiality – of bodily materiality. When Sloterdijk conceives of the human as a being who comes-into-the-world through birth and not only through language, he tends to subsume bodies and materiality in biology or biological processes. While anthropotechnologies are remaking humans, it does not seem to be a matter of (concrete) human-technology relations. Rather, 'the human' who inhabits and informs Sloterdijk's 'Rules' is the human qua biology and species. As such, with anthropotechnologies – and the actions and implications thereof – being conceived at a rather general, even abstract, level, bodies and humanness remain absent from Sloterdijk's thesis.

Furthermore, some ambiguity informs Sloterdijk's take on anthropotechnologies in relation to the human as biology and species. On the one hand, Sloterdijk is nostalgic about the diminishing influence of language and humanism in domesticating humans – this is particularly explicit in his

109. The (rather conventional) elaboration of rules or guidelines, which would be philosophers's responsibility, might in fact not be an appropriate solution – as chapters five and six will illustrate.

closing paragraph in which he hopes that even though Letters and books have lost most of their power and eminence they can still come-into-the-clearing as archives. On the other hand, while he is quite critical vis-à-vis technoscience in general and is particularly wary of genetic technologies, he is against 'anti-technological hysteria,' which he sees as a remnant of modern metaphysics opposing humans and technologies, and rather optimistic as concerns the future of the species (Goffette 2006: 26; Hottois 2002: 233; Michaud 2008: 52). For Sloterdijk, biotechnologies qua anthropotechnologies remain a hominization, or even humanisation, process. Even more, humans and (anthropo-)technologies form a 'co-intelligent system' wherein 'what is mostly bad has a self-eliminating effect, what is mainly good has a self-reproduction effect, and what is mainly neutral produces enough redundancy to ensure continuity' (Sloterdijk[110], quoted in Goffette 2006: 26, my translation). This somehow fatality or at least optimistic confidence on Sloterdijk's side is quite surprising. More fundamentally, this attitude, which is detached from practices, forecloses the possibility and necessity to ask and question what kinds of bodies are materialising with/in anthropotechnologies. Indeed, what and who matters – comes to exist and to count – as 'authentically' human with/in anthropotechnologies? When keeping at the level of the species while hoping for the best – or even being sure it will be for the best – the human-in-becoming who is being tamed and bred with anthropotechnologies remains a generic category, a blackbox.

Conclusion

The concept of anthropotechnology as used by Sloterdijk resonates with Leroi-Gourhan's bio-techno-genesis and Stiegler's originary technicity. It encapsulates the fact that humans do not pre-exist as such but are the result of certain taming and breeding practices, of anthropotechnics that, with the growing momentum of biotechnologies – genetics in particular and technoscience in general – are becoming (literal) anthropotechnologies. If the concept draws attention not only to the contemporary urgency of thinking about the human's becoming in relation with technology but also to no longer do so in modern liberal humanist terms, thereby resonating with this chapter's purpose of devising a heuristic tool that would enable to think and account for the mundane, intimate relations between humans and technologies, Sloterdijk's apprehension of anthropotechnologies is not without problems. On the one hand, the materiality of both technologies and humans is not accounted for. To focus exclusively on the species and biology while attending to technology in general terms cannot explain how anthropotechnologies are transforming humans in practice: anthropotechnologies are not modifying humans in abstract but material terms. This was Leroi-Gourhan's lesson: the onto-anthropological intertwinement of humans and technologies is always already a corporeal entanglement. Yet, technologies qua technological practices and artefacts as well as human bodies and their mundane interactions are absent from these accounts. On the other hand and linked to the previous point, if anthropotechnologies are conceived as changing the human qua species, as participating into hominization, they are not envisaged in normative terms. However, anthropotechnologies might be dis/enabling certain bodies to materialise as human, that is, to come to exist and to come to count as human (see also my discussion of normation in chapter two). Interestingly, when Sloterdijk mentions that selection is part of anthropotechnologies and that humans are becoming shepherds, the resonance with Foucault's concept of bio-power, which encapsulates power over life and describes the governance of life as pastoral power, is striking. Nevertheless, the connection is never made. Insofar as Foucault has actually shown not only how putatively proper and improper humans are made within discursive apparatuses, wherein technologies play a role, but also how bodies are central in such production, the concept of anthropotechnology could gain form his insights.

110. Sloterdijk, Peter. 2000. La domestication de l'être. Paris: Mille et une nuits: 97.

2.3 Anthropotechnologies and the Making of Human Subjects: Bodies and Normativity

'My objective … has been to create a history of the different modes by which, in our culture, human beings are made subjects,' Foucault (1982: 777) explains while reflecting upon his work. The human and what it means to be human cannot be understood outside of the historical and cultural forms it takes, e.g. the huMan. Anthropos or the human are abstract notions that are given shape and meaning through particular bodies of knowledge and techniques, that is, made into certain kinds of subjects (Brown and Stenner 2009: 155; Haraway 1991; Rose and Rabinow 2003a: xxiii). If processes of subjection and subjectivation (i.e. assujettissement[111]), that is, the becoming subject(s) of human beings in specific historical times and societies, are central in Foucault's work, such processes are not independent from bodies. In fact, Foucault's concept of bio-power has been particularly fruitful in showing how power-knowledge apparatuses, i.e. heterogeneous assemblages of laws, rules, scientific and philosophical statements and propositions, technologies, institutions, and architectural configurations (Foucault 1994: 299)[112], seize bodies and produce certain (embodied) subjects.

With the notion of bio-power, Foucault shows that in Western societies, modernity is intertwined with the governmentalisation of (biological) life. By the end of the eighteenth century, the sovereign power and the correlated right of letting live and making die (le droit de glaive) has been not so much replaced as complemented and permeated by bio-power which instead makes live and lets die (Foucault 1997: 34; 214). Bio-power, which developed into two directions, an 'anatomo-politics of the human body' through disciplining techniques of power and a 'bio-politics of the population' through regulating ones (Foucault 1976: 183), has had human life enter into political calculations and administration in order to manage and foster it. As Foucault writes,

> *[l]es disciplines du corps et les régulations de la population constituent les deux pôles autour desquels s'est déployée l'organisation du pouvoir sur la vie. La mise en place au cours de l'âge classique de cette grande technologie à double face – anatomique et biologique, individualisante et spécifiante, tournée vers les performances du corps et regardant vers les processus de la vie – caractérise un pouvoir dont la plus haute fonction désormais n'est peut-être plus de tuer mais d'investir la vie de part en part*[113] *(Ibid.).*

111. The French notion of assujettissement encapsulates both being subjected to and subject of (power, etc.). It does not have the same negative, or rather passive, connotation in French as in the English subjection. Assujettissement refers not only to one's subjection to power but also to one's (active) becoming as subject.
112. As Foucault explains, '[c]e que j'essaie de repérer sous [le nom de dispositif], c'est, premièrement un ensemble résolument hétérogène comportant des discours, des institutions, des aménagements architecturaux, des décisions réglementaires, des lois, des mesures administratives, des énoncés scientifiques, des propositions philosophiques, morales, philanthropiques. … Le dispositif lui-même c'est le réseau qu'on établit entre ces éléments' (Foucault 1994: 299). My translation: 'What I intend to pick out under the name of apparatus [dispositif] is first a resolutely heterogeneous set that comprises discourses, institutions, architectural settings, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral, and philanthropic propositions. The dispositif itself is the network that gets established between these elements.'
113. 'The disciplines of the body and the regulations of the population constitute the two poles around which the organisation of the power over life has unfolded. The implementation during the classical age of this double-faced great technology – anatomical and biological, individualising and specifying, oriented toward the body's performances and looking toward life's processes – characterises a power whose highest function is henceforth perhaps no longer to kill but to invest life through and through' (my translation).

With its disciplining and bio-political sides, bio-power is pastoral power. It is exercised in accordance with the model of the relationship between a shepherd and its flock. It is both an individualising and collectivising form of power in which the shepherd watches over particular subjects and the ensemble, over 'omnes et singulatim' (Foucault 1979). While this resonates with Sloterdijk's own account of anthropotechnologies, it also problematizes the politicisation – so to speak – of life, of the human qua species and the human qua body.

Even though discipline historically appeared before bio-politics, I will attend first to the latter, especially as it questions Sloterdijk's identification of anthropotechnologies as breeding technologies and the novelty thereof. Bio-politics is centred on human life, or rather on the human insofar as s/he is a living species. Biological and specifying (Foucault 1976: 183), it consists in the regulation of the population thus focuses on the species body, namely the body imbued with processes and mechanisms of life. Therefore,

> *c'est sur la natalité, sur la morbidité, sur les incapacités biologiques diverses, sur les effets du milieu, c'est sur tout cela que la biopolitique va prélever son savoir et définir le champ d'intervention de son pouvoir*[114] *(Foucault 1997: 218).*

Bio-power, in its bio-political configuration, purposes to control – regulate and foster – the unpredictabilities of human life qua a population of living beings (Ibid.: 219). Bio-politics thus implements mechanisms of prediction, of statistical estimations, of global measure(ment) – a whole field of knowledge – so that it can acts on large-scale phenomenon of population, i.e. birth, mortality, longevity, and so forth. These are security mechanisms, bio-politics being a regulatory or i/ensuring (assurancielle) technology of power (Ibid.: 222). Contra Sloterdijk, neither the human zoo nor the need for rules emerge with biotechnologies.

Furthermore, with respect to bio-power's disciplining side, as Foucault shows, the anatomo-politics of the human body is pivotal in producing 'subjected and practiced bodies, "docile" bodies' (Foucault 1975: 162). In fact, this configuration of the 'bipolar diagram of power over life' (Rabinow and Rose 2003b: 2) is key to the making of the Modern liberal subject, the one true human, and his hygienic body: it is key to the making of proper humanness (within modern liberal humanism, hence transhumanism and bioconservativism). The body that is taken as the natural, originary (for bioconservatives) or desired (for transhumanists) state of the human condition has been disciplined and normalised, purified from its undisciplined corporeality: it has been invested, marked and produced by the power-knowledge discourses and practices of (bio-) power. As 'machinery of power that explores [the body], breaks it down and rearranges it … so that [bodies] may operate as one wishes, with the techniques, the speed and the efficiency that one determines' (Foucault 1975: 162), discipline is taming embodied subjects. It is an anthropotechnology. Materiality and normativity entwine: pivotal in the making of putative human bodies and subjects, discipline qua anthropotechnology is highly corporeal and mobilises concrete technological artefacts. In this respect, Foucault can even be considered a philosopher of technology (Dorrestijn 2012).

Centred on the human body, which is both object and target of power, the individualising art of detail that is discipline relies upon and operates within and through institutions such as the army, the factory, the hospital, school, and the family. In fact, through practices such as the learning of writing at school or shooting in the army, the body is penetrated materially and in depth by power relations. In this 'intensification of the body' (McNay 1994: 99), technologies or artefacts are crucial.

114. 'It is over birth, morbidity, diverse biological incapacities, the effects of the milieu, it is over all this that biopolitics will take its knowledge and define its power's domain of intervention' (my translation).

As Foucault writes concerning the ways in which the pupils' bodies are disciplined,

> *[t]he part of the left arm from the elbow must be placed on the table. The right arm must be at a distance from the body of about three fingers and about three fingers from the table, on which it must rest lightly. The teacher will place the pupils in the posture that they should maintain when writing and will correct it either by sign or otherwise, when they change this position (Foucault 1995 [1976]: 152).*

Elbow, arms, fingers, position, posture and gesture: the body is mobilised and shaped in relation with material objects such as the table and, one might assume in the process of learning how to write, a pen. It is in relation with artefacts that the 'instrumental coding of the body' (Ibid.: 153) takes place. A similar process occurs in the army where the bodies of soldiers are shaped through routines enacted with an artefact, in this case the rifle. The right hand, the right knee, the eye, the waist, and the entire body are mobilised. It is in the interaction between one's body and the weapon, through the enactment of bodily gestures, that one becomes a soldier. One might say that the realisation or actualisation of the rifle's or the pen's material invitation becomes routinized, ritualised and sedimented into the soldier's and the pupil's bodily practices, hence part of their repertoire of bodily techniques (Mauss 1934) or body hexis[115] (Bourdieu 1980). Through this process, the soldier's and the pupil's bodies are disciplined. Tamed, they are made subjects. The body with/in technology being crucial in one's becoming-subject, anthropotechnologies are, as I shall address, somatechnologies.

It is essential to note, however, that discipline – as well as bio-power's normalising pole, bio-politics – is not an exclusively negative force. Throughout his work, Foucault has never ceased to oppose the common acceptation of power as repressive. Power – and bio-power is no exception – is both potentia and potestas, namely positive and negative, productive and repressive (Foucault 1976, 1982, 1997) or in Braidotti's (2006) terms, enabling and hindering. As Foucault exhorted his readers:

> *[i]l faut cesser de toujours décrire les effets de pouvoir en termes négatifs; il "exclut," il "réprime," il "refoule," il "censure," il "abstrait," il "masque," il "cache." En fait le pouvoir produit; il produit du réel; il produit des domaines d'objets et des rituels de vérité. L'individu et la connaissance qu'on peut en prendre relèvent de cette production*[116] *(Foucault 1975: 227).*

Power is not something one has but is rather immanent to its field of action. It is as it unfolds that power produces its targets (Foucault 1976: 130). In the case of bio-power, the body and population do not pre-exist as a blank surface awaiting to be disciplined and regularised but are constituted as such by the effects of power/knowledge knots. Furthermore (bio-)power is not only an objectivising force but also a subjectivating one, that is, human beings are both object and subject of power: power both 'subjugates and makes subject to'[117] (Foucault 1982: 781).

115. Pierre Bourdieu's hexis corporelle (translated as body hexis) is the incorporated and naturalised habitus (i.e. ensemble of dispositions or internalised structural, societal and cultural frames). It refers to the repertoire of acquired, assimilated, and incorporated postures, movements, and practical habits, such as the way of walking, standing, moving, holding oneself, talking, etc. (Bourdieu 1980).

116. 'We must cease once and for all to describe the effects of power in negative terms; it "excludes," it "suppresses," it "represses," it "censors," it "abstracts," it "masks," it "conceals." In fact, power produces; it produces reality; it produces domains of objects and rituals of truth. The individual and the knowledge that may be gained of him belong to this production' (my translation).

117. Regarding this mode of subjectification and the production of the subject, Judith Butler offers a very clear

In his discussion of bio-power in general and sexuality in particular, Foucault discerns four subject positions produced by the play of power and knowledge, namely, the hysterical woman, the masturbating child, the (reproductive) Malthusian couple and the perverse (homosexual) adult (Foucault 1976: 139). All subjects of and to bio-power, these figures result from the combination of disciplinary (or anatomo-political) and regulatory (or bio-political) processes (Ibid.: 193). In fact, bio-power is an anthropotechnological apparatus wherein who matters as (im/proper) human is enacted. In this respect, as demonstrated by the work of Georgio Agamben (1998), Achille Mbembe (2003) and Judith Butler (2004), bio-power can also reverse into 'necro-power' (Mbembe 2003), that is, a power of death wherein modes of subjectivation – the making of putatively human subjects – give way to processes of de-subjectivation or de-humanisation that produce less-than-human lives[118] (i.e. bare or precarious lives in Agamben 1998 and Butler 2004 respectively).

As shown through this review of Foucault's account of bio-power, anthropotechnologies are always intertwined with the body[119] and humanness (i.e. who counts as human). Bio-politics and discipline are critical in (re-) shaping them. It is as they take a hold on bodies that bio-politics and discipline (un-) make (putatively) human subjects. However, while the body is focus and locus of power in Foucault, always enmeshed with issues of humanness, it still remains rather general, if not generic (Braidotti 1991: 87). 'The body,' rather than bodies that are always material realities differently affected by putative humanness due to their dis/ability, gender, sexuality, race, and class, inhabits Foucault's bio-power. Furthermore, while 'the body' tends to dissolve into the subject, material agency tends to dissolve into power-knowledge apparatuses and discourse in general. In fact, it is insofar as they play a central role in processes of subjectivation with/in power-knowledge apparatuses that the body and technological artefacts are addressed, i.e. the body inasmuch as it is power's focal point and technological artefacts insofar as they are an element composing apparatuses. Despite the value of a Foucauldian understanding of anthropotechnologies, it does not enable to apprehend the mundane intimate relations between bodies and technological artefacts and how they are entangled with humanness. As I will argue in the next section, the concept of somatechnology constitutes a posthumanist heuristic tool for apprehending the intimate relationships between humans and technologies. While recognising that the onto-anthropological intertwinement of humans and technologies is corporeal, somatechnology foregrounds the materiality and normativity of both humans and technologies as well as their intimate relation. Interestingly, the concept has also found credence in feminist scholarship dealing with technology.

interpretation: 'Power not only acts on a subject but, in a transitive sense, enacts the subject into being. As a condition, power precedes the subject. Power loses its appearance of priority, however, when it is wielded by the subject, a situation that gives rise to the reverse perspective that power is the effect of the subject, and that power is what the subject effects' (Butler, Judith. 1997. The Psychic Life of Power: Theories in Subjection. Stanford: Stanford University Press: 13, quoted in Rosenberg and Milchman 2009: 64, emphasis in original)

118. While Agamben (1998) devises the concept of bare life in relation to the people imprisoned and killed in Nazi concentration camps, Mbembe (2003) coins the term necro-power in the context of slavery and the colonial occupation of Palestine by Israel. As for Butler (2004), it is the situation of the prisoners detained in Guantanamo post 9/11 that informs her analysis of precarious lives.

119. Recalling chapter three, as Haraway (1991) conceptualises the cyborg, she also conceives it as exemplifying the becoming (techno-)bio-power of technoscience. Where bio-power, through its disciplining of the individual body – i.e. anatomo-politics – and its regulation of the population – i.e. bio-politics – aims at fostering and managing life (Foucault 1976: 177-211; Foucault 1997: 213-235), with techno-bio-power it is a matter of fostering and managing life itself by (re)coding it and (re-) engineering it (Haraway 1991; 1997). For Haraway, Foucault's bipolar diagram of power needs to be amended to the extent that it has transformed: other modalities are at play. As she phrases it, '[i]t is time to write The Death of the Clinic. The clinic's methods required bodies and works; we have texts and surfaces... Michel Foucault's Birth of the Clinic (1963), History of Sexuality (1976), and Discipline and Punish (1975) name a form of power at its moment of implosion. The discourse of biopolitics gives way to technobabble' (Haraway 1991: 245, note 4). At the joining of technoscience, advanced capitalism and informatics, as the informational view of the body dominates with bodies and life becoming codes, (flux of) information and texts, techno-bio-power is therefore less concerned with life, than life itself (Haraway 1997; Rose 2001, 2007). While the appearance of 'techno-babble' or techno-bio-power does not amount to the disappearance of the other modialities of bio-power (i.e. bio-politics and anatomo-politics), it does not either question the fact that bodies are still the locus and focus of power. Anthropotechnologies, as they become ever more intertwined with technoscience and mutate, are still intimately linked with bodies.

2.4 Somatechnologies – Materiality and Normativity in Intimate Human-Technology Relations

In an article in which she urges philosophy of technology to take into account and account for the body, Susanne Lettow (2011) also refers to technologies as somatechnologies. Her understanding of somatechnologies is inscribed within the phenomenon of human enhancement and technologies becoming literal anthropotechnologies. As such, it resonates with Sloterdijk's conception of the latter insofar as somatechnologies refer to 'all those technologies intentionally geared toward modifying bodies' (Lettow 2011: 110). If the term somatechnology therefore aims at foregrounding the role of the body, or rather that the transformation of the human through (enhancement) technologies is a bodily matter, with it Lettow also draws attention to philosophy of technology's neglect of bodies and urges the field to stop 'referring to an anthropological essence of "the human" [and instead] analyse, in an integral way, the various contingent and stratified bodily technological practices' (Ibid.: 116). Humans do not enter into relationships with technologies qua abstract entities but as material beings – as bodies. Thus, to account for somatechnologies, Lettow insists on the importance of focusing not only on bodies insofar as they are a central dimension of (human) agency, but also on practices insofar as they foreground the materiality of action and the role of the body. In this respect, my apprehension of somatechnologies is similar to Lettow's. However, even though she links somatechnologies to Foucault's conception of (bio-) power in order to draw attention to the fact that (soma-) technologies are situated in power relations within specific historical and cultural contexts, she only points towards it as a research direction but does not explore it.

Yet, for somatechnology to be a viable and generative posthumanist concept, not only must it account for the materiality and agency of bodies and technologies in practice, but also for the role played by somatechnologies in the (re-) making of humanness. Somatechnologies convene and convey norms; they are embedded in and imbued with normativity. While it is at the level of practices, within the intimacy between humans and technologies, that somatechnologies must be apprehended for them to account for the materialisation of bodies with/in technologies, the issue of humanness – of who and what matters as human – must also constitute an integral part of the concept of somatechnology. Somatechnology is indeed not only indebted to Foucault's account of bio-power but also and above all to feminist posthumanist accounts of the cyborg and the posthuman with their insistence on location and cartographies of power. In this respect, somatechnology resonates with both Nikki Sullivan and Samantha Murray's (2009) and Susan Stryker and Nikki Sullivan's (2009) apprehension of the (larger) term 'somatechnics.'

With it, Sullivan and Murray (2009) not only reiterate that the onto-anthropological intertwinement of humans and technologies is a corporeal entanglement – originary technicity is originary somatechnicity – but also that neither technologies nor bodies are outside power relations while their interaction is key for the making of humanness. In their own words, what somatechnics encapsulates

> is *the notion of a chiasmatic interdependence of soma and techné: of bodily-being (or corporealities) as always already technologised, and technologies as always already enfleshed. ...[T]he term 'somatechnics' [is] an attempt to highlight the inextricability of soma and techné, of 'the body' (as a culturally intelligible construct) and the techniques (dispositifs and 'hard technologies') in and through which corporealities are formed and transformed. This term, derived from the Greek sôma (body) and (craftmanship), supplants the logic of the 'and', suggesting that technés are not something we add or apply to the body, nor are they tools the embodied self employs to its own ends. Rather, technés are the dynamic means in and through which corporealities are crafted, that is, continuously engendered in relation to others and to a world. As such, the term reflects contemporary poststructuralist understandings of embodiment as the incarnation or materialisation of historically and culturally specific discourses and practices, as fundamentally inter-corporeal, (trans)formative and ethico-political (Sullivan and Murray 2009: 3).*

It is in the corporeal intertwinement of humans and technologies that im/proper human bodies and subjects are made. As Stryker and Sullivan (2009: 61) state it, 'bodily being in the world involves a somatechnic event.' Assuredly, somatechnics acknowledges the material and normative quality of humans and technologies, and their relations. However, this definition bears similar problems as the Foucauldian – poststructuralist – conception of anthropotechnology: it is quite broad, especially with respect to techniques, a notion that encapsulates both dispositifs (apparatuses) and 'hard technologies' which are thereby and quite problematically put on the same level of analysis. If (hard) technologies might be or are very likely to be part of some apparatuses as they (re-)shape corporealities, the term somatechnics cannot account for what happens and is at stake in the intimate relationships between humans and technologies. In fact, it seems that a confusion exists between the use and understanding of techné, technics, techniques, technologies and dispositifs, a confusion that carries the risk for somatechnics to remain at the discursive, even metaphorical (see previous chapter), level despite the appeal to bodies, technologies and practices.

This is why I retain somatechnology rather than somatechnics as a posthumanist concept to apprehend the intimate relationships between humans and technologies insofar as it foregrounds the material and normative intertwinement of bodies and technologies while recognising both as agentive, rather than brute or passive, matter. As it encapsulates the intimacy of bodies and technologies, somatechnology enables to think the intimate relations between humans and technologies; somatechnologies are intimate technologies. The concept is also preferred to prostheticity. As said in the previous chapter, prostheticity has not only become a trope but also tends, on the one hand, to generalise every and any relation with technology to a matter of prosthesis and, on the other hand, to obfuscate and invisibilise the specificities of the (intimate) relations between humans and a prosthesis.

Furthermore, drawing conclusions from the (posthumanist) cyborg and posthuman, but also from human's originary techninity which is always a non-anthropocentric bio-techno-genesis and corporeal intertwinement with technology, one has to acknowledge that if (some) technologies are indeed anthropo-technologies, and as such redefining, changing (what it means to be) human, they are also, or rather first and foremost, somatechnologies. The technologies that compose the technoscientific landscape are acting on and interacting with the body. This is through such actions and interactions that they not only contribute to transform the latter but also what it means to be human. By conceptualising (anthropo-) technologies as somatechnologies, the interplay of materiality and normativity is acknowledged. The issue is not, however, to reduce everything to 'the body' but by-passing bodies and their materialisation with/in technologies misses what is at stake with technologies that enter into ever more intimate relationships with humans – technologies that are, as I will address later, generally outside of a use configuration – and have a human enhancement potential.

With respect to 'the body,' reinstating Grosz's remark, it does not exist, only bodies do. Moreover, as Annemarie Mol has forcefully demonstrated, the body is multiple (Mol 2002). That is, the body's ontology changes depending on the practices in which it is enacted. Therefore, with/in the power-knowledge practices of technoscience, both the informational and the molecular body have emerged and tended to supplant the clinical gaze and body (Barad 2007; Haraway 1991; Hayles 1999; Rose 2007). Not only technoscientific practices but also technologies (of imaging, gene-splicing, computing, etc.) have been key in these onto-epistemological redefinitions of 'the body' (Barad 2007; Rose 2007). However, the focus has remained on technoscientific practices[120], especially knowledge practices, rather than on the ways in which bodies are remade in the mundane, lived, intimate relations with (soma-) technologies. Likewise, the materiality of bodies has tended to be conceived as a material effect of discourse or language (Butler 1993) or as emerging within broader material-discursive apparatuses of bodily production (Haraway 1991; Barad 2007). Accounting for and being accountable for the kinds of bodies that materialise – come to exist and come to matter as putatively human – in the intimate relations with technology is therefore an urgent matter. Insofar as somatechnology not only characterises concrete technologies, namely technologies situated in intimate relations with bodies, but also foregrounds the materiality and normativity of humans and technologies, I propose the concept of somatechnology as a heuristic tool to help undertaking such a crucial task.

120. Rose (2001; 2007) however has interrogated how individuals negotiate and enact new forms of subjectivity and selfhood with the gaining momentum of the molecular view of the body.

Conclusion

As the relations between humans and technologies are becoming ever more intimate with potentially or putatively enhancing technologies, conceptual tools are needed to apprehend them without reviving modern liberal humanism which, as showed, is not only exclusionary but also anthropologically flawed. Insofar as prostheticity and its posthumanist potential have dissolved into tropes and tend to obfuscate not only the intimate but also all relations between humans and technologies, I have convened and examined philosophical anthropological conceptions. At stake is to be able to account for and be accountable to the bodies that materialise – come to exist and come to count – in intimate relations with technologies. Bodies need to be taken seriously. In fact, bodies and humanness, materiality and normativity have to be attended to.

Within classical philosophical anthropology, humans and technologies, and more particularly bodies and tools have had a particularly close and intertwined trajectory. The body, in fact, has occupied a central position insofar as tools have been conceived in bodily terms, namely as organ projection and/or extension. Despite the resonance of these conceptions with human enhancement and their potential for grasping the intimate relations between bodies and technologies, the latter are still blackboxed. Or rather, when technologies are understood as organ projections and/or organ extensions, bodies and technologies are reduced to a set of functions and remain hermetic to each other. Modern liberal humanist prejudices still pervade and it ultimately becomes impossible to speak of intimate relations between bodies and technologies.

The relations between humans and technologies, and the intimacy thereof, have more recently been understood in terms of originary technicity, originary technicity being always already an intertwinement of bodies and technologies. That is, the onto-anthropological entanglement and co-constitution of humans and technologies is a bodily matter. Exploration of the latter, however, has remained at a general, rather abstract level insofar as what technologies do has been approached either in relation to the human qua species and its evolution or in relation to the human's onto-anthropological condition and its genesis. While bodies have tended to be reduced to biology, the mundane intimate relations between humans and technologies have been left unaddressed. Similar problems characterise the conception of enhancement technologies as anthropotechnologies. While (human's) materiality is equated with biology, technologies appear as an issue for the becoming of the human qua species but not as a matter of intimate relations with living human beings. In this frame, humanness – whose and what bodies count as human – is not even considered. Within a Foucauldian framework, while anthropotechnologies address the human as a material and normative reality, technologies and bodies dissolve within power-knowledge apparatuses. As such, anthropotechnologies does not constitute an appropriate concept for apprehending the intimate relations between humans and technologies.

In fact, if (enhancement) technologies can be understood as anthropotechnologies, they must also and above all be regarded as somatechnologies. Somatechnologies are technologies that are situated in intimate relations with bodies; somatechnologies are intimate technologies. A second dimension however characterises somatechnology: the concept is also apprehended as a heuristic tool. Within somatechnology lies the proposal that in order to account for the impact of technological artefacts on what it means to be human, it is high time to focus on humans qua material and normative realities, on bodies and humanness. As it encapsulates both dimensions as well as the intimacy of the relations between humans and technologies, somatechnology constitutes a (posthumanist) heuristic tool for accounting for and being accountable to the materialisation of bodies with/in specific technologies and the enactment of humanness. While a necessary starting point and heuristic – even mnemotechnic – tool, somatechnology does not (yet) address the practicalities of the intimate relations between humans and technologies, i.e. the ways in which bodies and humanness are transformed and are enacted – materialise – in their intimate relations with technology. Concrete somatechnologies must therefore be explored. This will be the task of the remaining of this thesis.

Chapter Five
Living with a Somatechnology: Exploring the Intimate Relations between Bodies and Technologies

After having investigated posthuman-ism and human enhancement, especially as they are framed in the debate opposing bioconservatives and transhumanists, showed how they are underpinned by and consecrating the exclusive figure of the modern liberal humanist subject – the post/huMan – and its hermetic separation from technologies (chapter one), and drawn attention to the plausibility and danger of human enhancement becoming a system of normation based upon a restrictive and oppressive conception of who counts as human, i.e. humanness (chapter two), I have indicated another genealogy to the posthuman (chapter three). With/in (feminist) post-humanist understandings of the cyborg, the posthuman and technoscience, the ontology of human beings is intrinsically technological. While modern liberal humanism appears as an anthropologically-flawed and oppressive conception of human beings with/in technologies – a Modern artifice – posthumanism not only brings accountability and the end of human exceptionalism to the forefront, but also foregrounds bodies and technologies: materiality and normativity in the relations between humans and technologies become crucial issues. In this frame, prostheticity has tended to become the accepted trope to encapsulate the intimacy of bodies and technologies within our technological lifeworld. However, as it has lost its material grounds and not only tends to flatten the diversity and richness of human-technology relations but also to invisibilise differently-abled people and their bodily experiences with prostheses, other concepts have become needed to apprehend the intimacy of humans and technologies as material and normative realities without reviving modern liberal humanism. After reviewing philosophical anthropological concepts that propose to think the intimate relations between bodies and technologies and their entanglement with humanness, I have offered somatechnology as a heuristic concept to fulfil this task (chapter four).

Somatechnologies are technologies that are acting on and interacting with the body. As a posthumanist concept, somatechnology emphasises that the onto-anthropological intertwinement of humans and technologies is a corporeal process, wherein bodies and technologies are materially and normatively entangled in the making of im/proper humanness. Insofar as somatechnology encapsulates the material and normative dimensions of humans and technologies as well as their intimate relation, it constitutes a necessary heuristic tool for apprehending enhancement technologies, especially what it means to be human with/in enhancement technologies. While a necessary starting point for apprehending what it means to be human with/in enhancement technologies, the scope and explanatory power of somatechnology as it is currently conceptualised still remains to be explored. Somatechnologies need to be investigated in practice. Assuredly, some of the technologies inhabiting and informing the human enhancement debate, and especially the most controversial ones, are still emerging – e.g. genetic, regenerative, and nano-technologies – hence the speculative (under)tones of the debate (see chapter one). Nevertheless, to understand the ways in which somatechnologies transform bodies and what it means to be human, two actual technologies with a human enhancement potential – two somatechnologies

– are to be drawn upon. More specifically, prosthetic and implanted technologies constitute the somatechnologies that I will examine.

Both have been identified as (potential) enhancement technologies (see chapter one), and in the last decade, implanted technologies have received quite a lot of scholarly attention. Especially if they touch upon neurological functions, they have been seen as having profound implications for what it means to be human (McGee 2008; Verbeek 2009; 2011). Similarly, prosthetics have been under journalistic and academic spotlight as the 2008 Summer Olympic Games in Beijing were the theatre of a controversy over Oscar Pistorius, a South African runner who equipped with his Flex-Foot Cheetah® Blades (from Össur corporation) was perceived as being enhanced and practicing 'techno-doping' hence having an (unfair) advantage over non-disabled runners (Coenen et al. 2009; Miah 2011; Wolbring 2008). Yet, reflections on these technologies have generally taken the shape of rather speculative ethical judgments on 'hyped' technological devices, e.g. brain-computer interfaces, deep brain stimulation, thought-controlled prosthetic limbs (e.g. Sandberg and Bostrom 2006; Vedder and Klaming 2010). However, even though implanted and prosthetic technologies have been at the centre of attention and have generated (ethical) discussions over their desirability, the latter have remained ungrounded. Alfred Nordmann (2007) has emphasised the deceit at play in speculative ethics – especially concerning the 'if … then' argumentative structure and its reliance on foreshortening, conflation and straw men – and I have underlined in chapter three (see in particular my examination of the prosthetic trope) that ignoring or erasing material grounds tends not only to simultaneously flatten and generalise the practices and realities in which these technologies are embedded and enacted, but also to reproduce exclusive patterns.

Therefore, I have conducted fieldwork, based on ethnographic methods, to explore somatechnologies[121] and more precisely the kinds of bodies that materialise with/in this type of technologies. The latter are spinal cord stimulation, which is a neuromodulation technology, and lower- and upper-limb prostheses. Certainly, objections as to the enhancement potential of these technologies might be raised. However, besides enhancement being an ambivalent notion as described in chapter two, it is my contention that an exploration of the concept of somatechnology with spinal cord stimulation and lower- and upper-limb prostheses can shed light on what is at stake with/in enhancement technologies. Furthermore, very pragmatically, while somatechnologies such as spinal cord stimulation and prosthetics can be empirically explored in their intimate relations with human beings, putatively enhancement technologies insofar as they are still emerging cannot; they are not (yet) lived with.

While the concept of somatechnology points to the entanglement of bodies and technologies with/in the enactment of (putatively im/proper) humanness, hence indicates that it is crucial to account for and be accountable to the material and normative dimensions of the intimate relations between humans and technologies, it raises methodological questions. That is, while somatechnology as a heuristic tool indicates that it is necessary to apprehend both dimensions as it encapsulates the intimacy of humans and technologies, it does not specify how to do so. On that account, before enquiring into the kinds of bodies that materialise with/in somatechnologies, the question of how to look at somatechnologies must be addressed. How to inquire into the intimate relations between bodies and technologies?

This chapter will attend to this interrogation and delve into the becoming intimate of somatechnologies. More precisely, following somatechnology qua heuristic tool, it will attend to the material dimensions of humans and technologies in their intimate relations – for heuristic and readalibility reasons however, the more normative dimensions will be mostly dealt with in chapter six. Firstly, I will introduce upper- and lower-limb prostheses as well as spinal cord stimulation as somatechnologies. I will also present the fieldwork I conducted with respect to these technologies. Secondly, following Lettow's (2011) lead, insofar as it foregrounds both the embodied dimension of human beings and the material agency of technological artefacts I will consider the postphenomenological approach to technology as a way to apprehend somatechnologies. In this frame, I will explore the latter as instances of (technical) mediation. After indicating several limits to this approach for apprehending somatechnologies, thirdly, I will attend to the becoming intimate of somatechnologies.

121 While spinal cord stimulation and upper- and lower-limb prostheses explicitly inform this chapter, they have pervaded the reflections developed in the previous ones.

1. Spinal Cord Stimulation and Prostheses As Somatechnologies

To account for and be accountable to somatechnologies, especially the kinds of bodies that materialise with/in them and what it means to be human when living with them, I have undertaken fieldwork in two technological fields. In order not to repeat the aforementioned limitations and risks associated with speculative endeavours (see also chapters one and two) and not to reproduce the reductions and over-generalisations that have accompanied the metaphorisation of (intimate) human-technology relations (see chapter three), this exploration of somatechnologies has to be empirically grounded. Therefore, I shall open this part with an exposition of the fieldwork I conducted and the kind of material I collected. Then, I will describe the technologies that have been central during my fieldwork, namely upper- and lower-limb prostheses as well as spinal cord stimulation. Such an enterprise is informed by the previously mentioned considerations concerning speculation and metaphorisation: it is necessary to understand what these technologies are, what they do and how they are composed to be able to apprehend and account for them as somatechnologies.

1.1 Accounting for Somatechnologies in Practice

As addressed in chapter three, when the intimate relationships between people living with technologies such as prostheses and implanted technologies and that very prosthesis or implant are mentioned, it is in general not for the particularity of their experience, but rather as a generalizable illustration of the porosity of the boundaries between bodies and technologies. In this metaphorical displacement and generalisation, while people living with prosthetic and/or implanted technologies are 'made to figuratively to speak for a cyborgian existence' (Betcher 2001: 38), they are not allowed to speak up, have a voice and have their voice heard – they are subaltern subjects. Certainly, the material-discursive practices in which prosthetic and implanted technologies are embedded and enacted are not limited to those of people who live with them. Yet, without an account of the latter's practices and lived experiences, the extent of what is at stake with somatechnologies and surely my main interrogation concerning the kinds of bodies that materialise with/in somatechnologies cannot be appropriately apprehended. This is why I have resorted to ethnographic methods, especially semi-structured interviews and participant observation, during my fieldwork. Even though they are neither complete nor exhaustive of reality, this material gathered from fieldwork about both prosthetic and implanted technologies is necessary to provide an appropriate account of somatechnologies.

After meeting Cecile De Vos (in February 2012), the person who would become my gatekeeper and main informant in the field of spinal cord stimulation at a research gathering, I have been invited to do fieldwork at a local Dutch hospital. It started with my presence in the surgical room, observing an implantation procedure. A week later, I could interview the person who underwent the surgery and was newly living with spinal cord stimulation. The second time I interviewed her, in July 2012, marked the end of my fieldwork related to spinal cord stimulation. As the latter took place within De Vos's own research – while she was working as a medical physicist at this local hospital, she was also then doing research for her PhD in neurophysiology – it received ethical clearance from the ethical board of the hospital. Twice in April 2012, I was offered to stay for several days at the local hospital to do observations and mainly to interview people living with spinal cord stimulation. At that time, De Vos was seeing some of her patients to run some tests for her own research (see De Vos 2013). When setting their appointments, they were asked whether or not they would agree to talk to me about their experience with spinal cord stimulation.

I interviewed fifteen people living with this somatechnology, first with De Vos attending and later with Tjerk Timan, a Dutch colleague. Their presence was necessary for linguistic reasons: it constituted a bridging presence between my inability to speak Dutch and some of the interviewees' difficulties or discomfort with English – all the while creating other complications. More importantly than at times my feeling of frustration over not being able to ask certain questions and to be in charge of the conduction of fieldwork, some issues related to power (relations) have emerged. De Vos is a medical figure at the hospital (where I did my fieldwork), one whom the interviewees knew and recognised as such, especially as her medical authority materialised in her white labcoat. While some of the people living with spinal cord stimulation I/we interviewed were accompanied by their partner, spouse or by one of their children (generally a daughter), when they were alone this power asymmetry appeared even more intense and pervasive. Asking one of my colleagues – Timan – who had conducted many interviews, was aware of these power relations, and with whom I had discussed them and my research more generally was a compromise between the necessity to curve language barriers and this power imbalance. Assuredly, these issues were not solved but the power asymmetry during the interviews subsided a bit. In any case, neither Timan nor I were perceived as medical authorities, which enabled me/us to create a different space – than the medically-constrained one – for what could be said.

Of the fifteen people living with spinal cord stimulation with whom I/we conducted interviews, thirteen were interviewed in the frame of De Vos's research that was then measuring the effects of a change of stimulation paradigm, while one was interviewed insofar as her neuromodulation device was equipped with a rechargeable battery – in contrast to non-rechargeable ones – and the other was the woman I interviewed twice after observing her implantation. After conducting interviews in April 2012 with the nurse and the neurosurgeon who, in this local Dutch hospital, deal with people implanted or to be implanted with spinal cord stimulation, in May 2012 I interviewed a former product developer of the St Jude Medical spinal cord stimulation system implanted in the fifteen interviewed people living with the technology. All these interviews were semi-structured, recorded upon consent and transcribed – by me when they took place in English, by Timan who also translated them when they took place in Dutch. Furthermore, I had continuous contact and (informal) conversations with De Vos, my informant.

Whereas I was able to gain access to different perspectives and practices involving spinal cord stimulation[122], and especially to those of people living with a (soma-) technology, my exploration of the field of lower- and upper-limb prostheses was more limited. Or rather, even though the locations in which I could follow the practices and perspectives dealing with and enacting lower- and upper-limb prostheses were more diverse than the local Dutch hospital in which I conducted most of my fieldwork concerning spinal cord stimulation, they were rather contained to one sector, that of engineering. After conducting semi-structured interviews with three biomechanical engineers from two Dutch technical universities in May 2011, I attended the 'Orthopädie + Reha-Technik 2012'[123] in Leipzig in May 2012. During this biennial international trade show and congress for prosthetics (as well as orthotics, orthopaedic footwear technology, compression therapy and rehabilitation technology), I performed participant observation and had informal talks with several people living with prostheses (especially upper-limb prostheses) as

122. However, I could not talk to the psychologist in charge of screening potential candidates for spinal cord stimulation as she was on a medical leave of absence.
123. See http://katalog.ot-leipzig.de/nfm/1819/1825.php and http://ot-world.com/ [Last accessed on October, 16th 2013].

well as with biomedical engineers, designers and prosthetists from different companies (Aqua Leg, Össur, Ottobock, Touch Bionics). When initiating these discussions, I disclosed my identity as a researcher and introduced the topic of my research. Similarly to my fieldwork with spinal cord stimulation, I guaranteed – if wanted – anonymity, but these informal talks were not recorded. My discussion there with Herman Boiten, developer of knee and lower-limb prostheses at Ottobock – the world leading prosthetics company – led to a visit to the company's European headquarters in Duderstadt, Germany in July 2012. During this visit, I was able to do some observations while given a tour of the facility and I had semi-structured interviews with not only Herman Boiten but also a senior designer and development leader, a product designer, a scientific engineer in the gait laboratory and the head of the biomechanical research department. A similar trip to Touch Bionics in Livingston, Scotland was planned when I was at the Orthopädie + Reha-Technik 2012 yet never took place – underlying the importance of gatekeepers. As accounts of people living with prosthesis have been published in academic articles (e.g. the direct accounts of Sobchack 2004; 2006; 2010; and the reported accounts in Mathias and Harcourt 2013; Murray 2004; 2005; 2009; Murray and Fox 2002; Saradjan et al. 2008), I shall also weave them with my own fieldwork concerning somatechnologies.

While grounded in two somatechnologies, i.e. spinal cord stimulation and upper- and lower-limb prostheses, this chapter, like the next, is not a comparative exercise but rather an attempt at giving an account and accounting for the bodies that materialise with/in somatechnologies. In fact, with one foot in empirical philosophy (Mol 2002), it is also inscribed in philosophy of technology's 'empirical turn' (Achterhuis 2001). Empirical philosophy weaves philosophical reflection with empirical material – generally gathered by means of ethnographic methods (e.g. participant observation and interviews). As Mol defines it, in empirical philosophy '[t]he empirical and the philosophical incorporate each other. One is included in the other and vice versa' (Mol 1994[124], quoted in ten Have 1997). Empirical philosophy blurs the boundaries between the philosophical and the empirical. Even though the empirical will be read through the philosophical and vice-versa, insofar as I will discuss and assess existing philosophical frameworks in terms of their ability to account for somatechnologies, theoretical frameworks and positions will be much more present and pronounced than what Mol describes in/as empirical philosophy. While associated with the latter, this chapter is also inscribed in philosophy of technology's empirical turn wherein attention is given to technological artefacts rather than to a transcendental notion of Technology and its conditions of possibility (Verbeek 2005). This empirically-grounded philosophy of technology which foregrounds materiality – the materiality of technological artefacts – aims at accounting for material agency and the ways in which technological artefacts are neither neutral nor mere intermediaries but rather affect, shape, and transform – mediate – the experiences of humans with their world.

It is within this frame and based on the materials I gathered during my fieldwork in the field of prosthetics and spinal cord stimulation that I will attend to somatechnologies, that is, not only to the intimate relations that take place between humans and technologies but also to the kinds of bodies that materialise – come to exist and to count – with/in somatechnologies. To do so, the somatechnologies under scrutiny need to be introduced. Beforehand, a precision concerning somatechnologies and especially my own relation to them needs to be introduced. While living in a technological lifeworld, being co-constituted by technologies and certainly close to, dependent on even, my laptop, mobile phone and glasses, I myself do not live with somatechnologies. Conducting fieldwork within the fields of spinal cord stimulation and upper- and lower-limb prostheses was therefore exploratory. It was also a sensitive matter: the experiences that people living with somatechnologies shared with me were, at times, filled with pain and distress. In fact, as I have been interrogating the bodies that materialise with/in somatechnologies and their entanglement with (putatively proper) humanness, my own location in the unmarked position or the position of the unmarked (bodies), became all the more manifest. Endowed with the privileges attached to whiteness, I also live with a putatively healthy able-body, both of which afford me visible and material anonymity to use Garland-Thomson's (2011) formulation. These are critical issues not only when living with somatechnologies – as shall become clear in chapter six – but also when investigating them. Therefore, I have attempted to account for and be accountable to them in the next two chapters.

124. Mol, Annemarie. 1994. 'Ondertonen en Boventonen, over empirische filosofie.' In Dick Pels and Gerard de Vries. Eds. Burgers en vreemdelingen, opstellen over filosofie en politiek. Amsterdam: Van Gennep: 83. While I modified the translation provided by Paul ten Have, Mol's original (Dutch) words are: '[e]mpirie en filosofie incorporen elkaar. Het een zit in het ander, het ander in het een.'

1.2 Prosthetics and Spinal Cord Stimulation: The Complexity of Somatechnologies

Insofar as the prostheses I encountered during my fieldwork were rather diverse, ranging from the passive, body-powered, myolectric, or hybrid prostheses that people were living with and/or engineers and researchers were designing, to their bodily location (i.e. upper- or lower-limb), I shall provide a short introduction here. Their differences, and how these differences matter, will be presented when relevant throughout this chapter. It can already be noted, however, that this variety of prostheses problematizes the flattening and generalisation processes at play in both the human enhancement debate and the prosthetic trope, both disregarding what a concrete prosthesis actually does and how different prostheses enact different realities and materialise different bodies. With respect to spinal cord stimulation, it is the system manufactured by St Jude Medical, Inc that I will present. Indeed, St Jude Medical's spinal cord stimulation is the one that is implanted at the local hospital where I conducted my fieldwork.

Upper- and Lower-Limb Prosthetics

As said in chapter three, prosthesis navigates between addition – the addition of a letter or syllable to the beginning of a word – and replacement – the replacement of an amputated limb or missing part of the body (Wills 1995: 132-133). This dual meaning is linked to the grammatical and medical origins of the word. While signifying replacement and addition, prosthesis also denotes closeness and intimacy. This combination – and ambivalence – has contributed to transform the prosthetic into a powerful trope. Prostheses are also – and principally – concrete (soma-) technologies.

Prostheses (qua technologies) have had a long history. The first prosthesis, the Roman Capua Leg allegedly dates back to 300BC[125] while Ambroise Paré's inauguration of modern surgical techniques in the second half of the sixteenth century went hand in hand with the elaboration of prosthetic devices (see his drawings of an artificial hand and leg below). Yet, it is only in 1704 that prosthesis in its medical sense, meaning 'the replacement of a missing part of the body with an artificial one,' was introduced in the English language[126] (Ibid.: 218). With this understanding, prostheses are intertwined with norma(lisa)tion processes (see chapters two and three), their purpose being to fill the gap left by congenitally absent or amputated limb(s), supplying – in both senses of the term – a lacking body.

125. For a historical overview of the field of prosthetics (with an emphasis on the United States of America), see Ott 2002 and more generally the edited volume by Ott, Serlin and Mihm (2002): Artificial Parts, Practical Lives: Modern Histories of Prosthetics.

126. Its philological sense – i.e. 'the addition of a syllable at the beginning of a word' – appeared in 1553 in the English language (Wills 1995: 218). In French, where the medical sense was introduced before the rhetorical one (respectively in 1695 and 1704), the distinction between both understanding is marked by an orthographic difference: prothèse being distinguished from prosthèse.

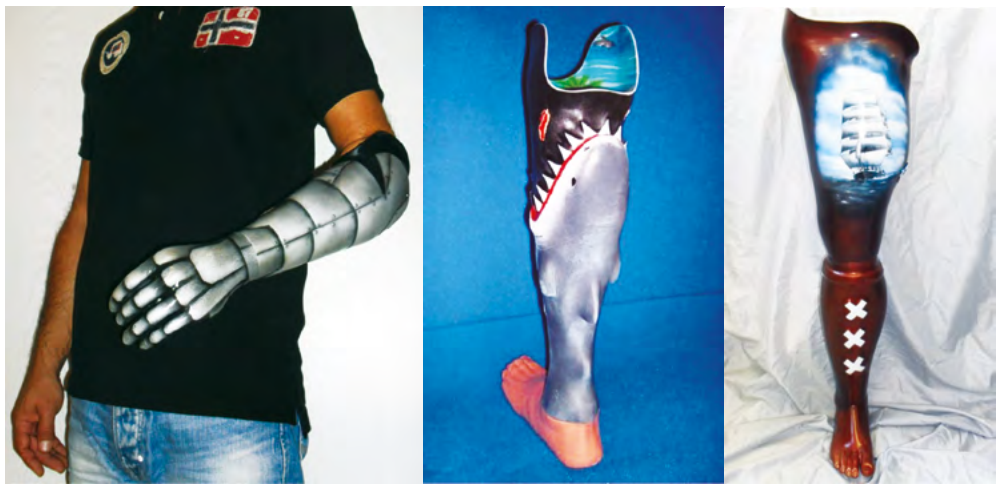
Paré's (1585[127]) drawings of an artificial hand and leg

(in Nicogossian 2010: 85 and Wills 1995: 245)

127. Paré, Ambroise. 1585. Les Œuvres. Paris: Gabriel Buon.

Insofar as my fieldwork is grounded in limb prostheses, there shall be the ones focused on here. More precisely, I shall limit the scope to upper- and lower-limb prostheses or, in other words, arm and leg prostheses. Therefore, I shall consider neither breast implants nor cranio-facial prostheses (e.g. dental, eye, ear, hemifacial prostheses)[128]. While their overall design has not radically changed since Paré's drawings, both upper- and lower-limb prostheses are composed of different elements. A socket that is the interface between the limb and the prosthesis, a wrist unit to flex and rotate the terminal device – the substitute for the hand – constitute upper-limb prostheses. For transhumeral, i.e. above-elbow prostheses, an elbow unit and possibly a shoulder unit are added to the aforementioned, i.e. transradial, ones to form the prosthesis. As for lower-limb prostheses, a socket, a knee unit, a foot and a shank that connects the foot to the knee unit are the prosthesis' components. A liner that covers the limb to reduce movement and chaffing in the socket is also generally added. In the case of transtibial, i.e. below the knee ('BK') prostheses, the shank directly connects the socket to the foot. For transfemoral, i.e. above the knee ('AK') prostheses, a thigh is another component located between the top of the knee and the bottom of the socket, or between the top of the knee and the hip joint for higher-level amputees. The 'units' are the prosthesis' joints, allowing for rotation, flexion, extension, as well as abduction and adduction movements. Cosmetic components generally finish prostheses: a (mostly) silicon glove covers upper-limb prosthetic devices while foam covers, stockings and coatings are used for lower-limb ones.

Once assembled, prostheses are therefore quite anthropomorphic. However powerful, anthropomorphic norms are also deviated from: a hook rather than a hand (as the upper-limb prosthesis' terminal device), springs rather than a foot with toes, the absence of a glove or foam cover and coating, the latter being not skin-like but semi-transparent, colourful or stylised – with e.g. sequins and glitter or individualised designs such as Frank Purk's creations[129] below, all of which I could observe at the Orthopädie + Reha-Technik 2012 in Leipzig – or specialised prostheses such as blades for running or grips for riding a bike or a motorcycle can compose one's prosthesis.



Some of Frank Purk's designs

128. For an account of bodies with breast and facial prostheses, see Jenny Slatman's project started in 2011 'Bodily Integrity in Blemished Bodies.' See also Slatman 2011 for a discussion of the question of bodily integrity for women who, having had breast cancer, choose to be living (or not) with breast prostheses (or implants).
129. See Purk's portfolio: http://www.frankpurk.de/ [Last accessed October 20th 2013].

Upper-limb prostheses

Upper-limb prostheses can be 'active' or 'passive,' the latter having no other function than a cosmetic one. Active – also called functional – prostheses are mainly body-powered or electrically powered. When body powered, the (mechanical) prosthesis is activated by a cable attached to a shoulder harness, the latter being secured on the shoulder opposite to the prosthesis. It is by moving one's (opposite) shoulder or arm that the prehension function of the prosthesis, that is, the ability to seize and grasp is actuated: pulling the cable enables the terminal device – e.g. a hand or a hook – to open or close. This type of prosthesis can be voluntary-opening or voluntary-closing. In the first case, it is when one applies force through the cable system that the terminal device opens. While rubber bands allow the latter to close, they also limit the strength of the grip. In contrast, it is to close the terminal device that force must be applied in the case of voluntary-closing prostheses, the grip, or more precisely the strength of the grip is thus dependent on the strength of the person using it.

Body-powered prosthesis (left) and Ottobock's myoelectric Michelangelo® prosthesis (right)

With electrically powered prostheses, which are heavier and more expensive than body-powered ones, opening and closing is effectuated by battery power. While this type of prosthesis can be hybrid – the opening and closing of the terminal device being electrically powered yet initiated through shoulder or elbow movement – it is generally myoelectric. Battery-powered, myoelectric prostheses are electromyographically controlled: they are controlled by electromyographic (EMG) signals. That is, the electrical motor of the prosthesis is connected to EMG electrodes that are placed on the skin so that one's muscle contractions become signals related to the terminal device's opening or closing, and/or the wrist's rotation, and/or the elbow's flexion and extension. Resonating with cybernetics and the centrality of control, communication and feedback (see chapter three), at issue with myoelectric prostheses are control and feedback. Heidi Witteveen, PhD candidate in biomechanical engineering at the University of Twente, the Netherlands exposed the matter to me during our interview in these terms:

[i]f you have a body-powered prosthesis, then the feedback is somehow more direct: there is a cable coming from your shoulder to your elbow and when you pull it, the position of your cable is exactly the position of your hand for example. And that's much more difficult to do when you have a myoelectrically-controlled prosthesis: then you have to do it another way. There is another step involved; it is more indirect (interview with Heidi Witteveen and Peter Veltink, May 18th 2011).

Insofar as it is through bodily movements that the prosthesis is actuated, control – the realisation by the terminal device of the intended gesture and, more generally, the ability to handle the prosthesis – is rather closely linked to feedback.

Indeed, as Prof.dr.ir. Dick Plettenburg, director of the Delft Institute of Prosthetics and Orthotics, the Netherlands told me, 'the position of your shoulders is a measure for the opening width of the hand and the force you feel is a measure for the force in the hand' (interview with Dick H. Plettenburg, May 13th 2011). Control and feedback are intertwined. With a myoelectric prosthesis, however, even though muscle contraction – insofar as it is recorded and converted into signals – controls the terminal device – i.e. opens or closes it, enables gripping – information about the position of the hand and about one's interaction with an object is not fed back to the user. The latter needs to rely on vision. In fact, at the time of the interview, H. Witteveen was working with Prof.dr.ir. Peter Veltink on vibrotactile feedback in the Myopro project[130], while the latest myolectric prosthesis commercialised by Ottobock in 2012 and showcased at the Orthopädie + Reha-Technik 2012 in Leipzig, the Michelangelo®, has (a subtle) sound feedback. Research in neural regeneration, with the prospect to interface nerves – both their afferent and efferent nerve fibres – with prosthetic devices is also being undertaken in this direction[131]. However, besides control and feedback being critical issues, cosmetic – the way the prosthetic device looks – and comfort – the possibility to wear it all day without it pinching or chafing the skin for instance – are also crucial elements, both for upper- and lower-limb prostheses. Nevertheless, even though myoelectric prostheses are a rather widespread type of upper-limb prosthetics and targeted reinnervation and neural interfacing are the object of ongoing trials and research in the latter field, these technologies do not extend (yet) to lower-limb prosthetics.

Lower-limb prostheses

As the interface between the limb and the lower-limb prosthesis, the socket is a primordial element – yet it is rarely, if ever, mentioned in scholarly discussions about prosthetic enhancement. Malte Bellman, a scientific engineer working at Ottobock gait lab in Göttingen, Germany, whom I interviewed on the 26th of July 2013, pointed out that the most challenging aspect for making a good (lower-limb) prosthesis was 'definitely the interface between the technology and the stump, the residual limb,' namely the socket, and continued: 'This connection should be very confortable and very functional as well. ... [Y]ou can put whatever [..] technology under the prosthesis, everything [but] when the interface is not done appropriately, you can forget the rest.'[132]

130. See http://www.myopro.nl/ [Last accessed on October 20th, 2013].
131. See for instance the Neurocap project carried at the University of Twente: http://www.utwente.nl/ewi/bss/research/research_themes/micro/neurocap_project.doc/ [Last accessed on October, 20th 2013].
132. Legend of the interviews: [-] interrupt; [..] pause; [l] laugh; [t] tears; [i] inaudible; // comments; [ ] explanation.

The prosthesis' fitting is a delicate balance between weight bearing, protection and comfort of the limb, and the control (and feedback) of movement whether standing or walking. While prostheses are (generally) mass-produced, sockets are custom-made. Computer-assisted technology to map one's limb can be used for manufacturing a socket. Whereas the latter is the interface between the body and the prosthesis, the foot is the interface between the prosthesis and the ground, a ground that can assuredly be flat and smooth, but more often than not uneven, inclined, made of gravel, pebbles or sand. It can also be slippery or consist of a flight of stairs. As such, prosthetic feet must not only provide a stable weight-bearing surface but also absorb shock[133]. To do so, the ankle joint is generally included in the prosthetic foot, its flexibility contributing to differentiate between 'energy-returning feet' and 'non-energy-returning feet.'

One of Ottobock's sockets

Ambulation is highly demanding in terms of energy. It has been estimated that people walking with a below knee prosthesis consume ten to twenty per cent more energy than people with a 'normal' gait while people walking with an above-knee prosthesis use between sixty and seventy per cent more energy than the latter – the respective difference doubling when walking with two below-knee prostheses and tripling or even quadrupling for people walking with two above-knee prostheses (Kelly et al. 2013). Energy-consumption is therefore a critical issue for lower-limb prosthetics. Linked to the flexibility of the foot – and knee – it is also a matter of balance with stability, as well as between light-weightedness and sturdiness of the materials. Non-energy-returning feet are generally single-axis as well as solid-ankle, cushioned-heel (SACH) feet. While the former enable both dorsiflexion and plantarflexion – i.e. the possibility to bend the foot upwards and downwards – and provide stability for the knee, they are heavier, more expensive and demand more maintenance than the latter. Both energy consuming – or in prosthetics jargon, non-energy-returning – these feet are advised for people who are rather sedentary, walking mainly indoor rather than outdoor.

133. Brian M. Kelly et al. identify three other functions for prosthetic feet. Besides absorbing shock and providing a stable weight bearing surface, prosthetic feet must replace lost muscle function, replicate the anatomic joint, and restore cosmetic appearance (Kelly et al. 2013).

From left to righ: Ottobock's SACH foot; Össur's Propio Foot®; Össur's Flex-Foot Cheetah®

While energy-returning feet are more flexible, they are not only more expensive but also, Kelly et al (2013) argue, 'improperly named because, in fact, they do not return energy. They do, however, assist the body's natural biomechanics and allow for greater cadence and less oxygen consumption.' Prosthetic feet that have a multi-axis and/or dynamic response (due to the presence of a flexible keel) belong to this category. A multi-axis prosthetic foot allows for more movement than single-axis ones insofar as it not only affords dorsiflexion and plantarflexion but also rotation as well as inversion and eversion (i.e. inwards and outwards movement of the sole of the foot). With such a foot, whose heel is also made of materials that deflect under load and, as they return to their initial shape, propel the limb forward, it is therefore possible to walk not only more but also on uneven surfaces (compared with non-energy-returning prosthetic feet). However, higher flexibility comes with less stability of movement. The other type of energy-returning prosthetic foot is the dynamic response one. While the multi-axis prosthetic foot is aimed at people with a minimal to moderate level of activity, the dynamic response prosthetic one is marketed at people who are young and active and/or athletic – even though older people might benefit from its light weight (350 to 700 grams). Unlike aforementioned prosthetic feet – whether energy-returning or non-energy-returning – this foot is generally not anthropomorphic; it is neither shaped nor looks like a foot with toes[134] and cosmetic covers – cosmeses – are not necessarily chosen by users nor provided by manufacturers. Rather, it is generally made of (two to three) deflection plates that act like a spring: energy is stored when the spring compresses as the user's body weight is transferred onto the prosthetic foot during heel strike, and it is gradually released at toe-off, enabling a smooth(er) roll-over of the foot. Microprocessor ankle-foot systems have recently been added to dynamic response prosthetic feet (e.g. Össur's Propio Foot®, Hosmer's Raize™). With moment and angle sensors adjusting the ankle-foot angle and with the possibility to adjust heel height, this prosthetic foot provides more stability and comfort when walking on uneven grounds, slopes and stairs. Furthermore, J-shape sprinting carbon blades (e.g. Össur's Flex-Foot Cheetah® blades and Ottobock's Sprinter and C-Sprint® blades) that rely on relatively the same mechanisms as dynamic-response feet but without the heel component are being custom made.

134. Even though early dynamic response prosthetic feet such as the Seattle Foot and the Ohio Willow Wood Carbon Copy 2 Foot are anthropomorphic, molded on anatomical feet, cosmeses are becoming increasingly optional.

For above-the-knee prosthetics, a knee joint is added to the prosthesis. Insofar as it must provide controlled motion when walking (i.e. during the swing phase) as well as support when standing (i.e. during the stance phase) without restricting one's ability to sit, bend and kneel, the knee unit is quite complex. Knees can be mechanical or equipped with a microprocessor; stability can be supplied with a manual locking system or a weight activated one, while motion or swing control can be provided via constant friction or fluid control systems (either pneumatic or hydraulic). Mechanical knees can be single-axis or polycentric. Consisting of a single hinge, the single-axis prosthetic (mechanical) knee is rather light, durable, and relatively inexpensive. But this simplicity comes at a price, namely the user's muscle strength and power to be able to remain stable while standing. Therefore, a manual lock to keep the knee still when standing and a constant-friction mechanism to prevent the leg from swinging forward too quickly when walking are added to such a knee. Polycentric (mechanical) knees are made of a four-bar linkage design – hence their other appellation as 'fourbar' knees – that provides them with multiple axes of rotation. Furthermore, these knees are increasingly equipped with fluid (whether pneumatic or hydraulic) swing control systems (e.g. Ottobock's 3R78 prosthetic knee). As such, greater movement stability and adaptability are afforded with polycentric knees, which nevertheless make them heavier, more expensive, and demanding more maintenance than single-axis ones.

For mechanical and (some) microprocessor-equipped knees (e.g. Endolite's SmartIP), stability can be supplied with a manual locking system or a weight activated one. While manual locking knees are (manually) locked when standing and walking in order to prevent buckling or swinging too fast, they are unlocked when sitting down. Even though this type of knee affords greater stability, it is high-energy consuming for the user while his or her gait becomes rather stiff and awkward. More widely used are weight activated stance control knees. These knees, that are generally someone's first prosthetic knee, do not bend when weight is put on the prosthesis, allowing stability when standing. When walking, this knee functions like a constant friction mechanism. Constant friction for swing control – swing control being necessary for maintaining a consistent gait – is provided by mechanical friction, the latter preventing buckling yet not allowing the user to walk at different cadences or speed. Fluid-control – pneumatic or hydraulic – motion control systems provide variable resistance hence enables users to walk at variable speed and cadence. When the knee is flexed, pneumatic and hydraulic systems (both equipped with pistons inside cylinders) respectively compress air and fluid (e.g. silicone oil or magnetorheological fluid). Not unlike the dynamic response feet and its spring mechanism, air and fluid are thereby stored and released as the knee extends. The greater mobility at multiple speed and on variable ground that is afforded by these knees comes however with a price: they are not only more expensive, but also heavier and demanding greater maintenance. At the present time, hydraulic systems have tended to supplant pneumatic ones, especially for knees equipped with microprocessors.

Ottobock's fourbar 3R78 knee (left) and Össur's microprocessor-equipped Power Knee (right)

Knees equipped with battery-powered microprocessors (e.g. Ottobock's Genium and C-Leg® knees, Össur's Power Knee and Rheo Knee®, Endolite's Smart IP and Orion knees, Proteor's Intelligent knees) have been introduced in the late 1990s and especially early 2000s and are currently the more technologically advanced knees available on the market. Sensors that detect speed and movement of the prosthesis convert this information into signals and supply them to the microprocessor, which adjust the hydraulic or pneumatic motion control system. Össur's Rheo Knee® is even equipped with a microcontroller that 'learns' how the user walks – it keeps and tracks a backlog of gait patterns. Therefore, microprocessor-equipped knees reduce the amount of energy that is required from the user when walking while enabling a more 'natural' gait on various grounds. These knees are however expensive and rather heavy (for instance, the Orion knee weighs 1.36 kilograms, the C-Leg® 1.42 kilograms, the Rheo Knee® 1.52 kilograms, and the Power Knee up to 2.7 kilograms without battery).

Conclusion

Under the umbrella term prosthetics/prosthesis exists a multiple reality. In contrast to the ways in which they are generally apprehended in the human enhancement debate, technologies in general and prostheses in this case are not uniform and homogeneous entities. Rather, composed of multiple elements, some being technological systems themselves, prosthetics – be they for upper or lower limbs – are complex material realities. Seemingly disconnected spare parts in my exposition, these components are assembled and fleshed out – lived – in Sobchack's recounting. The words of the American cinema and media studies scholar who, versed in phenomenology, has been living for the past two decades with an above-the-knee prosthesis, deserve to be quoted at length.

> *A prosthetic leg has many components and involves dynamic mechanical and physical processes, as well as a descriptive vocabulary all its own. To date and beginning with my very first prosthetic, as an above-the-knee ("AK") amputee I have had four different sockets – these moulded of fiberglass and "thermo-flex" plastic to conform, over time, to the changing shape of my stump. The first socket was secured to my body tenuously through a combination of suspension belt and multilayered cotton "socks" of different thickness, which were added or subtracted depending on my fluid retention, the weather, and my slowly changing shape. The sockets that followed about a year later, however, were secured snugly through the suction I referred to earlier. Now I put the leg on by pulling my flesh into the socket with a "pulling sock" and then screw a valve into a threaded plastic hole embedded in the fiberglass, depressing it so that all the air escapes and my stump and the socket mood themselves each to the other. I have also had three different metal knees made out of aluminium and titanium, all of which were attached to a small wooden block, itself bonded to the socket. The first was a mechanical knee with an interior safety "brake" that could be set to freeze at a certain angle so as to stabilize me in "midfall" inflexion, the second a double-axis hydraulic knee that I didn't like because its reaction time seemed to lag behind my increasingly accomplished and fluid movements, and the third my current single-axis hydraulic knee whose extension and inflexion move transparently (at least most of the time) in isomorphic concert with my own bodily rhythms. Over time there have also been two different lightweight metal leg rods that, replacing my tibia and fibula, run from the knee down into the foot – the first a dull silvery aluminium rather like the stuff of my crutches, and the second a glowing chartreuse green titanium that I sometimes think a shame to hide. … Ultimately, the metal rods, like the rest of the leg and thigh, were covered with sculpted foam that my prosthetist shaped to complement, albeit not exactly match, my fleshy leg. And then I've also had two feet although I've only needed one at a time – both of hard rubber composition with an interior spring that allows me to "roll over" and shift my weight from heel to ball even without an ankle joint, both the same model "Seattle Foot." … Given my replacement and accumulation over time of all these prosthetic parts, I now have a complete spare leg in the depths of my closet … and, somewhere in the trunk of my car, there's an extra socket (put there and never taken out after I got a new lighter-weight one) (Sobchack 2004c: 217-218).*

Composed of several complex parts that can be stored in a closet or in the trunk of one's car, prostheses are technologies one lives with. In fact, worn by their users, these artificial limbs are situated in an intimate relation with bodies: not only modifying bodies – they are putatively supplying a lack – they are intended to be a (transparent) extension of their body, to be part of their body. As Martin Pusch, the head of development in strategic technology management at Ottobock, phrased it during our interview, the point is 'not to think about the prosthesis, [but] to feel that it is their leg, not a prosthesis' (interview with Martin Pusch, July 27th 2012). They are somatechnologies. Before enquiring into this matter, the other (soma-) technology that has been central during my fieldwork needs to be introduced.

Spinal Cord Stimulation[135]

In contrast to prosthetics that, while intimately close to the skin, remains outside the body[136], spinal cord stimulation is a technology that is implanted into the body. A type of neuromodulation technology, it is used as a last resort treatment of chronic pain caused by various types of neuropathy or failed back surgeries.

While the modulation and reduction of pain has become an issue related to human enhancement – as shown by Andy Miah's (2010) discussion of the Downstream Regulatory Element Antagonistic Modulator (DREAM) which is a protein that would be playing a pivotal role in pain sensations[137] – it is a central element in spinal cord stimulation. More precisely, the modulation of chronic pain is the technology's function. Chronic pain is a rather – if not the most – common neurological disorder and in many cases, it is very difficult to treat it with medication (De Vos 2013). While acute pain is a healthy and useful warning signal – indicating that something is wrong with one's body –, when it is chronic, pain has no warning function anymore. Rather, pain itself becomes the problem and demands for attention. Intractable chronic pain severely impairs people's lives as it has a negative influence on almost all aspects of life: on one's physical abilities, sleep, social life, mental health and wellbeing – on one's world (Scarry 1985; Jackson 1994; 2005).

Neuromodulation, or electrical neuromodulation, is an invasive – i.e. surgically implanted – technology that acts directly upon the neural tissue. It consists of the modulation of nerve activity through the delivery of electrical energy directly to a target area. Stimulation electrodes can be implanted in the brain, on the spinal cord or on peripheral nerves, and an implanted battery that generates the necessary electrical stimulation pulses is connected to the electrode lead via a subdermal extension cable. Neuromodulation works by actively stimulating specific brain areas or nerves to produce 'natural,' 'healthy' biological responses, that is, responses that might have been disturbed or diminished because of a disease or a medical condition.

As a type of neuromodulation device, spinal cord stimulation is a technology that continuously administers electrical current pulses to the dorsal columns of the spinal cord in order to interrupt or reduce neuropathic pain perception. In fact, what spinal cord stimulation does is interrupting the pain signals that are sent from the painful body part towards the brain. In most cases, pain is replaced by a 'more pleasant sensation.' In other words, spinal cord stimulation does not directly target or cure the cause of the pain, but replaces pain perception by another sensation called paraesthesia. That is, as soon as dorsal columns are stimulated, paraesthesia is elicited in the body parts that are innervated by the stimulated nerves. Paraesthesia is usually described as a "tingling sensation." The perception and appreciation of paraesthesia is very diverse, varying from pleasant to annoying. In most cases however, and as I will address later, paraesthesia is very bearable.

135. Parts of the description and analysis of spinal cord stimulation provided here have been written with Cecile De Vos for an article (under review). See also De Vos 2013.
136. Were neural regeneration and interfacing with a prosthetic limb to be successful, it will trouble this (inside/outside) delineation. Note however, and this will be discussed later, that current prosthetics (and somatechnologies in general) also problematizes this boundary.
137. Modulation of the DREAM protein is envisioned in sports in Miah's (2010) exposition. Such modulation would reduce exercise-induced pain sensations.

Even though the working mechanisms of spinal cord stimulation are still unknown[138], the electrical stimulation of the spinal cord is rather successful for the management of neuropathic pain (North 2012; Oakley 2003; Wu et al. 2012). The stimulation settings can be adjusted to the wearer's preference or need. Stimulation frequency is one of the parameters that can be adapted, and for many wearers it largely influences the perceived paraesthesia. Indeed, stimulation with frequencies below 30Hz evokes more distinct tingling sensations described as many tiny prickles/tickles, whereas stimulation with higher frequencies is generally experienced as a smoother sensation. New stimulation paradigms with intermittent or continuous stimulation frequencies of 500Hz and above are believed not to cause any paraesthesia at all and to achieve good results as well (De Ridder et al. 2010, Van Buyten et al. 2012). Of the fifteen people living with spinal cord stimulation with whom I/we conducted semi-structured interviews, fourteen of them had just been part of a two weeks trial with one of these new stimulation paradigms.

As previously mentioned, spinal cord stimulation, and neuromodulation in general, is a so-called invasive technology. Strictly speaking, the technology owes its invasiveness to the fact that a pulse generator and stimulation electrodes are surgically implanted. Generally the implantation of the spinal cord stimulation device comprises two phases. First, the electrode lead is implanted in the epidural space and connected to a temporary pulse generator situated outside the body. After this implantation, there is a trial period of several days during which people are connected to a pulse generator through wires coming out of their back. It is only if the trial period is successful, that is, if significant pain relief is experienced that the external pulse generator is converted into an implanted, smaller, one. This pulse generator is implanted under the skin of the lower abdomen or upper buttock and can be quite heavy and rather bulky. In the Netherlands, most of the implanted pulse generators are still non-rechargeable, thus have to be surgically replaced after some years (generally between three and seven).

The electrode lead that is most often used in the Dutch hospital in which I/we conducted research consists of eight flat electrode contacts and is six centimetres long and five millimetres wide (St. Jude Medical, Plano, TX). During the placing of the electrode lead in the epidural space, the patient who has received local anaesthesia is lying prone on the operating table. S/he must be awake in order to provide information on whether the dorsal column is stimulated at the right side(s) and level(s): the electrical field on the dorsal column should excite those nerve fibres that innervate the painful area, and the paraesthesia elicited by the stimulation needs to cover the painful area completely. Most people experience the implantation procedure as very demanding, not to say traumatic.

Like prosthetics, spinal cord stimulation is composed of multiple elements, some being technological systems themselves. The implanted parts – consisting of the electrode lead and the pulse generator – are not the only pieces of technology that constitute the neuromodulation device. There is also an external part to the spinal cord stimulation system; a remote control and a coil enable people to interact with the implanted pulse generator to change the stimulation settings.

138. Spinal cord stimulation is originally based on the gate control theory elaborated by Ronald Melzack and Patrick Wall and published in 1965 in a Science article entitled 'Pain Mechanisms: A New Theory.' This theory postulates (electrical) inhibition of pain by non-painful stimuli (Rossi 2003: 10). On this basis, it is the implantation of a stimulating lead on the spinal cord in 1967 by Norman Shealy, a neurosurgeon in La Crosse, Winconsin (USA) that corresponds to the introduction of neurostimulation in medical practice (Peterson 2012: 6-7; Rossi 2003: 10). However, as Cecile De Vos argues, while the gate control theory constitutes the first framework for understanding how spinal cord stimulation works, it is nevertheless 'an oversimplication of the complex mechanisms that occur in the spinal cord and brain' (De Vos 2013: 11).

Spinal Cord Stimulation device

(from left to right: electrode leads, pulse generator, remote control and its coil)

In fact, in the fifteen semi-structured interviews that were conducted with people living with spinal cord stimulation (because of chronic pain due to failed back surgery syndrome or diabetic neuropathy), when I/we asked them to show me/us how the neuromodulation system works, all of them focused on this external component, the remote control with the coil. After they opened a little leather bag containing the remote and the coil, they plugged the coil's wire into the remote control. Then, as they turned on the latter, they positioned and held (with their other hand) the coil over the pulse generator (i.e. on their low abdomen or upper buttock). The remote made a high beeping sound that soon was replaced by a crackling sound as it searched for the signal of the pulse generator. Once the two devices connected to each other via radio frequency, the sound stopped. It is by using the buttons of the remote control that people living with spinal cord stimulation can adjust the stimulation amplitude or switch between stimulation programmes.

However, this adjustment of the stimulation settings takes place within predefined limits. Indeed, it is the physician or the nurse who, in coordination with the people living with the neuromodulation technology and their needs, sets one or more stimulation programmes, as well as the upper and lower limits of the stimulation amplitude in the implanted pulse generator. The remote control can be used to adjust the stimulation amplitude or to switch between stimulation programmes, but people living with spinal cord stimulation cannot modify, redefine, or reprogram them[139]. Different programmes can be used when their pain varies during the day, as a result of different activities or postures. An augmentation of the stimulation amplitude causes an increase in the sensation of paraesthesia. Usually this increases the pain suppression effect or distracts the person living with spinal cord stimulation from the pain, although (too) high stimulation amplitudes can be perceived as very uncomfortable and even painful.

139. In this respect, André Elands, a former product developer for St Jude Medical whom I interviewed on May 24th 2012, recalled an anecdote apropos of a signal and system engineer who was living with spinal cord stimulation and hacked his pulse generator. The result of his experimentations with different stimulation configurations proved very valuable insofar as it gave the manufacturer of spinal cord stimulation – Medtronics in this case – insights into the effects of various stimulation frequencies and amplitudes.

Conclusion

Spinal cord stimulation and prosthetics, while being very different, composite and complex technologies, are both acting on and interacting with the body. They are somatechnologies. Implanted (doubly so), the neuromodulation technology resides under one's skin while prostheses qua artificial limbs are attached to one's body. This closeness seems to set them apart from usable, handleable, separate technological artefacts (e.g. a television set, a microwave, Heiddegger's – and philosophers of technology's – favourite example: a hammer, a telescope, or even a mobile phone). Somatechnologies are intimate technologies. Throughout this thesis, I have referred to intimate relationships between bodies and technologies without explicating these relationships, without explicating what intimacy between bodies and technologies implies. Does closeness or proximity between bodies and technologies equate intimacy? How is intimacy lived and done? It is my contention that if we are to understand what is at stake with these (soma-) technologies – some of them being potentially enhancement technologies, yet all intervening and acting in- or onto bodies – the type of relations they participate in and the kinds of bodies that materialise with/in them must be investigated.

As a heuristic concept, somatechnology foregrounds not only the intimate relations between humans and technologies but also their material and normative dimensions, thereby foregrounding bodies and humanness with/in technologies rather than an abstract notion of the human. Insofar as technological artefacts – and the agency thereof – and embodied subjects are central in postphenomenological approaches to technology, or rather, to human-technology relations, it seems to constitute a promising starting or vantage point for apprehending the material and normative dimensions of humans and technologies encapsulated in somatechnologies.

1.3 Towards A Postphenomenological Approach? Somatechnologies as Instances of Mediation

Because philosophy of technology has made the analysis and conceptualisation of human-technology relations a central aspect of its scholarship, it might constitute a rather promising entry into somatechnologies, into the ways in which bodies materialise with/in technologies and re-enact what it means to be human. According to Lettow, within philosophy of technology, postphenomenology is 'the most promising approach for an understanding of somatechnologies' (Lettow 2011: 111) insofar as it not only takes seriously both the embodied dimension of human beings and the material agency of technological artefacts but has also drawn attention to the possibility for technological artefacts to be embodied. Furthermore, to the extent that it has abandoned both a transcendental notion of Technology and the investigation of its conditions of possibility, and rather considers human-technology relations and especially the actions and meanings of concrete technological artefacts – the ways in which they affect, shape, and transform, i.e. mediate the experiences of humans with their world – without upholding the modern liberal humanist subject, Sharon (2011) has named this empirically-grounded philosophy of technology 'methodological posthumanism'[140]. Can it constitute, however, an appropriate methodological framework for accounting for and being accountable for somatechnologies?

To answer this question, postphenomenological approaches to human-technology relations shall therefore constitute the initial frameworks though which and with which my fieldwork material involving prosthetics and spinal cord stimulation will be read and woven. Don Ihde's postphenomenology will open this section. I will present his typology of human-technology relations, and particularly focus on the embodiment relation. As I will show, even though it is a valuable approach, its invisibilisation of bodies, or rather its reliance on a purified concept of bodies, its prime concern with technologies in a use configuration, and its rather individualistic stance undermine postphenomenology's ability to account for somatechnologies, for the intimate relations with humans they engender, and for what – and whose – bodies materialise with/in these technologies.

In line with its phenomenological forefathers, humans' being-in-the-world is central for postphenomenology. The world is always a lifeworld. In Peter-Paul Verbeek's words,

> *[h]uman beings are continually engaged with their world … [I]t is impossible to speak about the world in the absence of human involvement with it. Reality-in-itself is unknowable, for as soon as we experience or encounter it, it becomes reality-for-us: a world. There exists neither human beings in themselves nor world-in-itself (Verbeek 2005: 110).*

140. As previously said, for Sharon (2011), bioconservative and transhumanist views respectively amount to 'dystopic' and 'liberal posthumanism,' the former endorsing a substantivist and gloomy view of technology while upholding the idea of a fixed human/huMan nature, and the latter conceiving of technologies as neutral instrument that would bring about the posthuMan, a technologically enhanced yet not transformed modern liberal humanist subject (see chapter one). 'Radical posthumanism' encompasses the approaches proposed by e.g. Haraway (1991; 1997), Hayles (1999), and Braidotti (2002; 2006). It is because they not only constitute a radical rethinking of human ontology but also promote alternative subjectivities that Sharon designates these posthumanisms as 'radical' (see chapter three). 'Methodological posthumanism' is the fourth type of posthumanism that she identifies. While it shares with radical posthumanism the view that humans and technologies are not ontologically separated but intertwined, hence rejects the modern liberal humanist worldview with its autonomous, unitary, fixed, and bounded subject who stands in a world of objects yet apart from and above them, it 'can be seen more as an attempt to develop better conceptual tools for studying science and technology in society rather than developing a new posthuman ontology – hence [her] use of the term methodological' (Sharon 2011: 7). As such, they constitute a promising starting point to account for somatechnologies.

Humans' being-in-the world, their embeddedness or situatedness in the world, is also a directedness-to-the-world. The latter – intentionality – is however technologically mediated. In line with posthumanism – as it has been delineated in chapters three and four – within postphenomenology, humans are recognised as not having a direct, but rather mediated, relation with the world. Our lifeworld is permeated with, and co-constituted by, technologies – like ourselves. As such, one is not directly in bodily-sensory experience present to the world, but rather via a technological artefact, such as when one wears glasses, watches television, or uses a mobile phone (Verbeek 2005). In fact, postphenomenology aims 'to reinsert the role of technologies in all the dimensions of the lifeworld' (Ihde 1990: 41). It is on this basis that Lettow (2011) conceives of postphenomenological philosophy of technology as a constructive framework for understanding what is at stake with somatechnologies, which are particularly intimate technologies.

In postphenomenology, technologies are not neutral instruments, but rather do things. They are agential. If humans are intentional – i.e. they are directed towards the world, which means for example that consciousness or perception is always consciousness or perception of something in the world – technological artefacts are intentional too. For Don Ihde, technological intentionality can take two forms. On the one hand, technological artefacts exhibit directedness towards the world or certain aspects of the world – e.g. temperature in the case of a thermometer or sound in the case of a recorder. This amounts to a 'technological telos.' On the other hand, technological artefacts have a certain 'inclination' as regards their use. A dip ink pen, a typewriter, and a digital word processor, while all resorted to for writing, differently shape and affect one's writing style: they have a different mediating role (see Ihde 1990: 102-103; 141-142; Verbeek 2005: 114-115). The concept of technical mediation has come to encapsulate this second form of technological intentionality.

In fact, postphenomenology has made the concept of 'technical mediation' central in its understanding of the ways in which technologies affect, modify, and co-constitute one's actions, perceptions, experiences of ourselves and the world, and morality (e.g. Ihde 1979; 1990; Verbeek 2005; 2006; 2011). As defined by Verbeek, technical mediation refers to 'how [technological artefacts] mediate the relations between humans and their world, amongst human beings, and between humans and technology itself' (2005: 11). Technical mediation resonates with Latour's concept of mediator. For Latour, nonhumans, and as such technological artefacts are not mere intermediaries but are mediators (Latour 1991; 2005; 2009 [1992]). That is, seat belts and their warnings, speed bumps, hinge and hydraulic door closers, keys, (bulky) hotel key chains, guns shape and fabricate the world, form and transform humans and the relations they have with/in the world. Latour formulates the difference between a mediator and an intermediary as follows. The latter

> *is what transports meaning or force without transformation: defining its inputs is enough to define its outputs. For all practical purposes, an intermediary can be taken not only as a black box, but also as a black box counting for one, even if it is internally made of many parts. Mediators, on the other hand, cannot be counted as just one; they might count for one, for nothing, for several, or for infinity. Their input is never a good predictor of their output; their specificity has to be taken into account every time. Mediators transform, translate, distort and modify the meaning or the elements they are supposed to carry. No matter how complicated an intermediary is, it may, for all practical purposes, count for just one – or even for nothing at all because it can be easily forgotten. No matter how apparently simple a mediator may look, it may become complex; it may lead in multiple directions which will modify all the contradictory accounts attributed to its role (Latour 2005: 39, my emphasis).*

While intermediaries are straightforward and neutral, mediators are complex and transformative. Mediation, and particularly technical mediation, is cornerstone in postphenomenological approaches to technology, the tradition within which Ihde has developed a typology of human-technology relations to account for our (technologically mediated) lifeworld. Insofar as only Ihde's embodiment and hermeneutic relations are configurations of technical mediation – in contrast to alterity and background relations – they shall receive more attention.

By alterity relations, Ihde means that one relates to a technological artefact as a 'quasi-other.' In such instances, e.g. when someone interacts with a computer or a cash dispenser, s/he is having an experience of the machine for itself, as an almost independent other. In this human-technology relation, the world is not experienced through the machine, but is rather context or background. In a background relation however, the technological artefact shapes the context of one's experience. That is, it (e.g. a central heating system) shapes one's relation to the world but it remains in the background as one is neither interacting with it nor experiencing the world by means or through it. Alterity and background relations are respectively formalised by Ihde as human à technology (-world) and human (-technology-world).

In configurations of technical mediation however, the world is experienced by means or through a technological artefact. Therefore, in hermeneutic relations, one is interacting with a technological artefact, but in contrast with alterity relations, no longer as a quasi other. Rather, it is the world that is perceived by means of the artefact. As such, when handled or perceived, the latter refers to something other than itself: it provides a representation of the world, one that requires to be interpreted. As Peter-Paul Verbeek phrases it when referring to the case of one's interaction with a thermometer, '[w]hen we read [the latter], we are not involved with the thermometer but with the world, of which the thermometer reveals one aspect, namely, its temperature. This revealing, however, does not have the character of a sensing of temperature but is rather a representation of it' (Verbeek 2005: 126). This representation, provided by the technological artefact, can fundamentally differ from what would be discerned in an unmediated bodily manner, as exemplified by Ihde's translation technologies like radio-telescopes and microscopes (Ihde 1990: 90-92; Besmer 2012: 300). This relation is formalised as human à (technology-world).

In contrast, in an embodiment relation, the world is experienced through a technological artefact. While the latter is perceived as a 'quasi me,' it is something other than the technology that is experienced. With his very tactile, haptic, example of the use of a piece of chalk on a blackboard, Ihde shows in Technics and Praxis (1979) that it is not the piece of chalk that is experienced but the blackboard through the chalk. Were the blackboard to be touched with one's bare finger or with a fine dentist probe, one's experience of it would be very different: in the former configuration, one would be able to sense a certain temperature and texture (e.g. old chalk dust), while in the latter, one could perceive small irregularities. In embodiment relations, when the world is experienced through an artefact, this technological artefact is embodied, incorporated into one's body schema, 'absorbed into [one's] experiencing as an extension of [oneself]' (Ihde 1979: 7). Furthermore, mediated by the technological artefact, one's perceptions and experiences are augmented in some respect and weakened in others – but in any case do not remain the same as the mediating artefacts change. 'Embodiment relations [therefore] display an essential magnification/reduction structure' (Ihde 1990: 76) – a structure previously referred to as a sensory-extension-reduction. In embodiment relations, if the technological artefact (e.g. the blind man's cane, to use a classic example) magnifies – enhances or extends – bodily and perceptual abilities, it also becomes unnoticeable as it is incorporated into one's field of perception. As Kirk Besmer summarises, embodiment relations are 'bodily extensions that withdraw from our awareness so that one experiences the world through the technology, and … they yield experiences that are analogous to ordinary, unmediated experience' (Besmer 2012: 299). While it is something other than the (embodied) technological artefact that is experienced, what is experienced remains similar to what would be perceived without it (e.g. the world through contact lenses). Ihde's embodiment relation, which seems to encapsulate the intimate relations between humans and technologies – I will come back to this issue later – is formalised as (human-technology) à world.

These relations – embodiment, hermeneutic, and alterity, and background – form a continuum. As previously said, something else than the technological artefact is experienced through or by means of it in the embodiment and the hermeneutic relations. In the first instance, the technological artefact is a 'quasi-me,' and in the second instance, it is 'read.' In both instances, however, the technological artefact might become a 'quasi-other,' prompting an alterity relation. This might happen when one's fringe awareness of the object for and in itself (e.g. a pair of glasses or a thermometer) becomes the focus of one's attention or 'when the technology in embodiment position breaks down or when the instrumentation in hermeneutic position fails [and] what remains is an obtruding, and thus negatively derived, object' (Ihde 1990: 94). Technological artefacts might also recede in the background. In this respect, Asle Kiran (2012) shows that artefacts play a mediating role not only in their actuality (their actual use) but also in their non-use, or rather virtual or potential use. That is, be it actually used or not, the presence of the technological device mediates one's actions. As Kiran explains, while

> *technologies influence the lifeworld through their actuality, they also influence it through their potentiality. An "idle" piece of technology has several possible roles in technical mediations. Each such role, in its state of possibility, can be called a virtual action. A mobile phone resting in your pocket is virtual communication; it can be utilised to realise the action of talking to a friend – talking to this friend is actualised communication (Kiran 2012: 78, original emphasis).*

While Kiran brings Ihde's typology beyond the configuration of use with his notion of technological presence, he also contributes to refine the background relation that, in contrast to Ihde's initial work, can be conceived as an instance of technical mediation. This continuum between the different types of relation is also indicative of technological artefacts' 'multistability.'

What Ihde emphasises with this concept is that technological artefacts do not have intrinsic properties. '[T]echnologies cannot be separated from their use contexts [which] implies that they have no "essence"; they are what they are only in their use,' Verbeek (2005: 117) explains. It is this dependence of technological artefacts on their context of use that multistability encapsulates. In practice and in action, technological artefacts are therefore multiple: their mediating characteristics, their meanings, or "identities" come to existence and stabilise when they enter in relation with human beings. Ihde illustrates the multistability of technological artefacts with the Necker cube, or rather with the ways in which the Necker cube can be perceived differently – as for instance a three-dimensional cube viewed from above, i.e. with its lower-left face in front hence with the top side visible, or as a three-dimensional cube viewed from below, i.e. with its upper-right face in front hence with the bottom side visible. The Necker cube, like technological artefacts, is multiple (Ihde 1990: 145). In Ihde's idiom, it is multistable

insofar as its meaning(s) stabilise(s) in concrete contexts (involving human perception or action).

To conclude this short overview of Ihde's framework, within postphenomenology technological artefacts are agential insofar as they (co-) shape the relations between humans and their world, amongst humans, and with technology in general. With technical mediation, context and praxis, situatedness and (embodied) action are central. As such, postphenomenology resonates with posthumanism (chapter three) and somatechnology as a posthumanist concept (chapter four). While promising, especially with its elaboration of the embodiment relation, can Ihde's postphenomenology account for somatechnologies, presently prosthetics and spinal cord stimulation? These somatechnologies have been introduced and the postphenomenological approach to technology has been presented. Yet, three issues need to be mentioned before delving into the matter of what is at stake with somatechnologies. While these issues that can hinder postphenomenology's potential as grounding methodological fabric for apprehending somatechnologies are identifiable at the conceptual level, they will appear all the more palpable and problematic when woven with my fieldwork material. As I will show, somatechnologies force us to renew – quite radically – our frameworks.

Firstly, the technological artefacts that inhabit and inform this postphenomenological approach to human-technology relations are usable and handleable, in any case detachable hence possibly kept at a distance (e.g. a dentist probe, a thermometer, a hammer, a pair of glasses). This focus on the temporality and configuration of use, with rather finite and definite human-technology interactions, makes it difficult for the postphenomenological concept of technical mediation to account for processes in general and processes of incorporation in particular while it invisibilises the agential dimension of bodies. More precisely, the dynamic aspect of mediation tends to get fixed, frozen by the primary focus on technology-in-use, and as such appear as rather straightforward and effortless. As I shall address, these aspects prove particularly problematic when dealing with somatechnologies.

Secondly, in the continuation of the previous point, embodiment, as it is construed in Ihde's embodiment relation, is problematic. While embodiment appears as central in postphenomenology – ultimately the mediating role of technological artefacts cannot be apprehended outside of humans' embodied experience and perception – it tends to become an un-fleshed out catchword. As Natasha Myers and Joe Dumit (2011: 249) caution, '"embodiment" risks a tendency to naturalize and take for granted bodies as a kind of pre-existing substrate.' Postphenomenology, wherein bodies are first and foremost locus of perception rather than material realities tends not to be immune from this tendency. The becoming-transparent of the technological artefact, insofar as it is absorbed in one's bodily experiencing, evidences bodies' plasticity. Yet, if bodies are plastic, that is, capable of embodying technological artefacts, it is only to the extent that they are perceptually malleable – extensible. However, this malleability or plasticity as it manifests in the absorption of technological artefacts into one's experiencing should not be conceived as amounting to a return to a pre-existing bodily substrate, to an unchanged, fixed body. Furthermore, bodies shall not be reduced to perception, no matter how extensible. This is too limited a focus for apprehending somatechnologies, which are not necessarily perceptual technologies. Material bodies ground the possibility for technologies to be embodied. Yet, it appears that while materiality through technological artefacts is given agency, bodies in their (very) materiality are denied such agency. At issue is therefore postphenomenology's sole focus on a perceptual yet seemingly immaterial body. This point and the former – i.e. technical mediation's concentration on the configuration and temporality of use – become particularly salient when weaving somatechnologies, e.g. prostheses and spinal cord stimulation, with Ihde's embodiment relation.

Thirdly and finally, postphenomenological approaches to technology tend to rely upon and exhibit a rather individualistic stance which has the tendency to blackbox both humans and technologies by and while downplaying relationality. Certainly, Ihde acknowledges the density of 'the texture of a "technosphere" within which we undertake our daily affairs' (1979: 7), but the ways in which he chooses to bring to the fore the mutual engagement of humans and technology is by focussing on the relations between a human, a technological artefact, and the world – that is, on how a technological artefact mediates the relation(s) between a human being and the world, hence the concept of technical mediation. This rather individualistic perspective tends to undermine – at best – or erase – at worst – humans' emergence and embeddedness in networks of relations. However, as seen in chapter three, taking into account and accounting for this dimension is crucial for apprehending humans with/in technologies. The human who informs and inhabits the postphenomenological approach to technology appear as a rather generic category.

A focus on usable, handle-able, and detachable technologies, combined with, on the one hand, a reliance upon a rather hygienic – immaterial and absent – body and, on the other hand, an effacement of humans' relationality are three issues that, contra Lettow (2011), might hinder postphenomenology's capacity for apprehending somatechnologies. Indeed, together these elements contribute to blackbox humans and technologies. While (certain) technological artefacts are agential, mediating actions, perceptions, and values, humans qua bodies and humanness, humans qua material and normative realities tend to be left unquestioned. As addressed in this thesis' previous four chapters, this is however crucial for understanding what is at stake with somatechnologies – and their so-called human enhancement potential. These three issues or limitations will guide this chapter and the next, constituting a red thread and preliminary direction for knitting my fieldwork material with the (conceptual) matter of bodies and technologies. In particular, the remaining of this chapter will particularly be concerned with processes, hence postphenomenology's reliance on the configuration and temporality of use, as well as with embodiment and the embodiment relation, while in chapter six, (material) bodies rather than embodiment and relationality will be central.

2. Becoming Intimate with Somatechnologies, A Learning Process

Grounding this chapter, prostheses and spinal cord stimulation are complex technologies. Not only composed of numerous elements, some being technological systems themselves, they are also not per se technologies that can be used. Rather, they act on, interact with, even intervene in the body – prostheses are artificial limbs closely attached to the body while spinal cord stimulation is (doubly) implanted under the skin and delivers electrical current on the spinal cord. They are somatechnologies.

As I shall demonstrate in this section, somatechnologies poses challenges for existing conceptual frameworks. Firstly, I will address how somatechnologies are no longer situated in a use configuration and compel us to re-explore embodiment (relation). Secondly, I will draw attention to the fact that somatechnologies cannot be apprehended outside of processes. Living with a somatechnology is the outcome of a dynamic and complex process wherein the moving body is pivotal.

2.1 Technologies Outside the Configuration of Use, Processes of Embodiment at Stake

Spinal Cord Stimulation's Prescribed Interactions

After the implantation procedure, people who are now living with spinal cord stimulation are invited by the neurosurgeon and, more generally, by the nurse in charge not to do certain movements, e.g. to bend their back or carry heavy bags, for a few months (to prevent the lead from getting displaced). In this respect, it can be said that this advice materialises in, or in Latour's idiom , is delegated to the remote control (Latour 1992). It is through the latter, with its buttons and small display, that one is invited or directed to modulate the stimulation amplitude and to switch between programmes. The remote control, by its 'technological presence' (Kiran 2012), shapes the actions of people living with spinal cord stimulation. Be it actually used or not, the presence of the technological device mediates one's actions. Even more, it is scripted behaviour. By asserting that the interaction with the spinal cord stimulation system through the use of the remote control is 'scripted,' or even 'pre-scribed,' behaviour, I refer to the concept of 'script' proposed by Madeleine Akrich (1992) and Bruno Latour (1992). Technologies can have 'scripts' inasmuch as they can prescribe certain actions, just like a movie script does. The scripts embedded and conveyed by a technological artefact therefore invite or suggest certain actions while they inhibit or discourage others (Verbeek 2011: 19). Indeed, while the intensity of the stimulation, hence the paraesthesia and pain can be influenced, steered even, by one's posture and bodily movements – a central aspect that I will discuss later –, the presence of the remote control affects – inhibits or discourages – this bodily activity.

As previously said, when I/we asked people living with spinal cord stimulation to show me/us how the neuromodulation technology works, they took the remote control and the coil out of small black leather bag, connected one to the other, and positioned with one hand the coil on their upper buttock or low abdomen (i.e. where the pulse generator is located, implanted) while they turned on the remote control with the other hand. By pressing the remote control's buttons and following the screen display, they increased or decreased the stimulation amplitude. Thus, the remote control (connected to the coil) appears as people's interface with the spinal cord stimulation system. As they can read the information displayed on the screen about the current stimulation programme – in the form of a human shape whose electrically stimulated parts of the body, e.g. back, right and left legs, appear as coloured in black – and the amplitude of the stimulation – in the form of vertical bars of increasing size – they seem to have entered in a hermeneutic relation with the remote control. The latter provides them with a representation of the electrical stimulation that is taking place on their spine. They can further interpret it as depicting their level of pain and paraesthesia – and vice versa. In Ihde's terminology, the remote control (connected to the coil) is therefore intentional in both senses of the term: not only does it have a certain inclination concerning its use – a script – but it also exhibits directedness. This directedness, however, is not towards the world but towards one's body (one's level of pain). A difficulty already emerges here with Ihde's framework, and postphenomenological approaches to technology more generally: concerned with the ways in which technological artefacts mediate the relations between humans and their world, they are silent about the ways in which these technological artefacts might mediate the relations between someone and his/her body.

Before discussing this issue, another instance of technical mediation that might characterise the remote control can be identified. The latter can initiate an alterity relation when e.g. it does not work or when one is unable to use it. Assuredly this transformation of the relation involving people living with spinal cord stimulation and the latter exemplifies technological artefacts' 'multistability,' but rather than people being unable to handle the remote control, the latter might actually disable some people (from using it). Mrs Bloemen, for instance, who suffers from diabetic neuropathy which weakens her hands and caused blindness of one of her eyes while the other needs surgery, told me that she barely uses the remote control because of the small size of the screen and buttons as well as the latter's rigidity. Designs matter for us/ability, and as a former product developer for St Jude Medical told me, spinal cord stimulation with its remote control and coil is 'a nice example of a horrible system [that] is really patient unfriendly [...] because if you put the antenna not on the right spot, it's not working anymore, [and] it looks bulky' (interview with A. Elands, May 24th 2012). While interaction with the remote control (connected to the coil positioned on the pulse generator) is the prescribed behaviour – scripted in the design of spinal cord stimulation's system – it can be disabling or, as it is conventionally named, 'user-unfriendly.' Postphenomenology, and presently Ihde's typology of technical mediation, can be useful in apprehending the ways in which spinal cord stimulation shapes people's actions and perception. A certain type of interaction, however, seems to be favoured by this approach. Assuredly, the remote control (connected to the coil) has been people's immediate response to how they relate to the spinal cord stimulation system, but handle-able and usable devices are also the type of technologies that inform and are shed light on by postphenomenology. The implanted lead and pulse generator, the other elements composing the neuromodulation technology, also act – e.g. they generate and deliver electrical current. Yet, implanted, hence not handleable and (mainly) invisible, they bring about other types of interactions and relations than interactions and relations of use; some that are invisibilised in Ihde's postphenomenological framework.

Implanted Technologies and Hybridity

In this respect, Verbeek (2008; 2011:139-152) suggests that the concept of technical mediation is brought to its limits with the growing momentum of implanted technologies such as pacemakers, deep brain stimulation, and microchips for enhancing blind people's vision. He argues that these technologies force us to reconsider intentionality insofar as mediation gives way to (physical) merger. That is, cyborg relations replace embodiment relations and technologically mediated intentionality – i.e. directedness towards the world – becomes hybrid intentionality. '[T]here actually is no association of a human and a technology anymore. Rather, a new entity comes about' (Verbeek 2008, 391). In addition to the cyborg relation and its correlate hybrid intentionality, Verbeek identifies another human-technology configuration that goes beyond technical mediation, one that borders on, or rather refines, Ihde's hermeneutic relation. Composite intentionality is formed out of the combination of this technological intentionality and human intentionality. More precisely, while the directedness towards the world that is exhibited by technological artefacts in Ihde's hermeneutic relation tends to be a representation of certain aspects of reality, other – more radical – forms of technological intentionality are displayed in and constitute composite intentionality, such as 'techno-constructions,' i.e. constructions of reality as in the case of 'radio-telescopes that produce a visible image of a star on the basis of "seeing" radiation which is not visible to the human eye' (Ibid.: 393). With his exploration of hybrid and composite intentionality, Verbeek attempts to bring postphenomenological frameworks beyond use configurations.

Yet, despite the heuristic value of cyborg relation and hybrid intentionality in drawing attention to the specificity of implanted technologies (compared to handleable and usable technological artefacts), the terms hybridity and cyborg do not explicate the practicalities, workings, or underpinnings of this novel human-technology configuration. Indeed, to what extent is hybrid intentionality different from technologically mediated intentionality and can help shed light on somatechnologies? Verbeek's definition of technical mediation can be reminded here:

> *What humans are and what their world is receive their form by artifactual mediation. Mediation does not simply take place between a subject and an object, but rather coshapes subjectivity and objectivity. … Humans and the world they experience are the products of technological mediation, and not just the poles between which the mediation plays itself out (Verbeek 2005: 130).*

With technical mediation being central in human intentionality, intentionality is already hybrid or cyborg. Assuredly, the concept of hybrid intentionality – or designation thereof – highlights the intertwinement of humans, world, and technology, and thereby acknowledges the human's 'cyborg ontology' (Haraway 1991) or its 'originary prostheticity' (Stiegler 1998) – see chapters three and four. Nevertheless, this begs the question of hybridity being ultimately a matter of interiority and invisibility (because under the skin) of the technological device. To posit a merger between technologies and humans without delving into the intricacies and idiosyncrasies of the relations between humans and implanted technologies creates, or rather enacts, hybrid intentionality. With Verbeek's postphenomenological framework, the latter becomes performative – implanted technologies are expected to dramatically transform one's intentionality, so much so that 'a new entity comes about.' Informed by a certain fascination with deep brain stimulation, while technologies and the human physically merge within the cyborg relation, human bodies and their (re-) making with/in technologies are silenced.

Implanted Technologies and Re-worlding: Embodiment as Process

Kirk Besmer (2012), who analyses how cochlear implants (CI) are embodied by their users, attempts to remedy these shortcomings (Besmer 2012). As he relies upon personal stories and academic reports about the experiences of people living with cochlear implants, he shows how living with the implanted device entails re-exploring and re-conceptualising existing postphenomenological frameworks. More particularly, drawing upon Ihde's work on the technical mediation of perception (1979, 1990) and Verbeek's subsequent aforementioned additions (2008, 2011), Besmer not only grounds and (literally) fleshes out the postphenomenological frameworks, but also highlights that exploring the experiences of cochlear implant wearers compels philosophical analyses to focus on embodiment. In the case of the cochlear implant, the human-technology relation involves both an active embodiment process and a degree of merger between the implant and its wearer. Embodiment and merger differ, however, from their initial postphenomenological conceptualisation (i.e. Ihde 1979; 1990; Verbeek 2008; 2011). According to Besmer, the relation between the cochlear implant and its wearer is distinctive insofar as it engenders a specific type of embodiment and intentionality, both 'cyborg.' They respectively consist in a particular combination of Ihde's embodiment and hermeneutic relations and of Verbeek's hybrid and composite intentionalities, yet in both cases, 'fully exemplifying neither' (Besmer 2012: 311).

Similarly to the implanted spinal cord stimulation system (and prostheses), the cochlear implant is composed of different devices or components, some internal, other external. The former group comprises of an electrode array surgically inserted in the cochlea and a receiver implanted at the bottom of the mastoid bone, while the latter consists of a microphone, a speech processor, and a transmitter or coil that are worn behind the ear and usually form a single element. Cochlear implants do not amplify sound as hearing aids do but rather stimulate electronically the auditory nerve fibres, whereby auditory signals can be received and interpreted as sound. As Besmer phrases it,

> *[t]he net effect of this system is not to restore full, normal hearing but for the implant wearer to receive meaningful auditory stimulation from environmental sounds, especially auditory frequencies associate with the human voice (Ibid.: 303).*

In this process, as Besmer shows, if the cochlear implant and its wearer merge, as the mastoid bone grows over the implant, this is not so much a physical merger in terms of 'hardware' as one in which the algorithm of the speech processor translates the environmental sounds into a series of electrical impulses that are meaningful signals for the auditory nerves – and are ultimately heard by the wearer. Due to the coded algorithm, the cochlear implant and one's nervous system merge as electronic and nerve signals interflow. Intentionality is hybrid (perceptual) intentionality. In other words,

> *that which perceives, the 'perceiving subject,' is a hybrid – human + implant – and the intentionality exhibited here is bodily intentionality. … [T]hrough the CI, perceptual intentionality is hybridised at the deepest level (Ibid.: 306-307).*

Undeniably, cochlear implants dramatically change one's perception and being-in-the-world, from a world of silence to a world of sound and noise. '[A] new world emerges around a new body. It is a complete re-worlding,' as Besmer phrases it (Ibid.: 307). In this re-worlding, in which cochlear implant wearers describe their experience as 'coming back to life,' rehabilitation is equated to transformation rather than

to recovery.

In Besmer's analysis, this transformation, or re-worlding, also stems from the fact that cochlear implants display features of Ihde's hermeneutic relations and materialise a composite intentionality. Indeed, recalling the different technological elements that compose the implanted technology, and more specifically, the different translations that occur between them for the environmental sounds to become a meaningful electric stimulation of the auditory nerve, Besmer characterises the cochlear implant as a translation technology (Ibid.: 306). The designation is borrowed from Ihde and describes technologies that enable users, or wearers in the case of the cochlear implant, to perceive aspects of reality otherwise indiscernible (e.g. sound for cochlear implant wearers). Microprocessors are central in translation technologies, whereby what is perceived are 'technoconstructions.' In this frame, a composite intentionality characterises the cochlear implant wearer. However, for composite intentionality to be operative, it must be embodied – or, more practically, the cochlear implant qua translation technology must be embodied. Besmer calls this embodied composite intentionality 'cyborg intentionality.'

Successfully hearing – and living – with a cochlear implant and exhibiting a 'cyborg intentionality' is the outcome of an extended and extensive, active and intense learning process, one in which embodiment is pivotal. The implantation procedure is only the first step of a lengthy and demanding rehabilitation journey. Indeed, if the cochlear implant eventually becomes an extension of one's perceptual body and withdraws from one's attention (i.e. becomes quasi-transparent), which are two features of Ihde's embodiment relation, it entails an experience of hearing that is rather different, 'dis-analogous' as Besmer formulates it, from a technologically unmediated perception (Ibid.: 306). As one can recall, the cochlear implant is a translation technology, one that provides the wearer with technoconstructions. In fact, for these technoconstructions to become part of one's 'perceptual habit' or 'perceptual repertoire,' Besmer explains, cochlear implant wearers must undertake and go through 'rehabilitation,' during which they must learn how to discriminate between noise and meaningful sound, as well as create 'auditory memories.' In other words, they must (re-) learn how to hear (Ibid.: 304). In this process, mapping sessions, during which the speech processor is fine-tuned so as to set the optimal stimulation programme(s) for each individual are crucial. The embodiment of a translation technology is the result of an intense learning process. For Besmer, such embodiment, or the becoming-transparent of the cochlear implant, amounts to one's intentionality being both composite and hybrid – cyborg.

Besmer's account of cochlear implants, more precisely his account of successfully and satisfactorily hearing with a cochlear implant resonates with living with spinal cord stimulation, yet substantial differences exist between the two implanted technologies. Besmer highlights the transformative potentiality and actuality of cochlear implants insofar as they participate in a reworlding for their wearer. He also underlines the importance of embodiment and emphasises that it is an intense and intensive process, thereby inviting us to reconsider how embodiment and embodiment relations are done in practice. While this is a lead I intend to follow to apprehend somatechnologies, it does not exhaust what happens when living with spinal cord stimulation and prostheses. Emphasis on intentionality and a conception of the body as a perceptual entity in particular is too restrictive a scope to account for somatechnologies. Somatechnologies – and among them, enhancement technologies – are not necessarily perceptual technologies: it is not "merely" the ways in which the body, or as proponents of postphenomenological approaches to philosophy would have it, the embodied subject perceives the world that is altered with somatechnologies. Rather, as encapsulated by somatechnology qua heuristic tool and as I shall address, the body itself and how one relates to it are transformed. In fact, even though Verbeek and Besmer consider technologies beyond configurations of use, they still blackbox both technologies and bodies. That is, while philosophy of technology has undergone an empirical turn, situating it within posthumanism, it has left humans qua material realities in a blackboxed position. It is this issue that I will develop in the next sections. More precisely, after attending to the ways in which intimacy is done in the relations between bodies and technologies, I will address how somatechnologies bring to the fore the materiality of one's existence.

2.2 'Doing' Intimacy: Learning to Live with a Somatechnology

Assuredly, spinal cord stimulation exhibits technological intentionality to use the postphenomenological idiom. The lead connected to the pulse generator especially, expresses some directedness. Yet, the implanted device is not oriented towards the world, as understood by the postphenomenological frameworks devised by Ihde, Verbeek and Besmer, but towards the human in its materiality – its body. The implanted technology is not directed towards the world, a world of sound, like the cochlear implant, but towards one's pain, bodily pain. As the electrodes fire and stimulate the spinal cord's nerve fibres at a certain amplitude and frequency, in a sequence determined by the programme set by the nurse or the medical physicist into the pulse generator, the burning or stabbing pain felt in one's lower back, legs, and/or feet is replaced by paraesthesia, a tingling sensation. If the latter can be construed as a 'technoconstruction' and as entailing the embodiment of a translation technology together with the emergence of a cyborg intentionality, the embodiment process has to be thoroughly reconceptualised. In pain and in paraesthesia, the body cannot be conceived as mere intermediary, as becoming as one with the implanted technology without being transformed. Likewise, concerning upper- and lower-limb prostheses, even though Ihde's framework can more readily account for them, its disregard for bodies renders it inadequate to apprehend what is at stake with these intimate technologies.

Somatechnologies cannot be understood without referring to bodies and their (dynamic) becoming. In fact, somatechnology does not simply refer to the technological device, whether implanted or prosthetic in the present case, but to the latter as it is interacting with, and eventually becoming part of, one's body. This intimacy between bodies and (soma-) technologies will be the central focus of this section, wherein the (learning and groping) processes through which somatechnologies are embodied and materiality (of bodies) are to constitute crucial issues. This shall be made clear with an exploration of the embodiment of upper- and lower-limb prostheses that will be read through or woven with Ihde's embodiment relation.

The Becoming-Transparent of Prostheses, A Body-Technology Enactment

Like spinal cord stimulation, both upper- and lower-limb prostheses demonstrate intentionality. But closer to current postphenomenological frameworks, they express directedness towards the world as they mediate the relation(s) between their 'wearers' and the world. As such, the change of a complete prosthesis or of a prosthetic component (e.g. the socket, the foot, the knee, or the hand) contributes to transforming one's experiencing of the world. A change of socket for instance might result in a very different perception of the ground. Stated as the most important and challenging element of upper-limb prostheses by Professor Siegmar Blumentritt who is the head of the biomechanical research department at Ottobock (Duderstadt, Germany), as well as by Martin Pusch who is the head of development in

strategy technology management at the same company and Malte Bellman who is a scientific engineer in Ottobock gait laboratory (Göttingen, Germany), the socket is not only the interface between one's skin and the prosthesis, but also between the person living with the prosthesis and the ground. As Bellman exposed to me,

> *[h]ow can they [people living with a lower-limb prosthesis] feel the surface of the ground? That's a question, because the interface, the connection between the prosthesis that transfers the load to the body and then from the body to the prosthesis again should be very good. So, if the fitting [of the socket] is not done appropriately – it's too big, the residual limb can move too much within – then the sensory aspect for feeling the ground, the surface of the ground they're walking on is disturbed or reduced. So it's not only a question of how to move something, but also a question of how to feel it and how to get the feedback (interview with Malte Bellman, July 26th, 2012).*

Therefore, a change of socket can dramatically transform one's perception of the world to the extent that not only one's steering capacity of the prosthesis might be improved or worsened, but also one's feeling of the ground when walking. In this respect, it can be said that the socket – provided, certainly, that the other components are also appropriately chosen and aligned – is crucial for the prosthesis to achieve (some degree of) transparency.

Ihde's embodiment relation is characterised by the (quasi-) transparency of technological artefacts (in one's perceptual field). However, as shall become clear with somatechnologies such as prostheses and spinal cord stimulation, transparency is not merely the technologies' state of being, but rather a becoming and a doing. More exactly, even though transparency is a desired outcome and the indication of use being successful and satisfactory, technological artefacts are not straightforwardly transparent. There is a becoming-transparent of technological artefacts, one that is being done by bodies and technologies, by bodies with technologies. Rather than a matter of perception, this becoming-transparent of somatechnologies becomes a matter of movements and gestures. In this regard, I would like to recall once more Sobchack's experience with her above-the-knee prosthesis and her recounting of it. The recounting of her experience with her leg prosthesis, in fact, will guide my exposition of living with (lower-limb) prostheses. Writing about her relation with her prosthetic leg, Sobchack tells that

> *[o]bviously, transparency is what I wish – and strive – for in my relation to my prosthetic leg. I want to embody it subjectively. I do not want to regard it as an object or to think about it as I use it to walk. … Insofar as the leg remains an object external to me, a hermeneutic problem to be solved, a piece of technology to "use," I cannot live it and be enabled by it to accomplish those intentional projects that involve it but don't concern it. So, of course, I want the leg to become totally transparent (Sobchack 2004a: 172, emphasis in original).*

To be enabling, the prosthesis must become transparent. This transparency or quasi transparency that is distinctive of Ihde's embodiment relation is what Sobchack aspires and works for – this is also what prosthetics manufacturers aspire and work for. Sobchack does not use her prosthesis. Rather, she sits, stands on, walks and more generally moves with it; she lives with a prosthetic leg. Transparency does not reside in the somatechnology; it is not a property of the latter. Transparency and the embodiment relation are an achievement, the result of a learning and groping process wherein intimacy is also being done.

That is, the becoming-transparent of her prosthetic leg is a corporeal event; it is in the interaction between Sobchack's body, or rather Sobchack qua bodily being, and the prosthesis that transparency is done. Otherwise, the prosthesis remains other, namely a technological artefact to be deciphered, manipulated, and experienced for itself – all elements characteristic of an alterity relation. For the above-the-knee prosthesis to become transparent hence 'absorbed into [her] experiencing as an extension of [her]self' (Ihde 1979: 7), she has (had) to experiment with it and feel it. In her own words,

> *in learning to use the prosthesis, I found that looking objectively at my leg in the mirror as an exteriorised thing – a piece of technology – to be thought about and manipulated did not help me to improve my balance and gait so much as did subjectively feeling through all of my body the weight and rhythm of the leg in a gestalt of intentional motor activity (Sobchack 2004a: 172, emphasis in original).*

Physical exercises and efforts as well as bodily sensations and imagination are necessary for the prosthesis to become embodied.

Learning to Live with A Prosthesis, An Intensive and Extended Training and Learning Process

'Learning to walk on a prosthesis is not done in the first day. After the amputation, it's a very long process of training,' Martin Pusch told me during our interview (which took place on July 27th, 2012 at Ottobock's headquarters in Duderstadt, Germany). After the limb had time to heal (for those who had an amputation, in contrast to people born without a limb), one's socket can be custom made, fitted and aligned with the other prosthetic components, and it is only after an intensive learning and training process that one can finally walk confidently. This is a matter of months, rather than weeks. As Sobchack recalls,

> *[i]n the summer of 1993, as the result of a recurrent soft-tissue cancer in my thigh, my left leg … was amputated high above the knee. For six months or so, while my flesh was healing and I was engaged in strenuous preliminary rehabilitation, I got about using crutches … Finally … my body was ready to go through the arduous plaster casting, fiberglass moulding, and microfitting of a prosthetic leg so that I could begin to learn to walk again – a fairly lengthy and complex process that imbricated both intensive mechanical adjustment and physical practice. There are all sorts of physical things I had to learn to do consciously in quick sequence or, worse, simultaneously: kick the prosthetic leg forward to ground the heel, tighten my butt, pull my residual limb back in the socket and weight the prosthetic leg to lock the knee, take a step with my "own" leg and unweight the prosthetic leg as I did so, tighten my stomach and pull up tall to kick the prosthetic forward, and begin again. This, nonetheless, took a great deal less time than I feared it would, given my middle-age, general physical clumsiness, and my almost will-ful lack of intimacy with my own body. Although it took much longer for me to develop a smoothly cadenced gait, I was functionally walking in a little over a month (Sobchack 2004c: 217).*

Learning how to walk with a prosthesis is a demanding and lengthy process. Training, while it must match the prosthesis components (i.e. the training programme and exercises will be different for a mechanical knee joint from one that is equipped with a microprocessor), aims to have people living with a (lower-limb) prosthesis walk not only safely and functionally but also confidently – and one might add intuitively. Generally starting with walking on a level surface within parallel bars, walking with a prosthesis means learning to 'shift your body between the parallel bars and to stand on one leg. Don't put all the weight on your arms and your sound leg, but trust yourself to stand on your prosthesis as well,' as Ottobock advises on its website. That is, walking and learning to walk with a prosthesis not merely implies trusting the latter but trusting oneself to the prosthesis (Kiran and Verbeek 2010). Trust does not reside with the person living with the prosthesis nor with the latter. Rather, trust is done and achieved in their (intimate) interaction; it is the result of the learning process. As Kiran and Verbeek (2010) explain it, trust is a matter of confidence, which means that learning to walk with a prosthesis requires people to 'deliberately and actively trust themselves to technology. Rather than being risky or useful, technology is approached here as trustworthy' (Ibid.: 424, emphasis in original). Training to be able to walk on/with a prosthesis – and live with somatechnology more generally as this will be particularly underscored in chapter six – is training with others, both humans and nonhumans (e.g. crutches, parallel bars, the physiotherapist's body). Progressively, these 'walking aids' are no longer needed. Eventually, the person living with a lower-limb prosthesis can not only walk on level ground but also up and down stairs and slopes as well as backwards. It is through exercises that one's movements, once enacted consciously – as exemplified by Sobchack's recollection – are performed confidently and intuitively.

However, the learning process entailed in walking with a prosthesis does not stop with one's first prosthetic fitting. Prosthetic components not only wear off, but people living with prosthesis might no longer feel comfortable with the composition of their prosthetic leg. Here, the reader might recall Sobchack's introduction to her leg prosthesis/prostheses that, in the course of ten years, has/have been made up of two sockets, three different knee joints, two metal leg rods, and two feet, as well as her comment about not liking her double-axis hydraulic knee because it seemed not to keep up with her smoother movements and gait when walking while she experiences her current single-axis hydraulic in a much more fluid – transparent – way.

Similarly, M. Pusch drew my attention to the reactions of people when they were fitted for the first time with a microprocessor-equipped knee joint, e.g. Ottobock's C-Leg®. He explained to me that '[t]he electronically-controlled knee joint reduces energy consumption as it lowers the friction as much as possible. … It makes it easier for the patient [to walk]. But patients tried, and the first thing they said is "I don't know where my leg is!" The feedback was missing. They wanted the mechanical knee again!' (interview with M. Pusch, July 27th, 2012). While the knee joint was designed to reduce the level of energy required from people to walk with their prosthesis, hence ease ambulation, it disrupted their experience of walking. Initially disabling, it required another learning and training process. Insofar as this was part of a trial for the C-Leg®, M. Pusch then set the knee joint to a resistance value equivalent to the friction of a mechanical knee, but decreased it a bit, and told them: 'I offer you a value that is slightly different. You still feel what you are expecting but with less intensity.' He continued:

> *[t]hey tried this. I saw them the other week and they have been satisfied. And after four steps [in the trial], we have been on a very low [resistance] value, and they walked with that. They came again, and I said: "now we are on the position where I think it's nice." Oh, it's very nice! And I gave them the old value. First, they said I was fooling them. Incredible, they said, I never want this high friction again! (interview with Martin Pusch, July 27th, 2012).*

The improvement that a prosthetic component – here a microprocessor-equipped knee joint – is expected to bring is neither direct nor straightforward. Rather, it demands a re-learning and is done in practice; it is done in movement(s). Walking with a prosthetic leg whose components change throughout one's life is always the result of an intensive and complex process wherein bodies and technologies intimately interact. More precisely, living with a prosthesis, be it for lower- or upper-limb, implies a demanding learning and training process, wherein mechanical adjustment and physical practice are imbricated to use Sobchack's phrasing. This can be further illustrated with upper-limb prostheses.

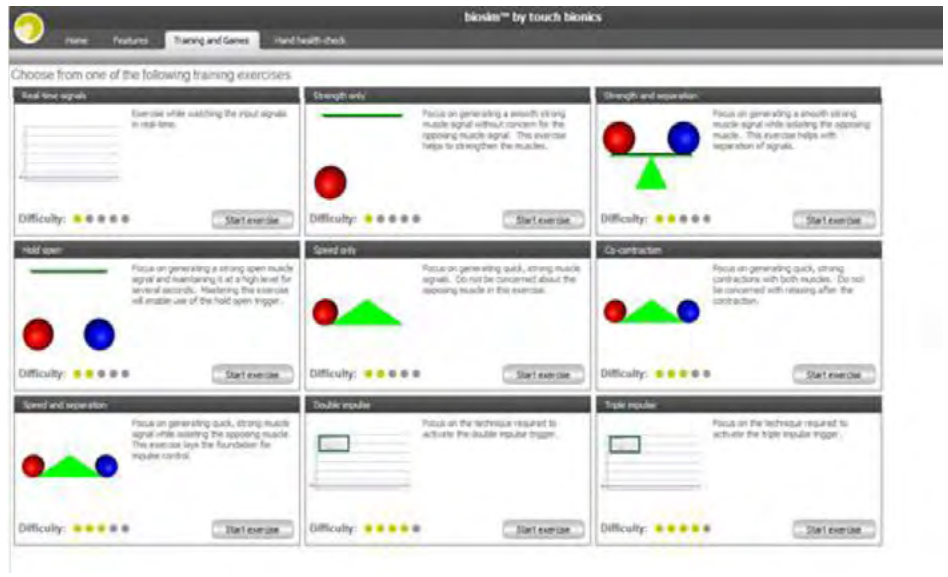
During my visit at the Orthopädie + Reha-Technik Congress that took place in Leipzig, Germany in May 2012, Neil Stephen from Touch Bionics told me that eighteen different people were working together to fit someone with the arm prosthesis they manufacture, the i-limb™ ultra. Their team consists not only of rehabilitation therapists and prosthetists, but also of mechanical, electronic and software engineers. Indeed, both Touch Bionics' i-limb™ ultra and Ottobock's Michelangelo® prosthetic hands – that I could observe at the Orthopädie + Reha-Technik 2012 – are myoelectrically controlled, which means that EMG electrodes are positioned on the surface of the skin (of the so-called residual limb) and transmit the electric signals they receive from muscle contractions to a microprocessor that measures and amplifies – interprets – these signals which, transmitted to the respective prosthetic components, are converted into hand's movements. Seven different hand movements are possible with the Michelangelo® hand which has two motor drives, one for gripping movements and gripping force and the other for the thumb which can move in an additional axis. Whereas the thumb, the index and middle finger are actively driven, the ring and little fingers passively follow the latter. As for the i-limb™ hand which has motors on every digits, twenty-four hand positions are achievable.

Touch Bionics' i-limb™ ultra (left) and Ottobock's Michelangelo® (right)

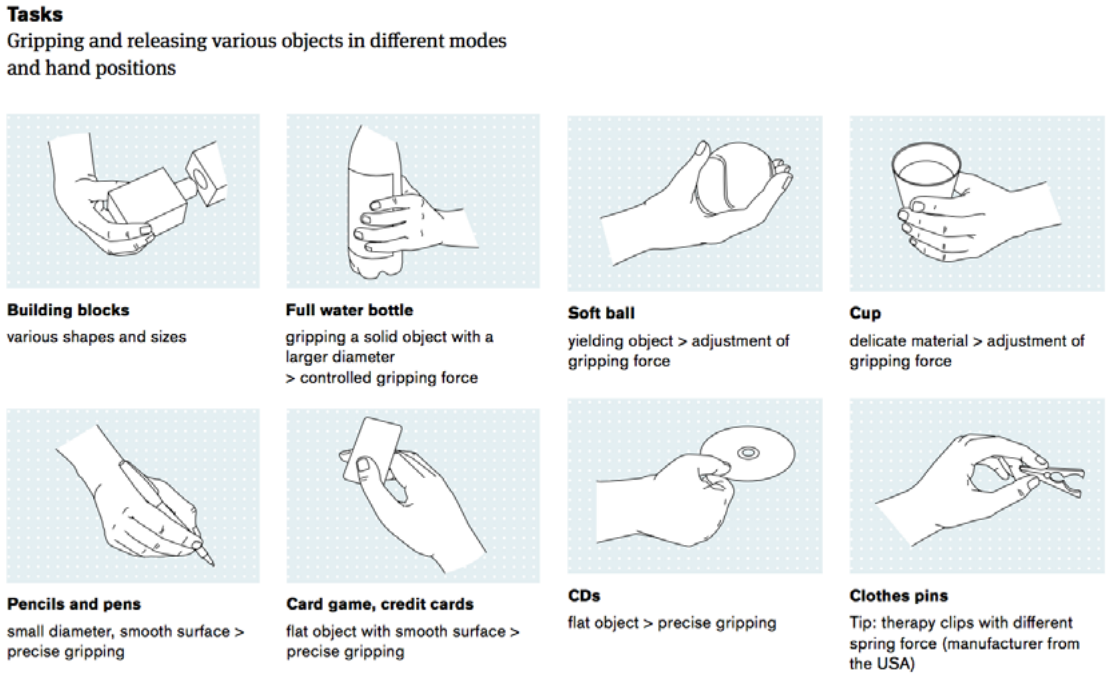
This wider range of hand positions and movements comes with greater complexity. While the positioning of the electrodes is crucial for muscle contraction signals to be optimally picked up and transmitted, the generation or realisation of the appropriate muscle signals – also called triggers – by the 'wearer' of the prosthesis is pivotal yet complicated. Using the biosim and the AxonSoft, which are the software respectively used to set and adjust the i-limb™ and the Michelangelo® via Bluetooth®, the fitting team or the prosthetist has to evaluate muscle signals and determine the optimum electrodes adjustment so that the prosthetic hand can be controlled – i.e. the electrodes should be (fine-) tuned so that they are sensitive enough to the intended muscle contraction signals (triggers) but not too sensitive in order to avoid picking up so-called extraneous noise signals, or else the prosthesis becomes uncontrollable. Resonating with Besmer's account of hearing with a cochlear implant while being reminiscent of the setting of the stimulation parameters for spinal cord stimulation, this mapping session that accompanies the first fitting of both the i-limb™ and Michelangelo® is followed by an intensive learning and training process.

'It takes time and practice to gain control and master the best way to do tasks with your prosthetic hand. The pace at which individuals gain this control varies, but we encourage you to be patient and seek training,' one can read on the first page of the i-limb™ User Manual. Myoelectric signals act as triggers for activating and shifting between hand positions, grips, and movements. While the correspondence of triggers and hand positions are pre-determined with the Michelangelo®, one being able to constantly switch between the seven hand positions, it is subject to more personalised adjustments with the i-limb™. More precisely, of the twenty-four hand positions the latter affords, only four can be realised at a given time. For each of the selected hand positions, s/he can associate a trigger, i.e. a myolectric signal. The latter is however not left to chance. Rather, one's choice of the signals that will be associated with one's selected features is constrained – and constraining – insofar as four predetermined triggers constitute one's field of possibilities. These are the 'hold open,' the 'co-contraction,' the 'double impulse,' and the 'triple impulse' signals. (Bodily) imagination and projection as well as interaction with other material objects might be necessary for someone to contract his or her muscles accordingly – s/he might have to picture and sense him- or herself performing a certain task to achieve the appropriate trigger and hand movement, such as making a tight fist or flicking one's fingers to realise the co-contraction trigger. Ultimately, however, s/he has to train to perform these signals; and training does not only aim at realising these signals smoothly – one might add automatically or transparently – but also so that these triggers are appropriately strong, fast and distinct to control the prosthetic hand. Training and practice are, in fact, crucial.

Both Ottobock's and Touch Bionics' emphasis on training materialises in, or is delegated to, software and DVDs containing exercises as well as to rehabilitation therapists. At home, people can practice controlling their prosthetic hand. With exercises that vary in terms of difficulty and are organised around training certain abilities, such as generating fast and/or strong and/or separated muscle signals (e.g. Touch Bionics' training suite in the figure below), people living with a prosthetic hand can learn how to produce the appropriate muscle contractions for activating certain hand positions and grips, hence realising certain tasks.



Screen shot of the training suite aiming at developing control of the i-limb™ ultra (Touch Bionics User Manual 2013: 20)



Tasks and exercises to be repeated at home and with one's therapist

(Ottobock Michelangelo Therapy and Rehabilitation Manual 2012: 23)

It is through this control training and through the realisation and repetition of tasks (e.g. gripping a bottle full of water to control one's gripping force, grabbing a soft ball or a cup to control and adjust one's gripping force, writing with a pen to realise more precise gripping movements, and more generally the tasks one has to perform in daily life – so-called activities of daily living, ADL – such as dressing and undressing, brushing one's teeth, preparing a meal) that the prosthetic hand becomes transparent – embodied. In this particular case, it could be tempting to follow Besmer (2012) and to say that living with a lower- or upper-limb prosthesis is similar to hearing and living with a cochlear insofar as it implies the embodiment of a translation technology. By focussing on the microprocessor embedded in the prosthesis that interprets muscle contractions and transmits them as signals for the realisation of hand positions and grips, living with a somatechnology could be conceived as embodying a composite intentionality, hence exhibiting a 'cyborg intentionality.' As I shall address however, this re-exploration of Ihde's embodiment does not exhaust what is at stake with somatechnologies. Bodies, the materiality and agency thereof, and the ways in which the becoming intimate of somatechnologies is done by bodies with technologies has to be further investigated.

Revisiting Embodiment with Somatechnologies

This fairly lengthy exposition of the extended and intensive learning and training process necessary for someone to be able to live with a prosthesis does not aim at comparing and assessing the advantages and disadvantages of different prostheses, but rather aim to underline their complexity – the complexity of somatechnologies. I relied upon different examples of prostheses, whether lower-limb prostheses composed of a mechanical knee joint or of a microprocessor-equipped knee, or two myoelectric arms to draw attention, on the one hand, to the fact that one does not use but rather lives with a somatechnology, and on the other hand, that living with a somatechnology is the outcome of a dynamic and complicated process wherein the moving body is pivotal. The complexity and dynamic character of this process resides neither in the prosthesis itself nor in one's body, but in their interaction – or, rather, intra-action to use Barad's (2007) term that emphasises the primordial and primary character of relations over the the relating entities, the latter emerging in their intra-actions, and as shall become clear in the next chapter their material-discursive entanglement with others. In fact, even though control of the prosthesis is a recurring and crucial issue when learning to live with a prosthestic leg or arm, control should not be confused with complete mastery over the technology. As seen in chapter three, control is with feedback a central concept of cybernetics, and the latter informs the workings of myoelectric prostheses in particular and prostheses in general. While control is effectuated through myoelectric signals, feedback is still a major – and unresolved – issue with prostheses. Relying upon the case of upper-limb prostheses, during our interview Siegmar Blumentritt exposed the problematics of feedback in these terms:

> *[w]ith our muscle system, we don't think about what we are doing. With a prosthesis, you have to think. I have always eye-hand coordination, visual realisation to know when to stop grasping with my forces. With a normal hand, I feel it, I do not have to think about this (interview with Siegmar Blumentritt, July 27th, 2012).*

While myoelectric signals enable to control the prosthetic hand, that is, allow for the realisation of a range of hand positions, movements and grips and ease the realisation of (certain) tasks, the person living with the prosthesis does not have feedback: s/he does not have sensation in her hand informing her about the strength of her grasp. Therefore, while 'taking attention away from the [prosthetic] leg and arm' (interview with Martin Pusch, July 27th, 2012) is an explicit goal of prosthetic manufacturers, without feedback, one has to rely on his/her vision, practical experience and/or trust oneself with the prosthesis.

As previously said, if prostheses become transparent, this transparency is being done by bodies and technologies, by bodies with technologies. Concerning embodiment, and more precisely embodiment in the postphenomenological frame of Ihde's relations, when processes rather than the finite and limited temporality of use are acknowledged, the embodiment relation might constitute an interesting heuristic tool for apprehending what is at stake with somatechnologies in general as well as with somatechnologies in relation with or in the context of human enhancement. Indeed, Ihde draws attention to an ambivalence – a 'doubled desire' – informing technologies participating in embodiment relations, namely the desire for both transparency and extension. In his own words,

> *on the one side is a wish for total transparency, total embodiment, for the technology to truly "become me." Were this possible, it would be equivalent to there being no technology, for total transparency would be my body and senses: I desire the face-to-face that I would*

> *experience without the technology. The other side is the desire to have the power, the transformation that the technology makes available. Only by using the technology is my bodily power enhanced and magnified by speed, through distance, or by any of the other ways in which technologies change my capacities. These capacities are always different from my naked capacities. The desire is, at best, contradictory. I want the transformation that the technology allows, but I want it in such a way that I am basically unaware of its presence. I want it in such a way that it becomes me. Such a desire both secretly rejects what technologies are and overlooks the transformational effects which are necessarily tied to human-technology relations (Ihde 1990: 75, emphasis in original).*

As it has been addressed from chapter one onwards, technological artefacts are neither instrumental nor neutral. Therefore, as emphasised by Ihde, a completely transparent technological enhancement is impossible. While quasi-transparency is an achievement – it is enacted in practices involving one's body and the (soma-) technology – it also displays, as previously said, a magnification/reduction structure. That is, as some aspects of the world are experienced as enhanced, other are perceived as reduced. Ihde illustrated this with the example of speaking through a telephone: the phone almost transparently conveys one's interlocutor's voice, but as it extends one's experience insofar as the conversation could not take place without the technological artefact, it also reduces it inasmuch as one is not able to experience the other's facial expressions and gestures, his or her body language (Ihde 1979: 9-10). While one's prosthetic leg enhances one's experience, especially in terms of mobility, it also reduces one's perception of aspects of the world. In this respect, Sobchack writes that her prosthetic thigh 'cannot make sense of the lacy lingerie that touches it, it cannot feel the silk stocking that caresses its artificial skin. In sum, my prosthetic leg has its limits' (Sobchack 2004a: 177).

This reconsideration and emendation of postphenomenology's embodiment relation and focus on usable or handleable technologies does not, however, amount to pronouncing it as the appropriate framework for accounting and accounting for somatechnologies. Postphenomenology's embodiment relation, even as it is recognised as being done by bodies with technologies and as a (learning) process through which one becomes intimate with somatechnology, does not exhaust what is at stake with somatechnology. As I shall address in the next part, such a view is too reductive insofar as it focuses almost exclusively on perception and intentionality, convening and conveying a particular body (or conception thereof), namely a perceptual yet absent body. However, prostheses qua somatechnologies not only transform and enact new bodies, but also bring the persons living with one in close proximity – intimacy – with their materiality. Before delving into this issue, it is necessary to address and illustrate how bodies, the materiality and agency thereof, are crucial for apprehending somatechnologies – yet (still) missing from postphenomenological approaches to technology.

Bodies and Somatechnologies: Materiality at Stake

While being able to live with a somatechnology is the result of an intensive and extended (even unending) learning process through which the somatechnology becomes transparent, this becoming-transparent is done by bodies with technologies. To conclude this part on the becoming intimate of somatechnologies, especially as seen through the lens of postphenomenology's embodiment relation, it is necessary to come back to the ways in which it is done by bodies with technologies. Sobchack draws attention to

> *the way in which learning to walk and incorporate a prosthetic leg has made me more – not less – intimate with the operation and power of my body. I now know where my muscles are and am physically more present to myself. I also enjoy what for me (previously a really bookish person) always seems my newfound physical strength, and I have discovered my centre of gravity (which, in turn, has transformed my entire comportment in ways that include but also exceed my objective physical bearing) (Sobchack 2004c: 220).*

The reader might recall here Sobchack's description of the bodily movements that she had to consciously perform when she learned to walk with her prosthetic leg – e.g. kicking the prosthetic leg forward, tightening her bottom, pulling her residual limb in the socket, weighting the prosthetic leg to lock the knee, tightening her stomach. During gait training and more generally in the ten years that she has been living – and walking – with her prosthesis, Sobchack has gained more awareness of and confidence in her body: not only does she know where her muscles and centre of gravity are, but she also feels more grounded in her body, more 'present to herself.'

This greater intimacy with her body is linked to the ways in which the prosthesis transforms her morphology. Bodies are however not passive but active in their becoming with somatechnologies. As Sobchack explains

> *after the amputation I lost an extraordinary amount of weight – not from dieting in the mode of the self-loathing females of our culture but from intensive exercise of, first, merely getting from here to there on crutches and, now, from "pumping iron" to keep the rest of my body ... up to the durability and strength of my prosthetic leg (Sobchack 2004a: 168).*

For the prosthesis to be enabling, physical training is necessary. Strengthening and straightening one's trunk and pelvis as well as one's muscles in both legs (i.e. the putatively 'sound' leg and the 'residual' limb) are needed to be able to steer and walk with the lower-limb prosthesis. While, as previously said, learning to walk with a prosthesis does not stop with one's first fitting, physical training does not come to an end when one is able to walk confidently with his or her prosthetic leg. Rather, regular and long-term training has to be undergone. The latter also applies to upper-limb prostheses. In this respect, Ottobock's Michelangelo Therapy and Rehabilitation Manual also emphasises the importance of physical training to strengthen trunk muscles (2012: 17). In fact, an enabling prosthesis both requires and creates a specific body – a muscled body. Contra the prosthetic trope – and human enhancement imaginary – hard(er) bodies are not so much the outcome of bodies becoming technological with prosthetic technologies as they are the result of the (more mundane) entanglement of prostheses, weight machines and physical training. While this transformation of bodies with prostheses can be conceived as a disciplining process, it also testifies to the fact that somatechnologies cannot be apprehended independently from the materiality of bodies and their agency.

Bodies not only change when living with prosthesis, but they also influence – are criticial in fact for – the ways in which the latter will be embodied and lived. While the volume of the stump tends to shrink over time – demanding the making and fitting of a new socket – people living with a prosthesis also tend to compensate for the 'missing' arm or leg with their posture and gestures. The presence of the prosthesis might indeed constrain people to perform compensatory movements with their 'sound' leg or

trunk in the case of lower-limb prostheses or with their shoulders as Ivan, whom I met at the Orthopädie + Reha-Technik 2012, explained to me when he pointed out that the soft fingertips and flexible wrist joint of his newly fitted Michelangelo® hand enable him to e.g. fit his hands in his pockets, thereby no longer requiring his shoulder to compensate for the prosthesis' presence (especially its rigidity) and permitting him to adopt a more relaxed posture. Furthermore, referring to bodies fitted with lower-limb prostheses, M. Bellman reported to me that '[t]he shorter the stump is … the higher the compensatory effect is' (interview with Malte Bellman, July 26th, 2012). That is, while prostheses transform corporeality, bodies' (different) materiality influences this transformation. The size and length of one's stump is not only decisive for one's bodily posture and gait with the prosthesis but can also prevent someone from being fitting with e.g. Ottobock's Michelangelo® hand. Due to its size, and especially to the length and width of the built-in battery, it cannot be fitted on relatively long forearm residual limbs – otherwise the prosthetic arm would be disproportionate to the 'sound' one. Not every body can be potentially enabled by Ottobock's latest prosthetic hand.

Bodies – material bodies – enable what can be embodied. As Sobchack (2004a: 172) phrases it, the 'naked capacities of my flesh also ground the very possibility of my partial transcendence of them' with and through technologies, here her prosthetic leg. Certainly, these capacities have to do with perception – e.g. experiencing of the ground when walking with a prosthetic leg, or vision for a telescope, sound for a telephone – but they also refer to the corporeal, material ground of one's existence and being in the world. Material bodies ground the possibility for technologies to be embodied. As I have showed, embodiment demands bodily effort and agency, it is not a transparent event. Bodies are not passively being transformed by prostheses but are active in their becoming with these somatechnologies – e.g. the importance of muscle contractions as well as gestures and postures in steering and embodying the prosthetic technologies. Prostheses, in fact, provide a renewed – if not completely novel – access to one's bodily materiality. They not only mediate the ways in which bodies are experienced, but the concreteness or weightiness – materiality – of one's bodily existence also becomes intimate as a different body comes to being with prostheses and somatechnologies in general. With/in somatechnologies, bodies 'dys-appear.' These aspects – the materialisation of different bodies with somatechnologies, the increasing intimacy of one's material existence, and bodies' dys-appearance – will be further addressed in the next part with spinal cord stimulation.

While close to bodies, somatechnologies are not straightforwardly and directly intimate technologies. Rather, they become intimate as they are embodied, embodiment being not only a process but also done by bodies and technologies. For the somatechnology to become transparent, an intensive learning and training process is necessary. One learns to live with somatechnology. This amended embodiment relation – insofar as it is recognised as being done by bodies with technologies and as a (learning) process through which one becomes intimate with somatechnology – does not however exhaust what is at stake with somatechnology. Bodies, their materiality and agency are critical for somatechnologies becoming intimate: they not only influence but also enable it. As I shall explicate in the next part, becoming intimate with a somatechnology is accompanied by becoming intimate with one's (lively) materiality, with what one's body can do.

3. Living with a Somatechnology, Re-exploring Bodies in Intimate Relations with Technology

As the somatechnology becomes intimate technology, another transformative process unfolds. Besides novel bodies materialising with/in somatechnology, the latter is accompanied by a renewed intimacy with one's (bodily) materiality. While the previous part relied mainly on upper- and lower-limb prostheses, my exploration of this dimension of somatechnology will be grounded in the latter as well as spinal cord stimulation. The exploration of the neuromodulation technology will be particularly fruitful in addressing the increasing intimacy with one's materiality when living with a somatechnology. In this concluding section, its analysis will also enable me to bring together the different dimensions of the becoming-intimate of somatechnologies.

3.1 Becoming Bodies with/in Somatechnologies, Accounting for Bodily Materiality

In contrast to upper- and lower-limb prostheses, spinal cord stimulation is an implanted technology. Or rather, two of its components – the lead and the pulse generator – are implanted under the skin – respectively positioned on one's spine and at the level of one's low abdomen or, in rarer cases, upper buttock – while a remote control enables to modulate the stimulation amplitude or to switch between programmes. As aforementioned, to resort to the remote control for this purpose is scripted or even pre-scribed behaviour. Indeed, while the intensity of the stimulation, hence paraesthesia and pain can be influenced, steered even, by one's posture and bodily movements, the presence of the remote control affects – inhibits or discourages – this bodily activity. Assuredly, spinal cord stimulation's scripted behaviour is corporeal insofar as the realisation or actualisation of the remote control's material invitation or injunction to use it implies and generates new practices that might eventually become routinized, ritualised, and sedimented into one's repertoire of bodily gestures and techniques (Mauss 1934). However, in one's relations with spinal cord stimulation, the remote control is not necessarily central. The relationships are more intimate. Similar to prostheses, bodily gestures are crucial for the becoming transparent of spinal cord stimulation – its embodiment. Indeed, the neuromodulation technology's disappearance under the skin does not equate to transparency. Implantation does not mean embodiment – nor incorporation, as shall be addressed in the next chapter. In fact, somatechnology's becoming transparent is quite paradoxical insofar as it entails a greater awareness of and intimacy with one's bodily materiality.

To a certain extent, the experiences and practices of people living with spinal cord stimulation resonate with those of people living with a cochlear implant (or with Besmer's account thereof). Undeniably, living with spinal cord stimulation entails a re-worlding, one that is reminiscent of the (aforementioned) experiences of people hearing with a cochlear implant that they described as 'coming back to life.' Mr van Houten, a sixty-one-year-old man whom I interviewed on April 11th, 2012 and who has been living with spinal cord stimulation since 2009, expressed the transformation he underwent in these terms:

> *It [spinal cord stimulation] changed my life. What I can do and how I feel. … When I don't have this, I'm sitting in a wheel chair, all day. And I sit down, and I look outside, I don't do anything – maybe, ja, get some coffee, at home, yes? And now I can go outside. I can go shopping, I can take care of my husband. And when I don't have this, [sigh] yeah, then I can do nothing. … I can say now I ehm I belong somewhere again [ik hoor er weer bij]. I'm now part of the life. And when I was ill and I was in a lot of pain, I always laid in bed (interview with Mr van Houten, April 11th, 2012)* .

In Besmer's account of cochlear implant wearers, the latter experience a re-worlding that is not only due to the practical implications of the implanted technology (being able to partake in some activities) but also its perceptual import (the technological intentionality exhibited by the device, its technoconstructions, and the emergence of a composite intentionality). In the case of people living with spinal cord stimulation, a re-worlding also takes place, one that is linked to the neuromodulation technology's practical dimensions, such as finally being (en)able(d) to walk, but not only. Unlike the cochlear implant, however, this re-worlding does not stem from perception being reconfigured, but from the materialisation of one's body with/in technology. While both are implanted technologies equipped with a microprocessor, spinal cord stimulation and cochlear implants have a distinctive technological intentionality, the latter being directed towards the world and the former towards bodies – especially bodily pain.

Pain and the Body's Dys-appearance

Pain – the body in pain and the painful body – is pivotal for understanding the re-worlding that people living with spinal cord stimulation experience. The neuromodulation technology is indeed a last resort treatment of chronic pain due to neuropathy or failed back surgery syndrome. The Douleur Neuropathique 4 (DN4) questionnaire has become the established screening tool to assess whether or not someone suffers from neuropathic pain, which is pain due to nerve damage. Neuropathic pain is generally experienced as burning, painfully cold, and/or as electrical shocks. It is also associated with tingling sensations, and/or pins and needles, and/or numbness, and/or itching. The painful area might also be characterised by hypoesthesia – i.e. reduced sensation – to touch or pinprick while light brushing might cause or increase pain. Fifty-three-year-old Mr Koopman, for instance, describes that

> *the pain that I have in my feet is constant [..] I'm always in southern France along the river, on the pebbles on my bare feet [..] so you should imagine walking on it. But, well, um, I also have a lot of flashy shooting pain. In my feet and toes. And often I have cold feet. And for these last two aspects, there the stimulator is working nicely. That's pretty much reduced (interview with Mr Koopman, April 12th, 2012).*

By narrating how pain demands that he lies or sits down, not able to do anything, and by describing his experience with pain as living one's life as if constantly walking bare feet on pebbles and being suddenly yet continuously 'shot' by pain, both Mr van Houten and Mr Koopman show how pain is not only 'unquestionably a sensation in a part or parts of the body, but … also always unpleasant and therefore an emotional experience,' therefore meeting, or rather incarnating, the definition of pain accepted by the International Association for the Study of Pain (IASP).

As Merleau-Ponty formulated it, 'the body is the fabric into which all objects are woven' (1962: 235) while being is always being in as well as to the world. Being a body-in-pain, however, enacts a world in which one's field of possibilities is hindered and hampered, a world that is even experienced as shattered and shattering. Being a body-in-chronic-pain (un-) makes one's world (Scarry 1985) . As Drew Leder (1990) would phrase it, in pain the body 'dys-appears.' In normal course of events, the body, or rather the lived body is characterised by a primordial absence. In fact, absence and presence are intertwined in the lived body, the latter being characterised by ecstasis (Leder 1990: 21-22). Derived from the Greek ek-stasis, the lived body whereby we are-in-the-world 'stands out.' That is, in action and perception, its 'very nature … is to project outward its place of standing' (Ibid.: 22). Ecstatic, the body is experienced transparently; it is absent. Nevertheless, as Leder emphasises, absence should not be equated with lack of being or void. Rather, there is presence in absence, the latter etymologically meaning 'being away.' However, in pain or in sickness, the lived body is characterised by a secondary absence – a 'dys-appearance.' Dys-appearance characterises the body's absent absence. That is, the body is no longer experienced as transparent, as the (back-) ground of our being-in-the-world, but it is rather brought back into the foreground of our awareness.

Somatechnologies and Becoming Intimate with One's Materiality

Postphenomenological approaches to technology – as well as philosophy of technology in general and transhumanist and bioconservative discourses – presuppose and enact an absent body. Yet, with somatechnologies such as spinal cord stimulation and (upper- and lower-limb) prostheses, the body's absence and dys-appearance is precisely what matters. For somatechnologies to become transparent, that is, to be experienced as transparent, implies getting in touch – becoming intimate – with one's dys-appearing body – with one's lively materiality. While prostheses and spinal cord stimulation bring one's bodily materiality into the forefront of one's experiencing, it is by making one's body transparent – by experiencing it as an absent presence – that somatechnologies are incorporated. Assuredly, the body's dys-appearance can be highly disruptive, if not destructive when in (chronic) pain, but to develop a relationship with it is necessary to embody somatechnologies. It would be tempting to assume that the body's dys-appearance and the becoming intimate with one's materiality are processes that characterises somatechnologies only insofar as they are interacting with a particular body, namely the body-in-pain. However, as already hinted at in the previous part, to be able to live with upper- and lower-limb prostheses also entails a becoming intimate with one's material dimension, with one's (lively) materiality.

Indeed, as aforementioned when attending to prostheses, the latter provide a renewed – if not completely novel – access to one's bodily materiality. For instance, as I have described, with myoelectric upper-limb prostheses, muscle contractions have to be performed at a specific speed, with a certain strength and in a particular sequence so that the appropriate triggers are produced to activate the desired hand positions and grips, hence to realise the intended task. In fact, in this process, as one learns to move, act and live with an upper-limb prosthesis, another body is enacted. When learning to produce appropriate muscle contractions, i.e. myoelectric signals, that will act as triggers for activating and shifting between hand positions, grips, and movements, one does not just get novel insights into what his/her body can do, but rather another body, one that is made of myolectrical signals and triggers, is enacted. Furthermore, when learning how to walk with/on a prosthetic leg, muscles have to be tightened and strengthened while specific and cadenced movements have to be accomplished, as Sobchack recounted. There, the lived body

is not an absent presence, but is experienced for itself with an unprecedented degree of unfamiliarity and strangeness even. Commenting on the body's primordial absence, Leder writes that in normal course of events,

> *[t]he self-presence we can achieve is limited, no less in action than in perception. I cannot thematize even a single movement in its entirety. Though I may concentrate on the rhythms of walking, most of the physiology of the act remains resolutely hidden from my awareness. … I have a tacit command over my body, accomplishing without the slightest difficulty actions I could not begin to comprehend or carry out in a reflective fashion. If I attempted to walk by consciously manipulating all the proper muscles I could soon find myself incapacitated (Leder 1990: 19-20, my emphasis).*

Leder's quote is revealing: when walking, what incapacitates him – and able-bodied people in general – is precisely what enables people living with a prosthesis. To be able to walk, Leder has to experience his body as absent. To achieve walking with/on her prosthetic leg, Sobchack had first to adopt a reflective stance over her body and manipulate all the proper muscles in the right sequence. Dialoguing with a passage of Merleau-Ponty's work– with which Leder's above citation resonates – where he mentions the 'thousand natural miracles in [his] body' as a result of which he can walk and more generally move without being aware or knowing which muscles and nerve paths are therefor mobilised, Sobchack expresses how

> *[t]hese "thousand natural miracles" were something I retrospectively treasured as, learning to incorporate and walk with a prosthetic leg, I had to consciously direct my body in each move of what previously had been a transparent action. Now, however, … I too walk to the door without thought of my walking, at home in both my body and the world' (Sobchack 2004b: 191).*

At first, with her prosthesis – and her amputation – Sobchack does not experience her body as an absent presence. Rather, it is dys-appeared. It is as she grapples with, grasps, and eventually becomes intimate with the materiality and concreteness of her dys-appeared body that she is able to walk with/on her prosthetic leg. Indeed, as the reader can recall, she remarked on how learning to walk and incorporate her prosthetic leg has made her more intimate with her body, as she now knows e.g. where her muscles and centre of gravity are and feels more present to herself (2004c: 220). As she became more intimate with her body, with her materiality, progressively she no longer experienced her body as dys-appeared but as an absent presence, an event that gives her 'great pride' and 'great delight.' In fact, becoming intimate with one's materiality is becoming intimate with one's material agency and what the body can do. Testifying of the challenges inherent in (satisfactorily) living with a prosthesis, which entails achieving to experience an absent body and a transparent prosthesis, it is also with great pride that, at the Orthopädie + Reha-Technik 2012, Ivan was showing me what he could accomplish with his prosthetic hand – e.g. opening and closing a water bottle, grasping differently-sized kitchen utensils, putting both hands in his pants' pockets, or joining them behind his head. Now able to walk confidently and pass as putatively able-bodied, Sobchack expresses her desire to 'show it [her prosthetic leg] off' and '[tends] to talk about – and demonstrate – the coordinated and amazing process of walking that we all don't normally think about but that the prosthetic leg is able to foreground and dramatise both to [her]self and for others' (Ibid.: 221). Resulting from an intensive and challenging process – an achievement – the becoming-transparent of the prosthesis is intertwined – coincides even – with the becoming-absent of the lived body.

With somatechnologies, both processes are entangled; bodies and technologies cannot be apprehended separated from each other. Not only are bodies transformed with/in their intimate relations with somatechnologies, but the latter enact – materialise – different bodies, e.g. one composed of myolectrical signals and triggers. In this process, to be able to live with somatechnology entails becoming intimate with one's materiality, what one's body can do. While this shall become even more palpable in the next part with spinal cord stimulation, the latter will also bring together the different lines unfolding with somatechnologies and developed in this chapter.

3.2 Gestures and the Recomposition of the Body-Self

As previously said, spinal cord stimulation is a last resort treatment of chronic pain due to neuropathy or failed back surgery syndrome. When chronically in pain, one's lived body is a dys-appeared body through which the world is experienced as shattered and shattering. In fact, before having the neuromodulation device implanted, everyone has experienced various, and generally heavy, types of medications, such as anticonvulsive drugs and opioids. To use Leder's words, when in chronic pain, 'the body is no longer alien-as-forgotten, but precisely as remembered, a sharp and searing presence threatening the self' (1990: 91). The body's dys-appearance with/in chronic pain endangers one's sense of self. Living with somatechnology becomes a vital issue.

Intruders and Recomposing One's Sense of Body-Self

In our interview, Mr Koopman explained to me that before having the neuromodulation implanted he was taking very heavy medication, so heavy in fact that he decided to stop taking it

> [b]ecause yes, my mind was flat, so to speak. And I did not noticed that so well, but my wife and the people around me who noticed said it, and that is an unpleasant experience to hear afterwards [..] So then, I said resolutely: I quit, (interview with Mr Koopman, April 12th, 2012).

Both pain and pain medication, because of the ways they affect and effect the body – making it dys-appear – and sense of self, are experienced as intruders. During most of the interviews I/we conducted, I/we eventually asked people living with spinal cord stimulation which option they would choose, were medication and the neuromodulation technology to enable the same pain reduction. Despite the very difficult – and even traumatic – experience of the surgical implantation, all answered without hesitation that they would opt for spinal cord stimulation. The reason for such a choice is linked to the effects of the medication (generally morphine), which are 'not nice' as Mrs Baten told me in a charged sigh (interview with Mrs Baten, April 12th, 2012). 'Your mind is not clear with the medication,' Mr van Houten told me in an echo to Mr Koopman (interview with Mr van Houten, April 11th, 2012).

Not only the body-in-pain but also the body-in-pain-medication can enact a rupture between

one's material – lived and living – body and sense of self. Sharing his experience with heart transplantation and immunosuppressants, Jean-Luc Nancy (2010) writes about the presence of an intruder, one that resonates with the experience that people living with spinal cord stimulation have (had) with pain and pain medication. 'Il y a l'intrus en moi, et je deviens étranger à moi-même'[141] (Nancy 2010: 31), Nancy asserts, before continuing:

> *On ne se reconnaît plus : mais « reconnaître » n'a plus de sens. On n'est, très vite, qu'un flottement, une suspension d'étrangeté entre des états mal identifiés, entre des douleurs, entre des impuissances, entre des défaillances. Se rapporter à soi est devenu un problème, une difficulté ou une opacité : c'est à travers le mal, ou bien la peur, ce n'est plus rien d'immédiat – et les médiations fatiguent. … Je finit/s par n'être plus qu'un fil ténu, de douleur en douleur et d'étrangeté en étrangeté (Ibid.: 39-40).*

Nancy's recollection bears striking resemblances with one's experience and life with chronic pain (Baszanger 1989; Charmaz 1999). Indeed, Kathy Charmaz explains that for people living with/in pain, 'body and self seem different' (Charmaz 1999, 364). Pain and pain medication are felt as intruders. As they affect one's body, they dis-articulate one's sense of self: one becomes a stranger to him- or herself. While spinal cord stimulation materialises a different body, it does not so much neutralise as it distracts and diffracts this affection, recomposing one-body-self.

As the electrodes fire and stimulate the spinal cord's nerve fibres at a certain amplitude and frequency, in a sequence determined by the programme set by the nurse or the medical physicist into the pulse generator, the burning and shooting pain felt in one's lower back, legs, and/or feet is replaced by paraesthesia, a tingling sensation. In fact, as the electrode array is implanted and positioned on the spine, and as the field of stimulation is mapped, pain is, to a certain extent, realised. As previously said, pain is multidimensional. Measuring or assessing whether or not someone experiences – and suffers from – chronic pain is based on (so-called) subjective and objective criteria. The people suffering from chronic pain put words on the painful sensation, thereby making it sharable or at least communicable, and ultimately 'objectively' identifiable as neuropathic pain by the medical world – which relies upon the DN4 screening tool – and measureable via an analogous pain rating scale ranging from zero to ten. However, as Isabelle Baszanger points out, in each medical encounter, 'the evaluation and legitimation of pain – the question of credibility – arises because pain is a sensation that can be directly perceived only by the person who feels it' (Baszanger 1989, 427). In this context, spinal cord stimulation objectivises the sensation of pain and realises the body-in-pain. When the electrode array is implanted and the field of stimulation is mapped, pain materialises. As the paraesthesia covers and replaces the painful sensation, the body-in-pain is effectuated alongside the body-in-paraesthesia. The latter is multiple, to borrow Mol's expression (Mol 2002). As one's body becomes multiple, one's sense of body-self – or more conventionally embodied self – is recomposed.

141 'An intruder is in me, and I am becoming a stranger to myself' (Nancy 2008: 167).

Becoming with Somatechnologies, Enacting Material Bodies

While the body becomes multiple, it is still dys-appeared – i.e. an absent absence. In fact, while it could be assumed that the device's implantation in one's body does not necessitate an embodiment process, to live satisfactorily (with) spinal cord stimulation requires, as for prostheses, a learning process and a becoming-intimate with one's materiality. As he discusses the rehabilitation process that cochlear implant wearers have to undergo, Besmer (2012) explains that successfully hearing with the implanted technology implies embodying a translation technology so that it can become part of one's perceptual repertoire. In the case of spinal cord stimulation, a rehabilitation process also takes place, one in which embodiment is key too. However, as previously mentioned, it is not so much one's perceptual repertoire that is at stake, but one's bodily sensations and movements, one's materiality. In one's embodiment of spinal cord stimulation and habituation to new sensations – e.g. paraesthesia and reduced pain – postures and gestures are pivotal.

As previously discussed, while the remote control permits people living with spinal cord stimulation to modulate the stimulation amplitude and switch programmes, it is not necessarily central in one's relation with the neuromodulation technology. The relationships are, in fact, more intimate. The stories told by the people I/we interviewed testify to the fact that some never use the remote control and others interact with, or rather steer, the stimulation by using their bodies. Mrs Jansen, a sixty-three-year-old woman who has been living with spinal cord stimulation since 2005, explained to me/us how the device works for her in these terms:

> *Well, you feel it directly [..]. Yes, uh [..] that's how I feel it right now. [..]The feeling goes on through the legs and back here [..] I feel it. And then, if I am lying down, or if I pull my head back, I feel it very clearly [..] If I have pain in my legs, I do like this [she pushes her head backwards] then it vibrates very strongly for a moment and then the pain decreases (interview with Mrs Jansen, April 12th, 2012).*

Spinal cord stimulation creates a distinctive tingling sensation (i.e. paraesthesia). While this sensation renders the lived body non-transparent but rather dys-appearing, the body's opacity is not as disabling as the body-in-pain or the body-in-pain-medication. In fact, as for prostheses, it is as they become more intimate with their (bodily) materiality and its agency that people living with spinal cord stimulation start experiencing the neuromodulation device as transparent and their body as no longer an incapacitating dys-appearance.

It is through her postures and gestures that Mrs Jansen directs the stimulation. As such, spinal cord stimulation not only puts in motion her body – i.e. enables it to move – but also creates bodily sensations – the feeling of vibration as the electrodes fire onto the spinal cord and that of paraesthesia progressively replacing the pain. As it (re-) configures her kinaesthetic awareness, the neuromodulation technology redefines her body. Movements are central. Or, more precisely, gestures are pivotal. Gesture is organised movement, it is the 'organised [form] of kinesis through which subjects navigate and alter their worlds' (Noland 2009, 4).

Gestures are the practices through which one's becoming with spinal cord stimulation takes place. As the reader might recall, it is also through gestures – to accomplish certain tasks with one's prosthetic hand or to walk confidently with one's prosthetic leg – that people learn to live, i.e. become with, prostheses. Through the enactment of certain gestures and the correlate kinaesthetic assessment

of the effect and affect of the stimulation, that is, through becoming intimate with their lively bodily materiality, people start living with spinal cord stimulation.

> *[T]he first, two, three days, ja, ja all day you're just playing with it. Yes. What is possible? Can I drive the car? … When you're sitting down and you put it on: oh, that's very nice. And then you go stand up: iuuuuuuuuuh! Yes? … You put it higher: aaah, it's not possible! And then you must learn: higher: what can you do? Yes? I put it on, and I try, I feel this [..] or a little lower … [W]hen I have a lot of pain, it goes higher. And when I lay down, I put my arm up, you can djjjuuuu! And my ears go a bit [laughing and scratching his ears] Je kunt niet liggen, you cannot lay down, and you must put it lower…It stimulates much more and then your toes are buh-dut-dut: you put it too high (interview with Mr van Houten, April 11th, 2012)*

While Mr van Houten's account illustrates the difficulties that exist in talking about one's body and sensations, it exemplifies the process of becoming with technology that is at play. And indeed, play is important here.

Through a playful enactment of gestures, spinal cord stimulation becomes embodied – and even more, incorporated, a dimension on which I will come back in the next chapter. That one playfully experiments with the neuromodulation technology resonates with Carrie Noland's reformulation of the concept of 'tâtonnement,' or 'groping,' proposed by paleoanthropologist Leroi-Gourhan, where '"[t]âtonner" conveys the sense of exploration, whether physical or cognitive: testing out a path not yet cleared or devising a sequence not yet inscribed' (Noland 2009: 105-106). As one experiments with spinal cord stimulation, s/he is moved by the implanted technology. S/he performs new gestures, thereby enacting a different body. With the neuromodulation technology, not only are bodily movements created and/or transformed, but one's kinaesthetic experience also changes. One's bodily sensations are reconfigured. Eventually – relatively quickly – these changed and newly experienced sensations become transparent. As Mrs Jansen explained,

> *[i]n the beginning, I thought I will never get used to it, because you constantly feel that trembling in your legs. And also, if you travel and you sit in the train, and the train or the bus drives over a bump, you feel that extra. [..] But at some point you feel it no more. … At one point I sat down and I thought: "oh, yes, that thing is still on, I didn't feel it at all today" (interview with Mrs Jansen, April 12th, 2012).*

Similarly, after having been part of a two-week trial with a new stimulation paradigm set in the device – i.e. burst stimulation – which neutralised the tingling sensation, Mr Koopman recalls that the neuromodulation technology

> *becomes a part of your life very quickly [..] It's just that the tingling feeling [..] if that is gone [..] the last fourteen days I did not have the tingling sensation and one does get used to that again as well [..] But the first few days it's like going outside without a coat – like you miss a part of your body (interview with Mr Koopman, April 12th, 2012).*

Ultimately – at the end of a learning and groping process – the becoming-transparent of spinal cord stimulation is intertwined – coincides even – with the becoming-absent of the lived body. As previously said, with somatechnologies, both processes are entangled; bodies and technologies cannot be apprehended separated from each other.

Admittedly, while the becoming-transparent of one's lived body and both implanted and prosthetic technologies requires people to become intimate with their bodily materiality, a degree of opacity remains: complete intimacy need not be achieved, e.g. one does not need to be aware of the blood being pumped in his/her heart and circulating through his/her veins. However, somatechnologies raise important questions, especially in relation to enhancement technologies and to the dominant discourses surrounding it (see chapters one to three). As Kathleen Woodward states it,

> *[o]ver hundreds of thousands of years the body, with the aid of various tools and technology, has multiplied its strength and increased its capacities to extend itself in space and over time. According to this logic, the process culminates in the very immateriality of the body itself (Woodward 1994: 50, quoted in Sobchack 2004a: 174)*

With somatechnologies, the reverse process seems to be at play. With somatechnologies, the matter is not so much the disappearance of the body but its dys-appearance, not its de-materialisation but a renewed intimacy with its materiality and material agency. With enhancement technologies, the degree and extent of materiality's presencing might even radically increase. Indeed, genetic technologies might demand and enact a heightened awareness of one's genetic makeup and its interaction with the environment, while technologies such as biofeedback that putatively enhance one's concentration require that one becomes aware of his or her brain waves – thereof engendering new understanding of one's embodied self (e.g. Brenninkmeijer 2013).

(Material) bodies are at issue with somatechnologies. It is through a groping process, wherein gestures are central that one learns to live with the latter, and while a re-worlding takes place with somatechnologies, living with such a technology entails a renewed intimacy with one's bodily materiality. This renewed intimacy shall not however be confused with getting to the core of the matter of an immutable body. Rather, bodies materialise with somatechnologies; they become with somatechnologies. As I have discussed, the becoming-transparent of somatechnologies goes hand in hand with the becoming absent of the body. While usable technological artefacts can also recede from one's attention, thereby becoming transparent while extending – and reducing – one's perception as exemplified in Ihde's embodiment relation, there seems to be something more or something else at play with somatechnologies. As the next chapter will address, to be able to live satisfactorily and successfully with such a technology, it needs to become part of the body.

Conclusion

After offering the concept of somatechnology as a heuristic tool for apprehending the intimate relations between humans and technologies, I have been investigating how this intimacy is done in practice. Somatechnologies such as upper- and lower-limb prostheses and spinal cord stimulation are not only complex technologies, but living with them is also an intricate and dynamic process. Insofar as they consider and conceptualise the relations between humans and technologies while taking seriously their material dimension, technologies being technological artefacts and humans being embodied humans, I relied on postphenomenological approaches to apprehend somatechnologies and how someone lives with somatechnologies.

While Ihde's (1979; 1990) embodiment relation – wherein a technological artefact becomes (quasi-) transparent and through which the world is experienced – appeared as promising for apprending the intimacy of the relations between humans and somatechnologies, I have highlighted several limitations to the postphenomenological approach. To apprehend their material dimension – i.e. bodies with/in spinal cord stimulation and with/in upper- and lower-limb prostheses – I have drawn upon two of these limitations, namely the focus on usable technologies and its correlate negligence of process as well as the potential reification and invisibilisation of bodies with embodiment. The third limitation, which is the individual scope of the postphenomenological approach that tends to blackbox human's embeddedness in networks of relations will be addressed in the next chapter.

As technologies are no longer situated in a use configuration, embodiment or rather a re-exploration of the embodiment relation becomes an urgent matter, one that has also been highlighted by e.g. Verbeek (2008; 2011) and Besmer (2012). However, despite offering valuable tools to think humans in their relation with ever more intimate technologies, insofar as postphenomenological approaches focus on human-technology-world relations, they not only tend to neglect the relations between humans and technologies (qua material realities) but also to blackbox humans' material dimension, their bodies. As such, they cannot appropriately account for the intimate relations between humans and somatechnologies. This became particularly palpable as I explored spinal cord stimulation and lower- and upper-limb prostheses. Materiality is at stake with these somatechnologies and their becoming intimate with people who are fitted or implanted with them.

While close to bodies, somatechnologies are not straightforwardly and directly intimate technologies. Rather, they become intimate as they are embodied, embodiment being not only a process but also done by bodies and technologies. For the somatechnology to become transparent, an intensive learning and training process is necessary. In the latter, movements and gestures are crucial. One learns to live and become intimate with somatechnology through a groping process. Bodies, their materiality and agency, are critical for somatechnologies becoming intimate insofar as they ground and enable this becoming. With somatechnologies, bodies and technologies cannot be apprehended separated from each other. In fact, if somatechnologies entail a re-worlding, to understand the latter cannot dispense with an account of bodies with/in somatechnologies. Not only are bodies transformed with/in their intimate relations with somatechnologies, but the latter enact – materialise – different bodies, e.g. one composed of myolectrical signals and triggers or the body-in-pain and in-paraesthesia. Furthermore, living with somatechnology entails becoming intimate with one's lively materiality and what one's body can do. In fact, while somatechnology's becoming intimate technology is accompanied by a becoming intimate with one's materiality, the latter process appears to be key for regaining or rather recomposing one's sense of (body-)self.

In this chapter, I have zoomed in onto the material dimension of the intimate relations between humans and somatechnologies. While a necessary endeavour, it is not sufficient to apprehend what it means to be living with somatechnology. As the next chapter will address, besides processes of embodiment, processes of incorporation are also at play with somatechnologies. In the exploration of the latter, the normative dimensions of the intimate relations between humans and somatechnologies will crystallise.

Chapter Six
Materialising Bodies With/in Somatechnologies: Humanness at Stake

Somachnologies are intimate technologies. In the present case, intimacy entails not only embodying spinal cord stimulation as well as lower- and upper-prostheses – which is an active process wherein movements and gestures are central – but also becoming intimate with one's materiality. Materiality, in fact, has proven central in this postphenomenologically inclined apprehension of the relations between humans and somatechnologies. Foregrounding human qua material reality and the agency of bodies while zooming in onto the ways in which bodies become (intimate) with somatechnologies is crucial to understand for what it means to be living with somatechnologies. Nevertheless, it is not sufficient to account for and be accountable to the kinds of bodies that materialise – come to being and to matter – with/in somatechnologies.

In the previous chapter, I have identified three limitations in postphenomenological approaches to technologies that might prevent them from being able to explain what is at stake with somatechnologies. While their focus on use configuration which freezes and invisibilises processes and their reliance of embodiment which neglects bodies and blackboxes humans (qua material realities) have been addressed, their individualistic stance which downplays, not to say erases, relationality has not been attended to. As I will continue my exploration of somatechnologies, relationality and humans' emergence and embeddedness in networks of relations will be central. More precisely, while somatechnologies are intimate technologies, the question of their becoming part of one's body or rather, the question concerning whether or not spinal cord stimulation and upper- and lower-limb prostheses are lived as part of one's body has been recurrent in my fieldwork. Interestingly, and to a certain extent paradoxically, somatechnology's incorporation is entangled with relationality: incorporating somatechnologies is a highly relational process. Done with others (both humans and nonhumans), incorporation is also linked to the enactment of humanness. In fact, informing the incorporation of spinal cord stimulation as well as upper- and lower-limb prostheses – and possibility thereof – is the question of which bodies materialise and especially matter as putatively human with/in somatechnologies. Following somatechnology as heuristic tool, while the material dimensions of humans, technologies and their intimate relation has occupied chapter five, this chapter will particularly focus on their normative dimension. While doing so, it will show how both dimensions are intrinsically entangled.

To attend to these issues, firstly, I will examine somatechnologies' incorporation, namely their becoming (a) part of bodies. After emphasising that it is not only an active and situated process but also a highly relational one, I will show how incorporating somatechnologies is entangled with the bodies of others, especially loved ones. Incorporating somatechnologies enacts intercorporeality. Secondly, I will draw attention to the normative dimension of incorporation and somatechnologies more generally. Not every body is able, and to a certain extent given the possibility, to incorporate somatechnologies. Addressing one of chapter three's key questions – cui bono? – I will delineate which and whose bodies (can) materialise – come to exist and to count, i.e. matter as human – with/in somatechnologies. Finally, as I will interrogate the ways in which somatechnologies 'enhances' one's intercorporeality, I will raise some questions concerning the boundaries of bodies and somatechnologies.

1. Incorporating Somatechnologies, Enacting Intercorporeality

While living with somatechnology involves the latter's embodiment and its becoming intimate, incorporation, etymologically meaning 'brought within the body' (Leder 1990: 31) and more generally somatechnologies being lived as part of the body, has been a recurrent issue during my fieldwork with prostheses and spinal cord stimulation. As the reader can recall, the goal of engineers developing prostheses (both for upper- and lower limbs) is for people living with one 'not to think about the prosthesis, [but] to feel that it is their leg' (interview with Martin Pusch, July 27th 2012). H. Witteveen shared the same objective, namely 'to have a prosthesis that is for its users a prosthesis that feels like their own arm, … [for] it [to] become more and more a part of the body' (interview with Heidi Witteveen and Peter Veltink, May 18th 2011). As for people living with prostheses, Craig Murray reports that most of the persons he interviewed who were living satisfactorily with an artificial limb 'experienced [it] as "part of" the body' (Murray 2004: 974). Indeed, as one of his male interviewees told him (in response to Murray asking '[w]hen you say it's part of you now, what exactly do you mean by that?'):

> *[w]ell, to me, it's as if, though I've not got my lower arm, it's as though I've got it and it's [the prosthesis] part of me now. It's as though I've got two hands, two arms (quoted in Ibid.: 974).*

And in the words of another one, a man born without a foot:

> *[o]ne of the major factors of my satisfaction with a new prosthesis is how little I feel it. That may sound strange, but to me, my prosthesis is an extension of my body. (I can actually 'feel' some things that come into contact with it, without having to see them. …). It must 'feel' as close to not being there as possible (quoted in Ibid.: 974).*

As these citations testify, the prosthesis not only becomes transparent (which enables the wearer to perceive the world, e.g. the texture of the ground, through his or her artificial limb, thereby resonating Ihde's embodiment relation), but also an integral part of one's body.

Similarly, with respect to spinal cord stimulation, the reader can recall the previous chapter and especially Mr Koopman feeling that he was missing a part of his body in the first days of the two-week trial with burst stimulation, the tingling sensation no longer being present in his legs and feet due to the changed stimulation paradigm – 'the first few days it's like going outside without a coat – like you miss a part of your body' (interview with Mr Koopman, April 12th 2012). Like him, spinal cord stimulation has become a part of Mrs Jansen's body: when asked if she thought the device has become part of her, of her body, she answered that 'that's a part of me now! It's a part of me [..] Yes. I mean [..] just as the eyes see indeed' (interview with Mrs Jansen, April 12th, 2012). More than for prostheses, conceiving of the neuromodulation technology as part of one's body was linked to living satisfactorily with spinal cord stimulation. How, however, shall incorporation and the way it is done be understood?

1.1 Incorporation as An Active and Relational Process

Incorporating Somatechnologies: A Matter of Body Models and Ownership?

For Helena De Preester (2011), who in her article questions Ihde's embodiment relation, what distinguishes (upper- and lower-limb) prostheses from usable and handleable technological artefacts is the phenomenon of incorporation. While both somatechnologies and usable technologies can become transparent, thereby possibly extending perception – or rather aspects thereof insofar as transparency, as understood by Ihde, is informed by a magnification/reduction structure – only the latter can become incorporated, 'brought within the body' (Leder 1990: 31). Even though necessary, transparency is not sufficient for technologies to be construed as part of one's body. Key in incorporation is not only the extent to which the technological artefact allows expression – thereby reasserting the importance of gestures – but also and above all body ownership, as De Preester contends. 'Tool use induces changes in motor and sensory capacities, but not in body ownership. True incorporation, in contrast, involves changes in the feeling of body ownership itself' (De Preester 2011: 123). That is, even though both usable technological artefacts and tools in general can become part of our motor and sensory capacities (i.e. they become transparent), 'the feeling of ownership that we have of our bodies clearly does not extend to, for example, the fork we use at dinner' (Botvinick 1994, quoted in De Preester and Tsakiris 2009: 311-312). In fact, body ownership is linked to the existence of a neurologically based, innate, top-down and stable body-model, De Preester argues after reviewing neuroscientific researches (De Preester 2011; De Preester and Tsakiris 2009). The latter constitutes a reference or limit point against which the body's transformations (e.g. the fitting of a prosthetic leg or arm) are assessed. In De Preester's words, it is 'a top-down influence that limits the plasticity of the representations of the body. … This means that we cannot incorporate no matter what in our bodies' (De Preester 2011: 125). As a consequence of the existence of such a body model, anthropomorphic constraints might exist as regards the (soma)technologies – and enhancement technologies – one can identify with and identify as part of his or her body – i.e. can incorporate. In fact, for her (and Tsakiris), at issue in incorporation is the achievement of a relation of wholeness or completion between the person living with a prosthesis and the artificial limb (Ibid.: 126; De Preester and Tsakiris 2009: 317).

Incorporation, as it is understood by De Preester (and Tsakiris), i.e. informed by prostheses and underpinned by a body model that relies upon a normative morphological completeness, seems to leave implanted technologies unaccounted for. Implantation, whereby a technological device is literally 'brought within the body,' seems to be equated to de facto incorporation or to be conceived as not necessitating such a process – after all, De Preester chooses not to include implanted technologies in her analysis insofar as they are e.g. putatively transparent (De Preester 2011: 121). Yet, as I will discuss, the implanted technology that is spinal cord stimulation entails an incorporation process. The latter is actively done in one's practices and relations with the somatechnology – be it spinal cord stimulation or prosthesis. In fact, while De Preester (and Tsakiris), who aims at clarifying how (wearing) a prosthesis differs from tool use, is concerned with the likelihood of neurological constraints to the possibility of incorporation, at issue here are the ways in which prostheses and spinal cord stimulation can be practically incorporated.

Incorporating Somatechnologies, An Active and Situated Process

While the becoming part of the body of somatechnologies – their incorporation – is linked to a feeling of body ownership in De Preester's conceptualisation, other scholars have showed how incorporation is linked to an active (and never-ending) process of identification (with one's changed body with somatechnology) wherein one's bodily integrity is not so much a restoration or reintegration as a transformation and a (re-) creation. In contrast to – and contra – the implicit stability and normative wholeness that informs De Preester (and Tsakiris)'s body model, in her latest autobiographical article in which she uses her body as an 'intimate laboratory,' Sobchack recalls Rita Carter's concept of body-maps:

> *Our body-maps are "built-in" rather than learned concepts, yet they are firmly grounded in the external world and remain intact only so long as they receive appropriate sensory feedback from physical interaction between the body and the environment. ... [Body] maps sometimes get 'stuck' in a configuration that is incongruent with the real body – as with phantom limbs – but normally they adapt to match the changes in the physical body so that we are unaware of their illusory nature (Carter, quoted in Sobchack 2010: 59-60).*

Body-maps transform as we, qua bodily beings, interact with our (material) environment. Therefore, while neurologically based, they are more plastic than the aforementioned body-model. Furthermore, as she emphasises how her phantom limb – i.e. her objectively disappeared yet subjectively dys-appeared left leg, namely the experience of seeing nothing there (where the now amputated leg used to be) yet still experiencing 'something' here (as she still feels her left leg) – profoundly upsets and disrupts what counts not only as a body part but also ultimately as the 'real' body, she recalls how the incorporation of her prosthetic leg has been intimately linked with a reconfigured or 'transformed morphological imagination' (Ibid.: 62). That is, as the prosthesis becomes part of her body, the latter does not remain unchanged: incorporation of the prosthesis shall be equated neither to its absorption into a fixed body nor to the restoration or completion of a pre-existing and pre-determined wholeness. In Sobchack's own words,

> *[w]hat was formally new was a perceived shape of my leg as I sat or walked with the prosthesis quite different from that of my earlier "phantom." Although objectively – in specular terms – my stump is fleshy, round, and very short (occupying only the top third of the space between my hip and knee), my incorporation of the prosthesis and its grasp of – and on – my body transformed my lived-body image. My leg now has integrity: I sense it (and it makes sense) as muscles, tapered and elongated well beyond the end of the suction socket that is joined by a block to the hydraulic knee, titanium leg and hard (but sprung) rubber foot. As a vague quasi-presence (when I focus on it rather than simply use it), it extends beyond the knee joint and then becomes absorbed in the dominant feeling of the resistance and springiness of my foot as it meets the ground. While I not longer feel discrete toes, I do feel the ball and heel of my foot. ... Thus the changed shape of my 'phantom' (and it takes an act of will to call it that in the prosthetic situation) enacts less a nostalgic longing than an anticipatory lengthening towards the ground. ... Its existence is not a focalisation on the past, on what was once there but is now missing. Rather, its lengthening (not longing) is a mobilisation of my motor capacities to fulfill a present intention (Sobchack 2010: 62, emphasis in original).*

Certainly, incorporation is irreducibly tied up with the becoming-transparent of the prosthesis – its embodiment – a process wherein movements, gestures and a greater intimacy with one's bodily materiality are central. It is in this process whereby the phantom (limb) is displaced and transformed – lengthened – by the prosthetic leg, that the latter is incorporated while Sobchack's bodily integrity is (re-) created.

Moreover, as the reader might recall, while it is with great pride that Sobchack walks confidently with her prosthetic leg, she is also generally positive about living with a prosthetic leg. Indeed, not only does she explain that 'I often find myself revealing as a marvel what the prosthetic leg is cosmetically supposed to hide (that I have a prosthetic leg)' (Sobchack 2004c: 221) but also that 'the truth of the matter is that once I got my prosthetic leg, I felt more, not less, attractive than I used to' (Sobchack 2004a: 169). One could say that she has identified with her transformed body. While Sobchack's positivity vis-à-vis her experience with a prosthetic leg is intimately linked to her successful embodiment and incorporation of the prosthesis, successful or satisfactory embodiment and incorporation shall however not be confused nor equated with absolute contentment with one's life with a prosthesis – and more generally somatechnologies. That is, living satisfactory with a somatechnology is always a situated and relational, hence a contextual and ambiguous experience. As Sobchack reminds her readers, the ways in which she lives (and describes) her prosthesis

> *is dependent on the nature of my engagements with others (how they see or avoid it or talk about it abstractly, or if I worry whether I can keep pace with them), with my environment (when I'm in unfamiliar territory the question is always "How far can I walk on it?"), with my mood (how physically attractive or frumpy do I feel overall and what part of myself will I single out for praise or blame?), and my project (Sobchack 2004c: 215).*

Embodying, incorporating, and more generally living satisfactorily with a somatechnology is therefore done neither by an atomised individual nor in a vacuum.

Incorporating Somatechnologies, A Relational Process

In this respect, even though it deals with organ transplantation rather than prosthetics and neuromodulation technologies, Jenny Slatman and Guy Widdershoven's (2010) discussion of bodily integrity through the analysis of two hand transplantations that were both clinically successful yet experienced very differently by their male recipients, Clint Hallam and Denis Chatelier , is particularly insightful for the somatechnologies under discussion (i.e. spinal cord stimulation and prostheses). In contrast to Chatelier, for whom the transplanted hands amounted to a re-worlding similar to that described by Besmer (2012) – he indeed writes that 'this transplant has changed my life. Now I am no longer a nobody [rien]' (quoted in Slatman and Widdershoven 2010: 70) – Hallam ultimately stopped taking the necessary immunosuppressant drugs (for the transplanted hand not to be rejected), thereby rendering amputation inevitable. The latter was performed in 2001. As he shared in 2008 his distressing story to the Sunday Mirror, a British newspaper, Hallam explained that apart from the female nurse who cared for him after the transplantation, with whom he fell in love and for whom he left his wife, 'I gained nothing. I had a good lifestyle, a good family, and I lost it all overnight because of wanting a hand' (quoted in Ibid.: 70). Hallam's re-worlding is a shattering experience – a de- or dys-worlding. As Slatman and

Widdershoven argue, Hallam and Chatelier's radically contrasting experiences with their transplanted hand/s are intimately linked to both men's ability to identify with their transformed bodies – i.e. 'to be the body one has'[142] (Ibid.: 75).

While recognising the importance and necessity of transplanted (and prosthetic) hands' becoming-transparent at the sensory-motor level or, more dynamically and aptly put, at the sensory-kinetic level (Sheets-Johnstone 2005) – movements and gestures being crucial in the embodiment process (see chapter five) – Slatman and Widdershoven emphasise that it is not sufficient to understand the hand(s)' un/successful incorporation, i.e. their experiencing as (a) part of their body (or not). In fact, even though Hallam experienced his transplanted hand transparently at the sensory-kinetic level, the latter remained a foreign thing, with which he could not identify. Fundamentally, (re-) identification with one's transformed body – and thereby, the (re-) making of bodily integrity – is not only visual but also affective. As Slatman and Widdershoven insist on, '[b]eing able to be the body one has implies for the hand transplant recipient being able to appreciate and accept both the strange body part's visual features … and its haptic, affective aspects' (2010: 75). Despite the transplanted hand being tolerated at the immunological, neurological, and sensory-kinetic levels, it remained a foreign, strange and even abject body-part or thing for Hallam. Visually and affectively, he could not relate to it. For him, this hand 'didn't match' (Hallam, quoted in Ibid.: 83). Not only did he regard its size, skin colour, and hairiness as different from his other hand, but the transplanted hand was also associated with loss (of his wife, family, and lifestyle). While before the transplantation Hallam was working and able to partake in activities he enjoyed, e.g. riding a motorcycle or water-skiing, Chatelier was no longer able to paint and make a living (he was a house painter) and viewed himself as a nobody, or even nothing (rien). As such, his transplanted hands changed his life, enabling him to become something – someone – thereby becoming part of his body. In fact, Hallam and Chatelier's hands are imbued with different – opposed – affective meaning.

In this regard, Slatman and Widdershoven draw attention to the intersubjective dimension of one's un/successful re-identification with and incorporation of the transplanted hand(s). While the latter are Hallam's and Chatelier's, they are also 'shared' with their loved ones who may or may not be able to re-establish an intimate relationship with the new hands: 'being held and caressed by the same man but by two hands with a different history and story might be very bewildering and even unbearable' (Ibid.: 86). The transplanted hands are incorporated with – and to a certain extent by – others. Elsewhere, in an article in which she discusses the experiences of bodily integrity of women who are breast cancer survivors and have undergone a mastectomy or lumpectomy, Slatman (2012) emphasises not only and once again how self-identification with one's transformed – 'disfigured' – body is crucial for these women to re-create bodily integrity but also how this self-identification is highly haptic – materialising in e.g. daring and being able to touch one's scarred and changed body – and intimately linked not merely to the reactions of others but more profoundly to the gaze and touch of their loved ones. For one of Slatman's interviewees, it is her seven-year-old grandson's ingenuous reaction to the sight of her modified body which amounted to a candid acknowledgement – he entered the bathroom as she was having a shower – that eased her appreciation of and identification with her changed torso (Slatman 2012: 291-292). Such inter-relationality in one's ability to identify with one's transformed body particularly resonates with somatechnologies' incorporation, with the ways in which they are made (part of the) body.

142. As Slatman and Widdershoven remind their reader, bodies are always double, being both experienced as subject and object, 'as a thing or Körper [and] as a lived body or Leib. … The Körper-experience corresponds with the experience of "having a body" and the Leib-experience with the experience of "being one's body." … … One's body is therefore the only thing that can appear both over 'there' in a perspective (as Körper) and in an absolute 'hereness' without perspective (as Leib)' (Slatman and Widdershoven 2010: 77-78). Leib and Körper are borrowed form Edmund Husserl's phenomenology. While both concepts seem, at first sight, to reinstate a dualism (Leib versus Körper), reminiscent of Cartesian dualism that conceives of the body as res extensa – extended thing – and the mind as res cogitans – thinking thing – Slatman and Widdershoven emphasise how Leib (what Merleau-Ponty refers to as the corps vécu, i.e. the lived body, or the corps propre, i.e. one's own body) and Körper are interdependent. They illustrate this interdependence with the example of two touching hands: the touching hand (experienced as Leib or part thereof) is also experienced as being touched. That is, it is also experienced as a touchable thing – as Körper. While both experiences (i.e. the Leib- experience and the Körper-experience) presuppose each other, there remains a divergence – a différance – between them. That is, the touching … and the touched … although reversible, never coincide' (Slatman and Widdershoven 2010: 80; see also Slatman 2012).

1.2 Incorporating Somatechnologies, Becoming Intimate with One's Intercorporeality

While always-in-the-world, bodies are double, being both subject and object. Both present and absent, here and there, bodies are folds that at once see and are visible, touch and are touchable, speak and are audible (Merleau-Ponty 1962; Slatman and Widdershoven 2010; Sobchack 2010). Bodies are-in-the-world with others – both humans and nonhumans (I will develop this element later). This dimension becomes all the more salient with somatechnologies to the extent that living with a somatechnology entails not only becoming more intimate with one's bodily materiality but to experience one's intercorporeality and more generally entanglement in networks of relations more intensely.

How Loved Ones Matter for Incorporating Somatechnologies

In this respect, Ivan, with whom I talked during the Orthopädie + Reha-Technik 2012, emphasised how much he likes the fact that his Michelangelo® hand enables him to perform some previously unachievable gestures – e.g. joining his hands behind his head or putting both hands in his pockets – and tasks – such as taking care of his bee(hive)s – but also and especially that he is finally able to hold his children, his baby in particular. Beforehand, when he was living with a more rigid prosthesis, this is something he would never do, because he did not like it – it felt too hard against his children's body – and his children did not like it either. But now it's different. It is in relation with his children, wife, and bees as well as within their own relationship with his new arm prosthesis that Ivan's acceptance and identification with the latter is enacted.

Concerning spinal cord stimulation, the account shared by Mrs Baten's, a sixty-one-year-old woman whom I interviewed and who has been living with spinal cord stimulation since 2009 uncannily resonates with the rather mundane yet critical event recounted by Slatman's aforementioned interviewee. After telling me that she always keeps her remote control hidden in a bag 'because the grandchildren are walking around and if they see something with buttons [..] they are crazy about buttons [laugh], so the remote goes behind bars!,' Mrs Baten explains how her eldest grandchild

> *who is thirteen … knows about it [that she lives with spinal cord stimulation] and he saw it once and he thinks it's ok … He was part of the process back then [when the neuromodulation technology was implanted], he was ten, so he was part of it and he first takes a peak and then it's all mighty interesting, but once they have seen [..] it's ok [..] it becomes a part of grandma. It's the way it is' (interview with Mrs Baten, April 12th 2012, my emphasis).*

It is in relation with her grandson, and more specifically in relation with her grandson's admission and validation that spinal cord stimulation is neither a strange nor a threatening thing but rather (a) part of his grandmother, (a) part of her body, that Mrs Baten re-enacts and re-iterates the neuromodulation technology's incorporation. In contrast, Mrs Bloemen does not consider spinal cord stimulation to be part of her body. While she sees the device as an instrument that reduces her pain, she also strongly rejects the idea of it becoming part of her body. Her resistance cannot be apprehended outside of her relations with her son and husband.

Incorporating Somatechnologies, Incorporating Other Bodies

Mrs Bloemen lives with spinal cord stimulation because of chronic pain due to diabetic neuropathy. While she is no longer diabetic as a result of a pancreas (and kidney) transplant, her son is, and she blames herself for his condition. 'He heard last year, January, he is diabetic too [tears]. And ehm, I think this is a problem because I feel guilty, ehm [..] because he has it and [..] I'm not anymore [..] [tears]' (interview with Mrs Bloemen, April 10th 2012). Spinal cord stimulation and her rejection thereof are entangled with her son's body. But not only. During our interview in which both her husband and Cecile De Vos – whom she knew as the medical physicist in charge of her two-week-trial with burst stimulation – were present, Mrs Bloemen explained her relationship with spinal cord stimulation by referring to her organ transplants:

> *I told Cecile [De Vos] my son asked when I was transplanted if I thought it was ehm [..] strange to have organs from somebody else in my body, and I said no, I get them and they're mine now. [Trembling voice] Ehm that feels like part of me. The stimulator, no. It still is an instrument.*
>
> *- Lucie Dalibert (LD): And this because? For you, how or what makes the difference?*
>
> *- MB: That it's there! Ehm, my son he has an insulin pump now, ehm [..] I didn't want that. Never. I didn't want something on my body that doesn't belong there. … [The remote control] you can place that away and it's gone! [laugh] you don't have to think about it. But this is, yeah, it's always there. You can't remove it. [..]*
>
> *- LD: And ehm, so spinal cord stimulation, you don't consider it as part of you?*
>
> *- MB: Oh no! No! Ehm, it's a big help for me. But it's still an instrument, and ehm [..] yeah. Ehm [..] [tears] I don't like it that [..] he [her husband] can feel it. [..] Yeah. At first you make jokes about it but at some point the fun stops.*
>
> *- Mrs Bloemen's husband (HMB): No, but, for me it's easier to see it as a part of her because without it she doesn't function that well. That's maybe easier as a partner to get over it than the person itself.*
>
> *…*
>
> *- Cecile De Vos (CDV): Because for you [Mrs Bloemen], it's more like an annoying piece of…*
>
> *- MB: Yes, an annoying thing that's sometimes in the way.*
>
> *- CDV: It's functional, but it's also in the way.*
>
> *- HMB: Yeah, the only time I see it is when we're in bed, to put it bluntly.*
>
> *- MB: Yes, yes, I know that. [..] But with clothing, you do take it into account too. And then, [..] you want to be sure that [..] others don't see it.*
>
> *- HMB: But if you wear a skirt or tight pants, you don't see it.*
>
> *- MB: Yes, but you have to assume that that's the case.*
>
> *- HMB: [joke] Yes, well, you don't see it from a distance!*
>
> *- MB, HMB and CDV: [laugh]*
>
> *(interview with Mrs Bloemen, April 10th, 2012)*

Similarly to the hand transplant recipient Clint Hallam, visually and affectively, Mrs Bloemen cannot relate to spinal cord stimulation. In the course of the interview, as she was mentioning yet another implanted device, a catheter located in her lower abdomen, she declared how much she 'want[s] it out. Enough of it!' Certainly, her relationship with spinal cord stimulation is neither straightforward not unequivocal. While she does not identify with the neuromodulation technology, she values it for what it does, namely deflating her pain. As such, getting used to the device – embodying it – was not too difficult 'because [she] was happy that the pain in [her] feet was gone.' But, as she directly added, '[m]y thing here [the pulse generator in her back] because you could ehm you could see it, you could feel it, ehm that was not [tears] ehm [..] no [..] I've had a hard time with that [tears]. … I can see it for myself [tears]… in the mirror. … I can't wear all my clothes because I don't want anyone to see it [tears].' As she visually and affectively detests her neuromodulation technology, or more precisely the pulse generator that, although implanted at the level of her upper buttock, she can see and touch under her skin, she cannot incorporate it. Spinal cord stimulation remains a tool or an instrument, not (a) part of her body. Nevertheless, as the interview extract manifests, Mrs Bloemen's rejection of, even revulsion at, spinal cord stimulation as it crystallises in the pulse generator cannot be apprehended by only considering the interactions between the somatechnology and her body. Or rather, even though intimate, these interactions do not stop at the boundaries of her skin but involve other bodies. The fact that one's corporeality is always already intercorporeality is made intimate knowledge with/in somatechnologies.

In contrast with the aforementioned persons living with spinal cord stimulation (or hand transplant/s or with a blemished body due to breast cancer), it is not so much the ability of her loved ones to identify with the implanted technology that is at stake as her 'incorporation' of their bodies – their gaze, their touch, their chronic disease and implanted technologies. Indeed, Mrs Bloemen's husband for example does not have difficulty identifying with, accepting, and even valuing spinal cord stimulation,

including the pulse generator that he only sees when they are in bed un- or less clothed and intimate. For him, insofar as the neuromodulation technology enables his wife to 'function,' i.e. to have a world and be in the world, and be 'less cranky,' it is 'a necessary evil, just like [his] glasses' (Mrs Bloemen's husband, quoted in interview with Mrs Bloemen, April 10th, 2012). However, similarly to her own neuromodulation device encapsulating her son's body with its insulin pump, her relation to her transformed body includes the projection of her husband's gaze, touch and relation to her somatechnologically-changed body. Further away, but with similar intensity, the gaze of others permeates Mrs Bloemen's relationship with spinal cord stimulation. While all bodies are both seeing and seen, Mrs Bloemen's distress over the visibility of implanted device(s) for others and her preoccupation over clothing reinstate the specular dimension of the female body, female bodies being more subjected (than men's) to others' gaze (Bartky 1997; Bordo 1997). Bodies like (soma-)technologies are not situated outside of (cultural and societal) power relations. The latter matter for one's – here Mrs Bloemen's – ability to relate – e.g. visually, haptically, affectively – to her somatechnology and to have it become (a) part of a body. This concern shall accompany me throughout this chapter.

While incorporating a somatechnology is a highly relational process, one that brings to the fore – or shall I say, enhances – one's intercorporeal dimension, hence underlines the importance of other bodies (especially loved ones) when living and becoming with somatechnology, it is also intrinsically linked to putative humanness. Who and what counts with/in somatechnologies not only informs the extent to which somatechnologies can be incorporated but also how people can live with somatechnologies.

2. Materialising Bodies with/in Somatechnologies, Enacting Humanness

Living with somatechnology is entangled with norms as to what constitute putatively proper humanness. As I shall draw attention to, these norms and one's un/conformity to them are pivotal in one's ability, even possibility, to incorporate somatechnology and more generally live satisfactorily with it. In order to tackle this crucial, if not vital issue, I will firstly recall how technologies and bodies are entangled with (putatively proper) humanness. Secondly, I will describe how one must enact healthy able-bodiedness and more generally must make one's intimacy with technology materially and visibly inconspicuous to be able to count as human. I will also interrogate whether (particular) somatechnologies might be challenging and redefining (putatively proper) humanness. Against this backdrop, thirdly, I will explore the kinds of bodies that materialise as human with/in somatechnologies.

2.1 The Entanglement of Technologies, Bodies and Humanness, A Reminder

The Politics of Artefacts

In 'Do artefacts have politics?' Winner (1980) has highlighted the exclusionary and discriminatory role artefacts can have. More precisely, in what has become a classical example of the political and normative import of technological artefacts, the American political theorist of science and technology shows how the overpasses on Long Island in the state of New York, United States, have been designed deliberately low by Robert Moses (1888-1981) to prevent buses from using these roads, hence to prevent their passengers from accessing Long Island's beaches. Winner's or rather Moses's low-hanging bridges are overtly racist and classist. Indeed, while automobile-owning white middle and upper-class people were able to drive under the overpasses and enabled as beach-goers, bus users usually consisting of racial minorities and lower classes were prevented from accessing Long Island's sea side. Similarly, Latour (1992) has described how spring doors, hydraulic and otherwise, rely upon and enact an ableist and classist modus operandi (intendedly or not) insofar as they disable certain bodies by preventing them to enter buildings. Furthermore, while he also refers to the seat belt as a literal law enforcer, Latour (2009 [1992]) fails to notice that the latter – like the airbag and the automobile in general – is underpinned by sexist prejudices. It is the average male body that counts as the norm in the design of seat belts (and airbags). Female bodies – that are generally smaller and may be carrying a child – as well as those of children are invisibilised and silenced, engendering a situation that may result in harmful consequences in case of accident (Wajcman 2004). In fact, not every human body is equally enabled by technology. Technological artefacts, like bodies, are normative material-discursive realities that are not only underpinned by the norms of putative humanness – which are intertwined with dis/ability, gender, race, class, sexuality as feminist work on intersectionality has vividly brought to light (Crenshaw 1991; Davis 2008) – but also enact what and who comes to exist and count – i.e. matters – as a proper human. As for the latter, i.e. humanness, it is irreducibly tied up with bodies.

Bodies, Humanness and Axes of Difference

As previously tackled when I discussed Foucault's bio-power (see chapter four but also chapter two), bodies are central locus and focus of power. In 'modern' societies, the latter's effects 'circulate through progressively finer channels, gaining access to individuals themselves, to their bodies, their gestures and all their daily actions' (Foucault, quoted in Bartky 1997: 147). Power-knowledge apparatuses, i.e. assemblages of technologies, institutions, architecture, discourses seize bodies and produce certain (embodied subjects). As showed by Foucault, through practices such as the learning of writing at school or shooting in the army, the body is penetrated materially and in depth by power relations: it is disciplined. More generally, sociocultural norms and imperatives – a product of power-knowledge apparatuses – 'have a grip on our bodies and their materiality, their forces, energies, sensations and pleasures' (Foucault 1976: 205). With respect to gender norms within Western white heteronormativity, Iris Marion Young has showed that 'even in the most simple body orientations of men and women as they sit, stand, and walk, we can observe a typical difference in body style and extension' (Young, quoted in Ahmed 2006: 60). Women's bodily postures, movements, and gestures are generally much more restricted than men's. Such gender differences are however not the manifestation of ingrained biological differences or mysterious essence, but rather the effects of a gendering process suffused with (hetero-) sexism (Young 1980: 152; Sobchack 2004b: 199). That is, becoming a woman implies 'throwing like a girl,' and as might be expected, 'walking like a girl, tilting her head like a girl, gesturing like a girl and so on. The girl learns actively to hamper her movements' (Ibid.: 153). Because in this process women experience their bodies at the same time as 'a thing' (as an object for and in the other's gaze) and as an ensemble of capacities, they exhibit an 'inhibited intentionality' (Young 1980: 145). Gender – hence the way women's and men's bodies move, inhabit space, and more generally act and are-in-the-world – is the result of this iterative process; it is, as Sara Ahmed phrases it, 'an effect of the kinds of work that bodies do, which in turn "directs" those bodies, affecting what they "can do"' (Ahmed 2006: 60).

As Ahmed also shows, racialisation processes and their underpinning racism as a result of which race is constructed also affect or rather '[shape] what bodies "can do"' (Ibid.: 112). Being-in-a-white-world with a white body is different from being-in-a-white-world with a black body. As both Ahmed (2006) and Sobchack (2004c) emphasise, in an echo to Franz Fanon's Black Skin, White Masks, being black or non-white in a white world is not only to perceive oneself as an object, a stained and devalued object, but also to experience one's body as being restricted, uncertain and blocked in the world. Indeed, whiteness and racism enable certain (i.e white) bodies to inhabit and extend themselves in the world while restricting, even negating others (i.e. non-white, the negative form of this appellation is itself telling and revealing of the invisible norm). Bodies' mobility, spatiality, and more generally what they can do is therefore intimately entangled with race and gender, with racialization and gendering processes. However, as encapsulated by the concept of intersectionality, power relations and axes of domination 'intersect.' As such, these categories (e.g. gender, race, sexuality, class, age, dis/ability) are not fixed and hermetic to each other, but are rather intertwined and influencing each other. As Teresa de Lauretis very aptly phrases it, subjects are 'en-gendered in the experiencing of race and class, as well as sexual relations' (de Lauretis 1987: 2). While in the entanglement of these categories, subjects are not unified and unitary entities, but rather multiple and potentially conflicted, these categories are intrinsically linked with what and who counts as human – less-than-human, nonhuman – subjects (see also chapter two and four). As Ahmed formulates it, to be able 'to pass into white space,' i.e. to enact what counts as a proper human body in institutionalised whiteness, even 'the white body must also be a respectable and clean body. Such a body is therefore also middle class and straight: it is a body "in line" with the "lines" that accumulate' (Ahmed 2006: 136). While bodies are situated within axes of difference that intersect, build upon each other, un/fold within one another, these axes of differences – gender, race, able-bodiedness, etc. – are, as previously mentioned, also done in and with technological artefacts and objects (Haraway 1997; Wajcman 2004).

Somatechnologies, and more precisely, bodies with/in somatechnologies do not escape the entanglement of bodies and technologies with (putatively proper) humanness. As I shall address, the enactment of healthy able-bodiedness is particularly central for bodies-with-somatechnology to matter as human.

2.2. Bodies with/in Somatechnologies, Doing Visible and Material Anonymity

Incorporating Somatechnology, Enacting Healthy Able-Bodiedness: Humanness at Stake

Going back to Mrs Bloemen, her distress over the possibility for others to see the implanted pulse generator (which informs her inability to incorporate the neuromodulation technology) cannot be understood without considering how for her being human is intrinsically linked to (white heteronormative) femininity. Having internalised the gaze (to use the Foucauldian terminology), her ambiguous yet intimate relation with spinal cord stimulation threatens her humanness. The presence of the pulse generator under her skin, implanted yet touchable and visible, prevents her from properly doing (white heteronormative) femininity which entails achieving smooth bodily contours. 'A woman's skin must be soft, supple, hairless and smooth; ideally, it should betray no sign of wear, experience, age, or deep thought,' as Sandra Lee Bartky observes (1997: 137). The implanted neuromodulation technology obstructs and disrupts the enactment and re-enactment of gender norms (in Mrs Bloemen's case, femininity).

While it would be tempting to construe the neuromodulation technology's interference with femininity and its performance as a welcome disruption and transgression of gender (thereby revealing how it is always an – arbitrary and violent, always unattainable – artifice), in Mrs Bloemen's case it is lived as a failure to 'be' fully human. Furthermore, her distress over the visibility of her neuromodulation technology (and pulse generator especially) is intertwined with the injunction to pass as able-bodied in order to be (seen) as fully human. Humanness, or rather the recognition thereof which materialises in civil invisibility (as opposed to stigma), is granted to unmarked, i.e. putatively normal and abled, bodies (Garland-Thomson 1997; 2009; see also chapter two). In fact, to a certain extent, Mrs Bloemen's malaise over her somatechnologically-transformed body is imputable to the 'compulsory able-bodiedness' that governs our societies, as Robert McRuer (2006) named it. 'Nearly everyone wants to be normal. And who can blame them, if the alternative is being abnormal, or deviant, or not being one of the rest of us? Put in those terms, there doesn't seem to be a choice at all' (Warner, quoted in McRuer 2006: 90). For Mrs Bloemen, the invisibility of her implanted devices is closely connected to the invisibility of her own body. Enacting femininity is intertwined – or intersects – with enacting an able and healthy body. Like (white heteronormative) femininity, health and able-bodiedness are unachievable (if only because they are only temporary conditions for each and every human being) yet potent positions against which humanness is measured.

As put forward in an earlier example, passing (as able-bodied) is the object of great pride for Sobchack who has achieved to walk confidently with her prosthetic leg. It is as the body moves and gestures confidently and as if it was not living with the somatechnology that able-bodiedness is enacted and measured by oneself and others. Paradoxically, the intensive process through which one embodies and possibly incorporates his or her prosthesis is rewarded by not being noticed. Or rather, as Sobchack emphasises, it is once able-bodiedness is successfully performed by the body with/in somatechnology that the somatechnology can be exposed to view, this exhibition taking place on one's own terms. This situation wherein the transformed body with/in somatechnology has to be invisible, wherein somatechnologies have to be undetectable while able-bodiedness, and its correlate health(iness) and bipedalism, have to be enacted begs the question of whether the 'double desire' that Ihde has identified in human-technology relations – i.e. the desire for total transparency and extension – is for others rather than one's own. The invisibility of the body with/in somatechnology, its ability not to stand out has been a recurrent issue during my fieldwork in the field of prosthetics, especially when the choice of a 'natural-looking' prosthesis, i.e. equipped with a foam cover imitating the volume and skin tone of one's 'sound' leg, was being addressed.

Un/Acceptable Bodily Markers

Before discussing this matter, as it puts in perspective the bodily marks that matter in healthy able-bodiedness, another dimension concerning somatechnologies needs to be introduced here. The latter exemplify how the norms concerning what is socially un/acceptable hence subject to civil invisibility or stare are rather arbitrary. Referring to body-powered upper-limb prostheses, Plettenburg explained how these prostheses that are actuated via a shoulder harness, despite being particularly light and enabling a high degree of control and feedback, have a major drawback, namely the visibility of the shoulder harness which

> *doesn't look nice. That's one of the problems, that's one of the drawbacks of the shoulder harness especially when you have a sweater or a dress like this [he points to a slide displayed on his computer screen]. … [P]eople complain about the shoulder harness, that it's visible, and that it shows through the clothes, and so on… [W]hen I walk around, and I see women looking like that [he draws my attention to one of his lectures' slide that contains a couple of pictures which are photographs of the back of some women whose bra is pinching their skin and distinctly visible under their clothes] then I start wondering why complain about the shoulder harness. … This [the mark(s) of a bra] is perfectly accepted, and if you show something like this [a shoulder harness that sees through clothes], everybody is: what is that? (interview with Dick H. Plettenburg, May 13th 2011).*

What are accepted signs or markers of womanness become unconventional smears and the object of inquiring looks with somatechnologies. Bodies with/in somatechnologies become other-ed. In fact, as they materialise in Mrs Bloemen's and Sobchack's lives with spinal cord stimulation and prostheses, as well as in Plettenburg's concern over the in/visibility and un/acceptability of bodily marks, norma(lisa)tion processes wherein able-bodiedness is the unattainable yet compulsory horizon – i.e. the norm – are ultimately and fundamentally othering processes (Moser 2000) whereby non-/not-so-/less-than-human bodies are differentiated from putatively properly human bodies. While somatechnologies certainly participate in and can be construed as (normative and normalising) apparatuses of bodily production, to use Haraway's formulation, this does not exhaust the ways in which living with somatechnologies recompose what it means to be human. Nevertheless, accounting for the intimate relationships between bodies and somatechnologies and for the materialisation of bodies with/in somatechnologies cannot dispense with an account of their entanglement in material-discursive normalising processes. Bodies with/in somatechnologies are intertwined with the enactment of humanness; they are enactments of humanness.

Doing 'Material and Visible Anonymity'[143]

As previously mentioned, while the visibility of the somatechnology is at issue for both spinal cord stimulation and prostheses, especially as it is intertwined with questions and definitions of (putatively) proper humanness, it is a particularly salient concern with prostheses. With Sobchack, I have mentioned how prostheses disrupts what is experienced as absent and present, as here and there, as real and artificial, these oppositions failing to apprehend her intimate relations with her prosthetic leg (see also Shildrick 2010). In this respect, the appearance of prostheses deserves special attention. As Pusch (from Ottobock) exposed it to me,

> *[s]ome patients differentiate between function and cosmesis: because they are oriented to an activity, targeted to reaching something, they don't care so much for cosmesis, they care about function. And for those, we try to give the functionality or to reach the functionality to a level which gives them a chance to achieve that. Other patients who are looking more for cosmesis, who want to hide more, they have to make compromises in functionality. A cosmesis, a nice appearance, at present is done with a foam cover, and the foam cover is restricting the movability of the joints. The cover costs some performance. It's not so much, but you can't ignore it as a patient. In one branch of strategic technology management, we found a solution which has a cosmetic aspect: maybe you saw [referring to the Orthopädie + Reha-Technik 2012], people have been walking around, it was a plastic shell which was transparent in several areas [of the rod]. And this is what we say: volume compensation. If you wear trousers, and trousers that don't fall that slim around the prosthesis, it looks more naturally, but if you lift the trousers, you see it's a prosthesis. But it's not as natural as the foam. And again, the foam is not as natural as the skin. [Then, as I asked him if he noticed some differences or patterns amongst people with regard to their choice of prosthesis, Pusch answered that] What I heard about is that in Southern countries, the demand for cosmeses is higher than other countries. Yes, ladies, obviously, they wear skirts and they want to have nicer cosmeses and even when they wear trousers. But those who have high(er) functional demands, they make a compromise. But I can't give you a general answer (interview with Martin Pusch, July 27th 2012).*

143. I borrow the formulation from Garland-Thomson (2011). While visible and material remarkability refers to standing out as not fitting with one's material environment and being stared at or 'greeted' with sanctioning looks and attitudes. Visible and material anonymity is granted to bodies that inhabit – fit – the unmarked position, i.e. the position of the normate.

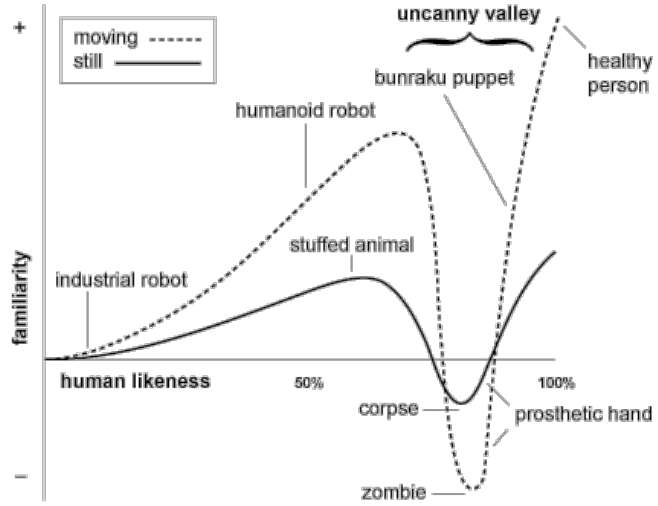
One's prosthesis, more specifically the assemblage of its different components, is the result of a compromise between functionality and cosmesis. This widespread observation that at first glance appears to be a matter of fact in the field of prosthetics is rather a matter of concern (Latour 2004). For the prosthesis to resemble as close as possible an organic limb – in terms of volume, texture, skin colour and hairiness – some degree of functionality, especially concerning the joint components, has to be traded off. Conversely, for the prosthesis to enable as much ambulation and grasping movements and gestures as possible, some concessions have to be made regarding the cosmesis and the extent to which the prosthesis looks like an organic limb. In both cases, key aspects of what is regarded as a properly human body, the latter being entangled with healthy able-bodiedness (Garland-Thomson 1997; McRuer 2006; Siebers 2008), are unachievable – whether in terms of what the body can do and/or how it looks.

As Pusch poses, and as e.g. Murray and Fox (2002) but also most of my interviewees in the field of prosthetics confirm, there is a gendered – and cultural – dimension in the compromise between functionality and cosmesis, women tending to choose in favour of the latter and men in favour of the former. Corroborating and adding to it, Stephen (from Touch Bionics) drew my attention to the fact that not only women especially opt for a skin-coloured glove – rather than a semi-transparent or black one – to cover the hand prosthesis but also that one of the questions they ask the most is whether they can apply nail polish onto the silicon nails. While the affirmative answer to this question points towards prostheses' potential and capacity to become part of the paraphernalia of femininity (the enactment thereof) – and tends to participate in and reinforce gendering processes – it also begs the question of which and whose bodies are enabled by prostheses. Prostheses, due to the necessary compromise between functionality and cosmesis, tend to reinstate and reiterate gender norms, wherein women's tendency to relinquish functionality in favour of cosmesis seems to partake in the gendering processes whereby women's bodily postures, movements, and gestures are generally more restricted than men's. Certainly, this does not amount to claiming that prostheses are per se sexist, but their material-discursive entanglement with gendering processes, insofar as they matter in one's intimate relation with somatechnology, has to be acknowledged.

Within (the field of) prosthetics, visibility has in fact become a central issue. Discussing what he observes to be the contemporary trend characterising prosthetics Plettenburg explains that,

> *there is something that is changing a bit: there are a couple of patients or people who have an arm defect, whatever politically correct terminology you want to use, who do not really care about standing out in the crowd so to say, and actually make a statement by having something that looks more cool [laugh]: not necessarily natural. … In general I think that we will [..] my guess would be that we will see two groups: one that goes for the natural appearance and another one that goes for more high-tech, or cool, or whatever you want to call it. Both have their own reasons, and they can perfectly exist together. And for us, probably, it is a challenge to service both groups (interview with Dick H. Plettenburg, May 13th 2011).*

Resonating with Pusch's aforementioned remark concerning the presence of a plastic shell rather than a cosmesis around parts of a lower-limb prosthesis – 'it's not as natural as the foam. And again, the foam is not as natural as the skin' (interview with M. Pusch, July 27th 2012) – while a cosmesis gives a seemingly natural appearance to the prosthesis, making it look like an organic limb, it does not amount to the 'real' thing but is rather located, as Stephen (from Touch Bionics) mentioned, in the uncanny valley. Based upon the work of Masahiro Mori (1970) who draws a correlation between the human likeness of certain (mainly technological) entities (i.e. the appearance and movement of e.g. industrial and humanoid robots, stuffed animals, prosthetic hands) and humans' emotional response to them (assessed in terms of familiarity), the uncanny valley refers to a dip in the proposed graph (see below).



The uncanny valley

Despite their resemblance to the human body, corpses, zombies and prosthetic hands provoke a negative emotional response on part of the observing humans. More concretely, the cosmesis of a prosthetic limb engenders a feeling of deception. While it enables the body-with-prosthesis to pass as able-bodied and putatively 'fully-human,' when one's performance is discerned as mimicry, the body-with-prosthesis becomes regarded as deceitful and is 'greeted' with staring, punishing and possibly stigmatising looks. Worn so as to perceive oneself and be perceived by others – i.e. to pass – as able-bodied hence achieve material and visible anonymity, the cosmesis when recognised as a cover can be extremely detrimental and hurtful for the person living with a prosthesis. Not or no longer wearing a cosmesis might be empowering.

Inappropriate/d Humanness

As Willem Bauer told me when we talked at the 2012 Orthopädie + Reha-Technik fair in Leipzig, he has had a natural-looking arm prosthesis for years – Bauer is born without a forearm. To have the i-limb™ changed a lot of things for him, not only in terms of what he can do – which is more than with his former prostheses – but in relation to the ways in which he perceives himself, in relation to the image he has of himself. In fact, it is his well being that has been positively impacted by the i-limb™. Indeed, as he explained to me, a normal- or natural-looking prosthesis still looks artificial. After a couple of minutes, people realise that it is not a real hand but an artificial one. And they think they have been

deceived. Yet, what's best on the market (of cosmesis) still looks artificial. Therefore, Bauer chose to have the transparent glove covering his prosthesis. Not only it's much 'cooler,' but it's also more honest. Ultimately that hand helped him a lot to deal with his disability. Hans Mulder, who is also fitted with an i-limb™ covered with a transparent glove and with whom I talked at the same venue as W. Bauer, shared a somehow similar story as he emphasised that the way his prosthetic hand looks is more honest. It's artificial, why hiding it? And it's beautiful. Nowadays, when he is driving with his prosthetic arm hanging outside the window during the summer, H. Mulder is amused by the reaction of people, by the fact that they're staring at it and wondering 'what is that?' Both W. Bauer and H. Mulder insist on the honesty of their prosthesis. Not trying to pass as what it is not – an organic limb – but rather displaying its artificial and robotic nature, the i-limb™ enables them to no longer having to pretend, perform, and measure up to able-bodiedness – and risk deceiving others and being perceived as deceitful. Both men are now proud to show their prosthesis, no longer feeling the need to hide their bodily impairment or difference, but rather experiencing it positively – valuing it. As it deflates the stare and reaction of the others, the conspicuous prosthesis deflates and diffracts disability – or at least the way it (and bodies-with-somatechnologies) is framed by the medical model, namely as a lack that needs to be normalised. To a certain extent, the body that materialises with such a prosthesis re-enacts humanness, one that is an 'inappropriate/d other.'

> *To be an 'inappropriate/d other' means to be in critical, deconstructive relationality, in a diffracting rather than reflecting (ratio)nality – as the means of making potent connection that exceeds domination. To be inappropriate/d is not to fit in the taxon, to be dislocated from the available maps specifying kinds of actors and kinds of narratives, not to be originally fixed by difference. To be inappropriate/d is to be neither modern nor postmodern, but to insist on the amodern (Haraway 2004: 69).*

Bauer's and Mulder's prostheses, or rather their bodies-with-prosthesis refuse to fit the frame of and defined by compulsory able-bodiedness, to fit the able-bodied norm (i.e. the normate subject position). They also refuse to fit able-bodiedness's other(ed) subject positions, namely that of 'the pitiful disabled' and 'the supercrip,' disability being conceived as a burden and associated with an unfulfilling and less-than-human life in the former case and disability being associated with courage, determination and heroic overcoming of their impairment – think of the media coverage of the paralympics games – in the latter (Nelson 1994). In doing so, they both experience their life with prosthesis much more confidently and happily. As they are recomposing (conceptions of) humanness, they are able to inhabit and enact livable presents and futures. However, what is achievable by Bauer and Mulder might be harder to do and even potentially unbearable for other – e.g. differently marked by e.g. gender, age, race, class – bodies. Other dimensions might be at play in the possibility and ability to wear a 'non-natural looking' prosthesis. Indeed, as I shall address in the next section, not every body can materialise and especially matter as (putatively properly) human with/in somatechnologies. Due to the entanglement of bodies and somatechnologies within material-discursive practices, no every body is given the space to matter with somatechnology – as I shall discuss, this is a crucial element for understanding the intimate relations between humans and somatechnologies, especially their in/ability to relate to and incorporate the somatechnology.

2.3 Mattering Bodies with/in Somatechnologies

Living with somatechnology is intrinsically linked with who and what counts as human. The body-with/in-somatechnology's in/visibility or unrecognizability as being in an intimate relation with a somatechnology appears as a particularly central issue. Indeed, as I have indicated, enacting healthy able-bodiedness insofar as it affords a certain degree of material and visible anonymity is a particular concern when living with somatechnology – one that is also critical for its incorporation. While bodies-with/in-somatechnologies' othered position within putatively proper humanness might be challenged and transgressed, quite tellingly, not every nor any body can be in a position to do so. In fact, given the material-discursive practices in which bodies and somatechnologies are embedded, not every body matters with/in somatechnologies. Because of this, relating to the somatechnology as (a) part of one's body and more generally living with somatechnology can be a challenging process.

Insured Bodies

Assuredly, financial considerations – e.g. the ability for the prosthesis wearer to pay for one and the ability for the prosthesis manufacturer to have its products covered by health insurance – are at play. As such, Ottobock for instance, that wants to increase its presence on the African and South American continents, does not manufacture the same knee joints as for the wealthy Western world and its healthcare systems. As disclosed by a member of Touch Bionics, fitting the i-limb™ at the company's centre in Scotland costs 50,000 euro while it may cost up to 120,000 euro when intermediaries are involved (e.g. to have it fitted in a German centre). In this respect, H. Mulder described that the content of one of his closets at home is worth more than 150,000 euros. This closet is where he keeps his arm prostheses, i.e. two i-limb™[144] that he wears daily, an Ottobock myoelectric arm prosthesis (other than the Michelangelo®) that he wears when he performs heavy tasks, and two prostheses that he wears to ride his motorcycle (one is heated). All of his arm prostheses have been paid for by his health insurance, even though the coverage of his i-limb™ has been the object of a struggle. In this regard, Stephen explained to me that Touch Bionics was, at that time, doing a comparative study in France where the i-limb™ was assessed in relation to other prosthetic arms in order to be granted reimbursement by the French social security system. Insurance companies have become crucial actors in the field of prosthetics (and somatechnologies more generally), their policies acting as gatekeeping – including and excluding – mechanisms concerning the kind of prostheses that are accessible to which and whose bodies. In this respect, assumptions concerning what (particular) bodies can do – assumptions linked to expectations in terms of e.g. age and/or gender and/or ability – tend to inform not only the proposed but also the insured prosthesis. Moreover, for Bellman, this development means that in the future,

> *there might be a discrepancy between what is technically possible and what the insurance companies pay. … The price [of prostheses] depends on the product, on the parts, on the components which are used to build up the prosthesis. Yes, maybe between 5,000 and 60,000 euro. So it really depends on the technology that is needed for the product, and on the insurance company of course. And on where the patient is supported, with which insurance company the patient is connected. It's always, also in our field, a question of money (interview with Malte Bellman, July 26th, 2013).*

144. One of them was donated by Touch Bionics in exchange, I assume, for displaying the i-limb™'s functionalities during event such as the Orthopädie + Reha-Technik congress and fair trade.

Insofar as welfare and healthcare systems are national, cross-country differences are to be expected in terms of 'choices' of prostheses, hence concerning the kind of bodies that materialise with prosthesis. Regarding my initial question about the dimensions at play in the possibility and ability to wear a non-natural looking prosthesis hence what one's body with/in somatechnologies can do – the reader might remember that prostheses are also a compromise between cosmesis and functionality – some differences have already observed between the United States and Europe by some of Touch Bionics and Ottobock's employees. Stephen (from Touch Bionics) noticed that much more people choose the transparent cover that shows the technological nature of the prosthesis in the United States than in Europe, while the designer I interviewed at Ottobock's headquarters remarked that the design of prostheses 'is changing a bit since, I think, the new generation of people who have to deal with a prosthesis are coming up, and with the U.S market where people are much more interested in how the prosthesis works. So, for new products, I'm looking for ways that they can have better looks and good function, to make it more transparent' (interview with Christian Horg, July 27th 2012). As I will address, this difference might be linked not only to the difference in terms of market composition between the United States and Europe, but also in terms of the kind of aesthetic – and its underlying components – that inform prosthetics and somatechnologies more generally.

Aesthetic Considerations and the In/visibilisation of Certain Bodies with Somatechnologies

Considering how much in/visibility matters not only for incorporating a somatechnology but also and more generally when living with one, aesthetic considerations are not a trivial but a critical dimension with respect to the materialisation of bodies with/in somatechnology. As mentioned in chapter one, the imagery and imaginary surrounding bodies with/in somatechnologies is particularly – highly – able-bodied, gendered, sexualised and racialised, and while it is rather common for prosthetically fit/ed white male bodies to be displayed, the intimacy of bodies and somatechnologies is rather euphemised, dampened or even erased when white female bodies are showed. Somatechnologically-transformed, female bodies are nothing but soft and smooth surface and edges while male bodies become masculinised and militarised bodies. Certainly, one could think about the striking contrast between WonderWoman's body and that of the Terminator, Iron Man, or RoboCop – a contrast that tends to fade as the transformations are no longer linked to 'hard' but 'soft' technologies, i.e. no longer based on implants and prosthetics but genetic and bioregeneration technologies as materialised by Heroes and other X-(wo)Men – but this gendered and gendering aesthetics tends to be produced and reproduced in the presentations and representations generated by the field of (bio-) engineering. As Lesley A. Sharp has showed, female bodies are invisible in bioengineering's aesthetics. That is, as she could observe in her fieldwork in the field of ventricular assist devices (VAD), when engineers talk about and present their work, not only do they focus on the male body, but also it is the 'miniaturised' or paediatric VAD with/in the infant or child's body that materialises when variations are discussed. As Sharp discusses, female bodies are not tolerated by bioengineers insofar as it disrupts the seamless, scarless, almost perfect interface between the body and the technology (Sharp 2011: 11; 18).

> *As tinkerers determined to perfect human flaws, they [bio-engineers when presenting their work] strip the body – like the implanted device itself – down to a basic prototype comprising a standardized and sanitized male form. Whereas robust male bodies readily incorporate artificial hardware, female anatomy presents disturbing challenges: too 'soft' and sexualized, the woman's body is anchored in an altogether different aesthetic, overshadowed by fleshy breasts and messy wombs. Whereas the mechanized male signals idealized perfection, the implanted female exposes the realities of surgical disfigurement. In her 'visible' form, she fractures the embodied promises of an idealized, bioengineered aesthetic (Ibid.: 26).*

In contrast to white men's generic and hygienic body which constitutes the norm and the standard against which or rather with which the perfection of the body-technology relation can be achieved, women's body is too corporeal and fleshy – too bodily. Dualisms and the traditional reduction and subsumption of women into their body not only inform these representations but are also re-instated in them.

Mrs Bloemen's account, and more generally the incorporation of a somatechnology – i.e. its appreciation as (a) part of one's body – as a relational process, so much so that it enacts intercorporeality, should be recalled here. As previously described, for the somatechnology to become incorporated, one's individual relation with the somatechnology no matter how intimate is not sufficient. The ability to relate visually, affectively, haptically is entangled with other bodies; incorporating a somatechnology entails incorporating other bodies, for instance loved ones – their gaze, their touch. To a certain extent, Mrs Bloemen's incorporation process is further complicated by the invisibilisation of female bodies with/in the bioengineering aesthetics and more generally Western cultural imaginary concerning female (techno-) bodies and their smooth bodily contours. This invisibilisation does not create a space for women living with somatechnologies to relate to their bodies-with/in-somatechnology, to their somatechnologically transformed bodies. As I will address later, a rather similar issue emerges with age/ing bodies with/in somatechnologies, which will further underline how critical are the bodies that (are enabled to) matter with/in somatechnologies for the quality of the intimate relations between humans and technologies – for liveable futures.

With respect to the in/visibility of female and male bodies in relation to somatechnologies, it must be recognised however that while exemplary, the relation of male bodies to implanted and prosthetic technologies was never always unproblematic. As David Serlin (2004) and Sharp (2011) draw attention to, male bodies have been material-discursively made to fit with prostheses in the twentieth century. Such a 'neutralisation' – and universalization – of male bodies with prostheses is linked to their intertwinement with masculinity and nationalism. As the wounded bodies of the soldiers who had returned from the war provoked anxieties about masculinity, amputation being associated with emasculation, the role of the American media was pivotal in associating prostheses and male bodies with the wealth and the health of the nation as they created and broadcast heroic stories about veterans' life and labour with prostheses (Serlin 2004: 48-52). Prostheses became a matter of triumphant heteronormative masculinity and national pride. Tight links still characterise prostheses and the military in the United States where many people living with a prosthesis are war veterans (who toured and fought in e.g. Iraq and Afghanistan).

In fact, as Sharp (2011) argues, the intimate connections between prosthetics and heteronormative masculinity rematerialise in the aesthetics of bioengineering, wherein the relation between male bodies and prostheses is one of complement, even compliment. Male bodies are those that matter within prosthetics. Disruptive, the all-too-unruly, fleshy and excessive female bodies are excluded from the (bio-) engineering – and prosthetics – aesthetic. Going back to the i-limb™ and the possibility to wear non-natural looking prostheses, the view of male bodies and technologies as complementary and even

perfecting each other (Sharp 2011) creates a space for male bodies to display – and gain confidence while doing so – the technological nature of their bodies with/in somatechnologies – hence opens more possibilities for somatechnologies to become incorporated. Living with a prosthesis that has a very technological appearance can be expected to be more problematic and challenging for female rather than male bodies. The technological or 'robotic nature of the i-limb prosthesis,' as phrased on the Touch Bionics website, might also explain its greater acceptance and/or desirability in the United States where a significant proportion of amputees has a military background. However, in this context too, gendered and gendering processes are at play.

Bodies with/in Somatechnologies: Some Cultural Differences?

As Sharp discusses the ways in which in 2007 Claudia Mitchell, a female American who served in the Gulf War and got her left arm amputated after a motorcycle accident, has been domesticated and (re-) feminised in the media after her arm prosthesis which involved targeted reinnervation was attached to her body, she highlights how gendering processes are convened and conveyed by prosthetics. For instance, in contrast to Jesse Sullivan, a man who was fitted with the same prosthesis as Mitchell and filmed using various power tools while performing outdoor and labour-related activities, Mitchell was filmed performing domestic tasks, from cooking rice and tossing salad to ironing shirts, the only power tool she used being 'inevitably a hand-held electric cake mixer' (Ibid.: 23). Masculinity and femininity are enacted with technological artefacts.

In 2012, when I attended the biennial Orthopädie + Reha-Technik congress and trade show in Leipzig, such gendered and gendering settings were not so much in display. Rather, at Ottobock's (very large) booth for instance, alongside Ottobock's employees, both men and women were demonstrating what their body-with-prosthesis could do in daily life, that is, by walking up and down stairs as well as on different surfaces (in the case of upper-limb prostheses) and by handling not only kitchen utensils, but also water bottles, glasses, and cards. In fact, while gender-ing was not such an issue, cultural differences were more striking. That is, while European companies staged daily life activities that were performed by both male and female bodies between thirty-five and sixty-five, the displays of American companies such as Freedom Innovations were more dramatic and spectacular: what bodies with lower-limb prosthesis could do was displayed by young and athletic men with a prosthetic leg who were playing basketball. Differences between the European and American markets underpin which and whose bodies matter with prostheses. Worldwide, prosthetic fitting is also linked to land mines and/or civil wars in e.g. Cambodia, Sierra Leone, Thailand (Ott 2004; Sobchack 2004c), to complications due to diabetes mellitus, cancer, vascular insufficiency which affect older adults in the Western world, to so-called congenital limb deficiency, and to traumatic injuries (Murray and Fox 2002; Ott 2004).

Ageing Bodies, Ageing Bodies in Parts

In the Western world, and all the more so in the Western-European part of the world where I conducted fieldwork, it is indeed older adults who mainly live with somatechnologies. As I will discuss, even though like female bodies, they tend to be invisibilised in the imaginary and imagery surrounding the intimacy of bodies and technologies, age/ing bodies have a different reality. To be an age/ing body tends to ease one's incorporation of somatechnologies.

Besides lower-limb prostheses being much more common than upper-limb ones (Ibid.), as Blumentritt stressed during our interview, '[y]ou have to keep in mind that most of the patients [and Ottobock is the world leader manufacturer of prosthetics and orthotics] are older than sixty-five. They're eighty, ninety per cent of the amputees' (interview with Siegmar Blumentritt, July 27th 2012). Similarly, during a discussion I had at the 2012 Orthopädie + Reha-Technik congress and trade show, my interlocutor who was one of Ottobock's engineers present at the event told me that

> *[p]rosthesis is a business. Our simple motto is to satisfy the needs of the clients. [And referring to the leaflet that I was holding in my hands and that was advertising Ottobock's AquaLine®, the leg prosthesis designed to go into the water]. The prosthesis, the technology is not shown, the legs are in the water, people are smiling. These are active people, middle-aged, quite young people: this then seems to be the target of Ottobock's technologies. Yet, the market is a market of elderly people. They have different needs. It is very important to remember this: the principal customers of Ottobock's (lower-limb) prostheses are elderly people.*

The imaginary and imagery surrounding prosthetics tends to differ from the actual bodies that are fitted with prosthetics and are considerably older and less active. However, age, and more precisely ageing, is a pivotal element to understand what it means to be living with a somatechnology. Certainly, while elderly people represent the main market for prostheses (at least in Europe), elderly bodies tend to become invisibilised, especially as prostheses become more putatively 'high-tech,' i.e. no longer uniquely based on mechanics but equipped with microprocessors. On Ottobock's international website, for example, elderly people are almost only featured in the rehabilitation section, prostheses being mainly showcased with younger, middle-aged and active bodies.

Likewise, at the 2012 Orthopädie + Reha-Technik, without necessarily all being able to play basketball each day, several times a day to display what their body-with-prosthesis could do, the persons living with prosthesis who were present at the trade show and whose role was to expose what they/it could do – what they could do with it – were all active, in both its labour and mobility-related senses. Elderly people living with prostheses were rather absent during this event. However, as noticed by Ihde, becoming increasingly intimate with somatechnologies is intrinsically linked to ageing. With this realisation, after having had teeth, hip and knee implants as well as a stent in one of his heart arteries, came the (telling) piece, 'Aging: I don't want to be a Cyborg.' As he explains,

> *the gradual accumulation of human-technology hybridization, or the cyborg process, often relates to effects of contemporary aging. … [C]yborg strategies [which] are often technological attempts to thwart even more severe effects of aging … remain trade-offs, compromises. It is better to have a pacemaker than to have life threatening arrhythmia;*

it is better to be able to walk with either a steel-Teflon implant or a prosthesis than not to walk at all … Yet all these trade-off compromises fall far short of the bionic technofantasies so often projected in popular culture (Ihde 2008: 38-39).

Ihde's remarks particularly resonate with spinal cord stimulation. As I shall address, age/ing seems to ease conceiving the somatechnology as (a) part of one's body. To a certain extent, age/ing naturalises living with somatechnology. As Mrs Baten recounted to me/us, when she talks to friends about her neuromodulation technology:

I do make jokes about it, I'm very relaxed about it because my back is broken, my eyes [..] I just had iris detachment, I've got rheumatics, I've got all kinds of stuff [..] I'm losing my hair, I've got implants in my mouth [..] The only thing missing is a wooden leg! [laughs] (interview with Mrs Baten, April 12th 2012).

As previously mentioned, Mrs Baten, who is experiencing ageing and its effects, considers spinal cord stimulation to be (a) part of her body-self. In fact, it might be insofar as she is becoming (an) elderly and views the neuromodulation technology as a normal or ordinary part of the ageing process that she is able to identify with it. Age/ing renders intimacy and identification with spinal cord stimulation un-, or at least less, problematic. In fact, somatechnologies produce ageing, even elderly bodies. Mrs Bloemen's rejection of the neuromodulation is quite comprehensible in this frame: she is after all only forty-five years old with a twenty-year-old daughter and a sixteen-year-old son who still live at home. Ageing and its effects are usually not (expected to be) experienced as intensely yet. In contrast to Mrs Bloemen, and similarly to Mrs Baten, Mr van Houten who is very happy with the neuromodulation technology compares it to its much more troublesome knee and tooth implants while referring to it as 'his pacemaker for the legs,' thereby normalising it for himself and others.

This association and acceptation of the somatechnology with one's age/ing further complicates the possibility of identification with the aforementioned cyborg or bionic imagery – and technofantasies. Mr Koopman, for instance, referred to himself as the "bionic man" when he recounted leaving the hospital with wires coming out of his back and connected to an electrical box (the latter enabling him to modulate the stimulation amplitude) after the first implantation procedure and before the pulse generator was implanted, but withdrew or put this affiliation at a distance almost directly ('nah, no'): the vulnerability of one's body recovering from surgery all the while in (chronic) pain and in paraesthesia does not easily fit the hyper-masculine and militarised cyborg imagery (see chapters one and three). In this respect, Mrs Jansen's description of her reaction to the neurosurgeon's suggestion to provide her with a rechargeable battery is symptomatic of the context in which somatechnologies such as spinal cord stimulation are situated.

Mrs Jansen: Oh well, they were thinking about a rechargeable battery [..] Yes [..] then I'll be hooked up to the power network [laughs]. That, I find so weird. [..] But, then you charge something and you have to ehm put it on your device and it recharges again. I heard that from another lady [..] that she had to do this everyday. [..] Well, I think [..] I have to charge my iPad every day as well, and my mobile as well. [..] I charge it every day, very loyal! [..] So yes, well [..] … If you do that at a time when you sit down anyways, then it's not such a hassle.

- Tjerk Timan: So you do not find that very strange.

- MJ: No, no. First, I found the idea a bit crazy, myself as a robot with all kinds of parts they replace.

- TT: Yes, you felt like that?

- MJ: Yeah [..] Two new eyes [Mrs Jansen has had cornea transplants] and that thing in my back and belly [..] Well [..] Sometimes I think a set of new knees would be nice! [laugh] But now I think, well yes if it is needed then ehm [..]

- TT: Yes [..] But do you feel different because of it, than before you had all this?

- MJ: No, no. I think that I've become a little slower [..] Significantly slower (interview with Mrs Jansen, April 12th 2012).

Spinal cord stimulation, like prostheses, not only participates in but also enacts the body-in-(replaceable)-parts. Understood and lived as part of ageing and becoming 'significantly slower' by Mrs Jansen, this 'neo-Cartesian body in parts' (Hacking 2007) is also challenging. When she was offered a rechargeable battery, she found the prospect of being 'hooked up to the power network' 'weird,' insofar as she would become (comparable to) a technological artefact – such as her iPad or mobile phone. In fact, she associates the idea of her body becoming an assemblage of reparable and replaceable parts with herself becoming 'a robot,' a development that she conceives as 'a bit crazy.' However, Mrs Jansen's initial surprise and incredulity is replaced by acceptance and compliance, at least concerning the 'replaceability' of her body (-parts) since she (still) does not have a rechargeable battery. Age/ing, which entails specific needs alongside becoming 'significantly slower,' justifies and legitimates this state of (bodily) affairs and seems to ease one's acceptation of spinal cord stimulation – and possibly prostheses. Age/ing bodies matter with/in somatechnologies, for one's ability to live in an intimate relation with somatechnology.

Conclusion

All the above dimensions not only inform the possibility to identify with and incorporate somatechnology but also compose what it means to be living with somatechnology. Incorporating a somatechnology is a highly relational process, done with human and nonhuman others, wherein one's intercorporeal dimension is intensely and intimately experienced. To a certain extent, somatechnologies produce intercorporeality while living with somatechnology is entangled with putatively proper humanness. Particular bodies materialise (and are given the possibility to materialise, i.e. to come to exist and to count) with/in somatechnologies. Compulsory healthy able-bodiedness, financial constraints, aesthetic norms, gendering processes, age/ing underpin the kinds of bodies that (can) materialise and especially matter with/in somatechnologies and how one lives with somatechnology. On that account, one can understand why incorporating and more generally living with somatechnologies can be a challenging process.

As a consequence, several interrogations emerge concerning how to apprehend the intimate relations between humans and somatechnologies. While one relates to incorporation, the other has to do with the ways in which postphenomenology tends to approach human-technology relations. Postphenomenological approaches to technology – and philosophy of technology in general – tend to solely focus on and zoom in onto the interaction between a human and a technological artefact, and the ways in which the world is disclosed in this interaction. In doing so, they blackbox humans by disregarding or downplaying (bodily) materiality (see chapter five) and by setting the limits and boundaries of what matters in human-technology-world relations to the (visible) contours of the individual human actant and agential technological artefact. Bodies with/in somatechnologies are situated within broader networks of relations and material-discursive practices. While this is true for any body and technological artefact, it is all the more salient concerning bodies with/in somatechnologies especially as they initiate processes of incorporation which are highly relational. Or more aptly put, as one becomes intimate with a somatechnology, his or her intercorporeality, location and materialisation in networks of relations are made intimate knowledge. This begs the question of whether the incorporation of somatechnology shall constitute the final entrance into the intimate relations between humans and somatechnologies. I will close this chapter by envisaging articulations and mis/fittings of bodies with/in somatechnologies alongside processes of dis/ablement.

3. Articulated and Mis/Fitted, Bodies with/in Somatechnologies and Processes of Dis/ablement

While compulsory healthy able-bodiedness, financial constraints, aesthetic norms, gendering processes, age/ing not only inform the possibility to identify with and incorporate somatechnology but also compose what it means to be living with somatechnology, with somatechnologies, the density of 'the texture of [the] "technosphere" within which we undertake our daily affairs,' to use once again Ihde's formulation (1979: 7) is also vividly experienced.

Whether it is when one's entrance or exit from a shop triggers (metal) detection technologies to beep – some shops, such as Action or Kruitvat, have become in/famous for people living with spinal cord stimulation in the Netherlands – or when one has to go through airport security, people living with/in somatechnologies are reminded not only of the technological nature of their lifeworld but also of their intimate entanglement with it. The latter, however, can result in practices of dis/ablement. Concerning the action of going through airport security, it is particularly dreaded or experienced as unpleasant by people living with somatechnologies. While it is the bulkiness of his previous hand prostheses that 'made travelling through airports a stressful experience'[145] for W. Bauer, the latter is also accompanied with additional X-rays and scans, thorough patdowns and possibly swabs while the prosthesis wearer might be asked to remove his or her prosthesis, an injunction that can be particularly difficult to perform for people living with above-the-knee prosthetic legs if not humiliating. Despite the fact that people living with spinal cord stimulation are advised to turn off their neuromodulation technology before going though airport security and are provided with a card that they can show when passing through detection technologies, 'passing' is precisely what is precluded here. For people living with somatechnologies, screening devices become 'outing' and disabling technologies insofar as not only are the somatechnology and bodily difference exposed to public view but also one's capacity to act is hindered and hampered.

Garland-Thomson has proposed mis/fitting as a (feminist materialist) concept to account for these dis/abling practices and more generally to apprehend how 'the particularities of embodiment interact with the environment in its broader sense' (2011: 592). Mis/fitting resonates with bodies with/in somatechnologies and the ways in which they matter (or not) as putatively human. When bodies are sustained and enabled by their material environment – largely construed by Garland-Thomson as comprising not only of buildings and the accessibility thereof as well as natural surroundings, but also of technological artefacts and other humans – one can speak of a fit. Conversely, when the interaction between a particularly shaped and functioning body with the material environment is not harmonious, i.e. when the latter does not sustain the former, a misfit occurs. That is, while a misfit – and correlate exclusion – occurs when somebody in a wheelchair encounters a staircase to enter a building, a fit materialises when s/he encounters an operational elevator. In Garland-Thomson's own words, '[a] misfit occurs when world fails flesh in the environment one encounters – whether it is a flight of stairs, a boardroom full of misogynists, an illness or injury, a whites-only country club, subzero temperatures, or a natural disaster' (Ibid.: 600). Mis/fits are therefore not only relational and material but also contextual and embedded in power relations. As Garland-Thomson emphasizes, part of what constitutes mis/fitting's theoretical usefulness is 'its grammatical and semantic flexibility' (Ibid: 593). In particular, to fit not only means to enter or to be in a suitable, proper and/or harmonious relation but it also has a more value-laden

145. See http://www.touchbionics.com/products/active-prostheses/i-limb-ultra/patient-stories/Meyer-Meyer/ [Last accessed December, 15th 2013].

connotation pointing towards social and moral fitness (see also chapter two). As she draws attention to, 'to mis-fit renders one a misfit' (Ibid.). That is, normative considerations and e/valuations of humanness underpin the ways in which bodies are sustained or not and dis/abled by their material environment.

In this respect, my account of bodies with/in somatechnologies echoes – fits – Garland-Thomson's conceptualisation of mis/fitting especially as she foregrounds that whereas fitting produces visible and material anonymity, such as when passing as a healthy able-bodied with somatechnology, misfitting engenders the correlate visible and material remarkability which crystallises in being 'outed' (as disabled), in standing out, in being stared at and 'greeted' with sanctioning looks and attitudes. Insofar as it is generally unmarked bodies – i.e. Western, white, heterosexual, able-bodied, male, middle-aged, middle-class – and their correlate privileged and dominant subject positions that encounter and experience the comfortable material configuration of fitting, the latter's cost, as Garland-Thomson ventures, 'is perhaps complacency about social justice and a desensitising to material existence. Misfitting, I would argue, ignites a vivid recognition of our fleshiness and the contingencies of our human embodiment' (Ibid.: 597-598). In this regard, as highlighted in chapter five, living with a somatechnology is achieved through a learning and groping process, whereby not only the technology becomes embodied but also intimacy and knowledge about one's own bodily materiality and what bodies can do is acquired. Such knowledge, a practical knowledge that is both a know-how and know-now (Pols 2010), is simultaneously a material knowledge, i.e. knowledge of the world's and one's materiality insofar as it is acquired as one lives – hence moves – with the somatechnology in particular contexts. On this basis, while being in the world with somatechnology may result in mis/fittings, living with a somatechnology becomes learning 'to be affected, meaning "effectuated," moved, put in motion by other entities, humans and non-humans' (Latour 2004: 205). It is, as Latour puts it, becoming articulated. Articulation, that characterises living with somatechnology and one's becoming in general, does not resolve or converge into a unique material-discursive configuration – e.g. being articulated or not – but is rather ongoing and open-ended. While incorporation refers to somatechnologies being conceived and lived as (a) part of one's body, articulation alludes to the ways in which bodies with/in technologies are lived as part of networks of relations and entangled with humanness. Articulations are not necessarily good or experienced satisfactorily. The latter depends on the apparatuses of bodily production one is entangled with – e.g. compulsory healthy able-bodiedness, gendering, age/ing processes, as previously identified.

Mrs Bloemen's unhappiness with her somatechnology can be seen as a 'bad' articulation: certainly, the somatechnology – here spinal cord stimulation – is essential for her not to be in pain and to enable her to be and do things (e.g. go shopping with her daughter or go for walks with her family) in the world, but living with it is also being intimately affected by her husband's gaze and touch, by her son's hereditary diabetes and insulin pump, by her inability to perform and conform healthy able-bodiedness and femininity, to achieve visible and material anonymity. In contrast, Mr van Houten is well articulated with his somatechnology, being affected and effectuated by a body no longer in pain, by his husband and his ability to care for the latter who is unhappy – or dare I say badly articulated – in a wheelchair, by his car and the possibility to drive it and go shopping or to the sauna, by the possibility to perform able-bodiedness and no longer being told to 'get your lazy ass out of that chair!' (interview with Mr van Houten, April 11th 2012), all of which interact with the hard time that his tooth and knee implants are giving him. 'Happy with this one [the neuromodulation technology],' Mr van Houten would like 'Cecile [De Vos] to make a zipper in here [his back], so that I can show it to people! [laughs]' (interview with Mr van Houten, April 11th 2012). These articulations, and more generally living with somatechnology, are a vital entanglement – a vital matter.

Conclusion

Living with a somatechnology is an intricate matter. While an account of the intimate relations between bodies and somatechnologies is necessary to apprehend what it means to be living with somatechnologies, it cannot stop at the visible physical borders of the skin and the technological artefact. If we are to account for and be accountable to bodies with/in somatechnologies, their embeddedness in networks of relations, sociotechnical assemblages, cartographies of power and how they matter must be explored.

As I have showed, bodies are transformed and become with somatechnologies through, between others, the remaking of gestures and postures, a changing morphology, the production of the body-in-paraesthesia and the body-as-myoelectric-signals, the becoming intimate of/with one's bodily materiality. In their intimate relations, bodies and somatechnologies such as prostheses and spinal cord stimulation are entangled with human and nonhuman loved ones, whether they are one's spouse, children, grand-children, friends, or the dog with which one goes for a walk everyday or the bees one takes care of. The latter are pivotal for one's ability to incorporate a somatechnology. The intimate relations between bodies and somatechnologies also involve other technological devices, whether it is one's car or bike both at times featuring prominently in the practices implicating bodies with/in somatechnologies, or whether it is the insulin pump of one's son, one's knee and tooth implants or organ transplants. The presence and action of screening, imaging, and detection technologies, whether they are located in hospitals, airports, or shops are also part of what it means to be living with a somatechnology. Furthermore, within specific historico-cultural contexts – e.g. the Netherlands in 2011-2013 – they are also entangled with apparatuses of bodily production, such as compulsory able-bodiedness, gender, age/ing, aesthetic norms and ultimately (putatively proper) humanness. In fact, to a certain extent, somatechnologies are apparatuses of bodily production. Spinal cord stimulation and prostheses can indeed be conceived as supplying putatively deficient bodies, as normalising or standardising them, as making them 'fit.' As Garland-Thomson puts it, these technologies 'ease the material divergences between bodies and their locations, making misfits into fits' (2011: 601).

Bodies with/in somatechnologies, and the ways they are lived, are enacted with/in these material-discursive practices and networks of relations. Haraway's following words when she describes the body, namely that 'the body is always in-the-making; it is always a vital entanglement of heterogeneous scales, times, and kinds of beings webbed into fleshly presence, always a becoming, always constituted in relating' (Haraway 2008, 163) become intimate knowledge for people living with somatechnology. A vital entanglement, bodies with/in somatechnology are also always intertwined with what matters as (putatively proper) humanness – they are articulations of what it means to be human.

Conclusion

As this manuscript is coming to an end, I would like to return to what prompted it, namely the prospect of human enhancement and posthuman-ism. To what extent has somatechnology as a heuristic tool contributed and can contribute to shed light on what is at stake and what it means to be human with/in enhancement technologies?

Somatechnologies are technologies that are acting on and interacting with the body. As a heuristic tool, somatechnology emphasises that the onto-anthropological intertwinement of humans and technologies is a corporeal process, wherein bodies and technologies are intimately entangled in the making of im/proper humanness. That is, as a heuristic tool, somatechnology encapsulates the intimate relations between humans and technologies while foregrounding the latter's material and normative dimensions. Somatechnology encloses the entanglement of bodies, technological artefacts and humanness. With somatechnology lies the proposal that in order to account for and be accountable to what it means to be human with/in enhancement technologies, one has to apprehend which and whose bodies materialise – come to exist and to count (as human) – with/in them. In fact, I argue that to understand what is at stake with enhancement technologies, they should be recognised as somatechnologies, as intimate technologies.

My recommendation of somatechnology as a heuristic tool is informed by several considerations, but especially by the ways in which human enhancement has been enacted in the discourses of so-called bioconservatives and transhumanists who have occupied a central, if not rather monopolistic, position on the subject.

The Implicit Normativity of the Human Enhancement Debate

Even though it is conceived as the technological enhancement of human beings and has been the object of a heated debate between transhumanists who defend the idea that we should aim to overcome the limitations of the human and evolve towards a posthuman being and bioconservatives who fiercely oppose human enhancement in the name of human nature, human enhancement has not been apprehended as a configuration of human-technology relations. Rather, as I have showed in chapter one, while mired in a deadlock, both rely on and uphold a conception of humans and technologies as hermetically – ontologically – separated and universalise and naturalise the modern liberal subject. In bioconservative defences of human nature and transhumanist pleas for a posthuman future, the autonomous, self-contained and disembodied – somatophobic – individual who is not only the uncreated creator and actor of his own life but also the master of his environment and the producer of true knowledge, i.e. the post/huMan, remains the measure of all things. In these discourses on the posthuman (and the prospect thereof), posthumanism becomes 'antiseptic' (Ansell-Pearson 1997) – a hyper-humanism – while humans and technologies qua abstract(ed), generic and rather hygienic entities are blackboxed alongside their relations. What human enhancement is, amounts to and even should be is posited and taken for granted; what putatively enhancement technologies do and how they transform human bodies is disregarded. Therefore, in this state of affairs, these discourses cannot apprehend what is at stake and what it means to be human with enhancement technologies. Alternatively, as this thesis has demonstrated, human enhancement must be tackled as an instance of human-technology relations.

Alongside this consideration, a sense of urgency has informed my delineation of somatechnologies as a way to apprehend human enhancement and enhancement technologies. As I have developed in chapter two, 'the human' of human enhancement is a highly normative and exclusive notion, one that is intrinsically value-laden and tied up to what and who counts or matters as human. More precisely, humanity in the guise of the modern liberal humanist subject has historically been exclusive insofar as certain bodies – i.e. non-male, non-heterosexual, non-white, differently-abled, non-economically and socially privileged – have not been considered fully human but rather closer to nature than culture and/or pathologised, that is, de-huManised and ultimately de-humanised. As the normative dimension of 'the human' – i.e. humanness – and its entanglement with bodies and technologies are never made explicit nor questioned in the human enhancement debate, enhancement technologies might reproduce and reinforce unmarked and normate bodies as the invisible yet potent norm while de-valuing differently-abled bodies. In this frame, human enhancement becomes a system of normation. The question cui bono?, that is, for whom and how human enhancement in general and enhancement technologies in particular work is posed with renewed intensity.

Even though showing how human enhancement becomes posthuman-ism, namely, a discourse that reiterates and even consecrates modern liberal humanism, its onto-anthropological flaws concerning the relations between humans and technologies, and its exclusive understanding of humanness as it crystallises in the disembodied post/huMan subject is a necessary step in apprehending human enhancement, it cannot constitute an appropriate way to understand what is at stake and what it means to be human with enhancement technologies. Rather, it brings to the fore the need for an exploration of what enhancement technologies do in their (intimate) relations with human beings and poses the question of how to undertake it (without reviving modern liberal humanism). It is by turning to a different genealogy of the posthuman and posthumanism that I started undertaking this task.

Cyborgs and Posthumans: Posthumanism versus Hyper-Humanism

As I have argued in chapter three, stemming from feminist scholarship, especially feminist studies of technoscience, the posthuman, its sibling the cyborg, and posthumanism ignite a different reality and other – more appropriate – ways of apprehending what it means to be human within enhancement technologies. By addressing how technoscience is an engine/er of hybrids, how modernity amounts to a purification process (with the creation of dualisms), how the cyborg – cybernetic organism – is our ontology in a technological lifeworld (i.e. how the ontology of human beings is intrinsically technological), this chapter not only sheds a new light on the previous ones as it re-explores and re-reads the dynamics and artifices informing modern liberal humanism, but it also indicates some directions and elements to consider to be able to apprehend what it means to be human with enhancement technologies. As it neither relies on nor upholds the modern liberal humanist view of humans and technologies as separated but rather takes stock of and maps the technoscientific condition, the posthumanism ignited by the cyborg and the posthuman shows a way out of the human enhancement deadlock. While the cyborg and the posthuman incarnate the contemporary intimacy of bodies and technologies, they are also ethico-political figures. As they expose that (re-) configurations of bodies with/in technology are embedded in cartographies of power thereby bringing the question cui bono? to the fore, they also point towards renewed ways of being human and/for liveable futures. Situatedness, relationality, materiality and accountability are key for post-humanist subjects and post-humanism more generally. The latter not only brings the end of human exceptionalism to the forefront, but it also foregrounds bodies and technologies: materiality and normativity in the relations between humans and technologies become crucial issues. As I have emphasised in this thesis, the entanglement of bodies, technologies and humanness needs to be accounted for.

The above considerations – i.e. the implicit normativity of the human enhancement debate – inform somatechnology which, as a heuristic tool, is grounded in this (feminist posthumanist) 'tradition.' However, it also departs from the ways in which the intimate relations between humans and technologies have been conceptualised in the lineage of the posthuman and the cyborg. With the cyborg and the posthuman, these intimate relations are conceived at either a general or epistemological level while the focus is ultimately on the field of biology rather than on technological artefacts. Furthermore, prostheticity – i.e. humans qua prosthetic beings – has tended to become the accepted trope to encapsulate the intimacy of bodies and technologies within our technological lifeworld. Nonetheless, having lost its material grounds, prostheticity not only tends to become all-encompassing, thereby flattening and reducing the diversity and richness of human-technology relations to a matter of 'prosthetic relation,' but also to blackbox the latter as it tends to instrumentalise and invisibilise differently-abled people and their bodily experiences with prostheses.

Techno-anthropology: Theorising Human-Technology Relations

While keeping in line with (feminist) posthumanism, due to this state of affairs, in chapter four I turned to philosophical anthropological approaches to technology to elaborate ways – a heuristic tool – to apprehend the increasingly intimate relations between humans and technologies. At stake in this endeavour is to be able to account for and be accountable to enhancement technologies and what it means to be human with enhancement technologies. I assessed these conceptualisations of human-technology relations by examining the extent to which they considered bodies and humanness, and more generally the material and normative dimensions of humans and technologies, without reviving modern liberal humanist viewpoints. While organic views of technological artefacts – i.e. tools as organ projection and/or extension – still consider humans and technologies in a hermetic position and reduced bodies and technologies to a set of functions, 'originary technicity' shows how the onto-anthropological intertwinement and co-constitution of humans and technologies is a corporeal matter. Even though promising, originary technicity tends however to reproduce prostheticity's flaws while its rather general perspective – the role of technologies in relation to the human qua species and its evolution or in relation to the human's onto-anthropological condition and its genesis – undermines its potential for apprehending the intimate relations between contemporary human beings and technologies. With the latter and enhancement technologies conceived in the frame of anthropotechnologies, similar issues emerge: it is the human qua species that becomes with technology. Furthermore, while bodies are subsumed into biology, the human's normative dimension remains absent. Assuredly, within a Foucauldian framework, anthropotechnologies address the human as a material and normative reality, but technologies and bodies dissolve within power-knowledge apparatuses.

Building upon Lettow's (2011) own recommendation but also revising it, I concluded chapter four by proposing somatechnology as a heuristic tool for apprehending the intimate relations between

humans and technologies and, more generally, enhancement technologies. Somatechnology foregrounds not only bodies with/in technologies but also the extent to which the transformations of the human with (potentially enhancing) technologies is a bodily matter. In order to account for the impact of (putatively) enhancement technologies on what it means to be human, it is necessary to focus on bodies, and more precisely on the materialisation of bodies with/in specific technologies – which or whose bodies come to exist and to count (or not) as human with/in (enhancement) technologies. As aforementioned, as it encapsulates the intimate relations between humans and technologies – somatechnologies are intimate technologies – somatechnology as a heuristic tool congregates humans and technologies qua material and normative realities, thereby enabling to account for and be accountable to the entanglement of bodies, technologies, and humanness.

Accounting for Bodies with/in Somatechnologies

In chapters five and six, the concept of somatechnology was put to practice by investigating how and which bodies materialise with/in two somatechnologies, one implanted and the other prosthetic. The former, spinal cord stimulation, which consists in the modulation of nerve activity through the delivery of electrical energy directly to the dorsal column of the spinal cord is a type of neuromodulation technology that is used as a last resort treatment of chronic pain caused by various types of neuropathy or failed back surgeries, and the latter, upper- and lower-limb prostheses, are technological replacements of – or additions to – an amputated or congenitally 'missing' arm or leg. Even though differently, both are acting on and interacting with the body. Both are intimate technologies. Both are somatechnologies. While in chapter five I explored the intimate relations between bodies and these technologies by focusing especially on humans' and technologies' material dimension, in chapter six I continued this investigation and unravelled their normative dimension by attending to the bodies that materialise and especially matter as (putatively) human with/in somatechnologies.

While close to bodies, somatechnologies are not straightforwardly and directly intimate technologies. Rather, they become intimate as they are embodied, embodiment being not only a process but also done by bodies and technologies. Insofar as they ground their analysis in technological artefacts and embodied humans, hence acknowledge their material dimension, I built upon postphenomenological approaches to human-technology relations and especially Ihde's (1979; 1990) embodiment relation – wherein the world is experienced through a technological artefact that becomes (quasi-) transparent – to explore the becoming-intimate of somatechnologies. However, the modus operandi of the becoming-intimate of somatechnologies confirmed some of the limitations that I had previously identified in these approaches (namely, the focus on usable technologies and its correlate negligence of process on the one hand, and the potential reification and invisibilisation of bodies with embodiment on the other hand – postphenomenology's individual scope that tends to blackbox human's embeddedness in networks of relations was particularly at issue in chapter six). For somatechnologies to become transparent, i.e. embodied, an intensive learning and training process is necessary. In the latter, movements and gestures are crucial. The ability to live in an intimate relation with a somatechnology is achieved through a groping process. Bodies and their agency are critical for somatechnologies becoming intimate. In fact, with somatechnologies, bodies and technologies cannot be apprehended separated from each other. Not only are bodies transformed (e.g. with the enactment of new gestures, actively strengthened muscles, morphological changes) with/in their intimate relations with somatechnologies, but the latter enact – materialise – different bodies, e.g. one composed of myolectrical signals and triggers or the body-in-pain and in-paraesthesia. Furthermore, living with somatechnology entails becoming intimate with one's materiality and what one's body can do. While the becoming-intimate of spinal cord stimulation and lower- and upper-limb prostheses is accompanied by a becoming-intimate with one's materiality, both processes are crucial to be able to live with somatechnology.

As I have developed in chapter six, not only processes of embodiment but also processes of incorporation are at play with somatechnologies and their becoming-intimate. Incorporation designates that somatechnologies are lived as being (a) part of one's body. Interestingly, incorporating somatechnologies cannot be apprehended by only considering the interactions – no matter how intimate – between one's body and somatechnology. Or rather, even though intimate, these interactions do not stop at the boundaries of the skin but involve other (human and nonhuman) bodies, for instance loved ones. As incorporating technologies such as spinal cord stimulation and upper- and lower-limb prostheses is highly relational and done with others, one's intercorporeality is made intimate knowledge with/in somatechnologies. To a certain extent, incorporating somatechnologies enacts intercorporeality. The ability and possibility for somatechnology to be(come) incorporated is furthermore entangled with putative humanness. Who and what counts as allegedly human (in specific historico-cultural contexts, e.g. the contemporary Netherlands) not only informs the extent to which somatechnologies can be incorporated but also how people can live with somatechnologies. Only certain bodies can materialise, namely come to exist and especially come to matter with/in somatechnologies. Aesthetic norms, financial and insurance-related factors, gender/ing and age/ing (processes) matter with respect to the bodies that count with/in somatechnologies, hence matter for the possibility and ability to live satisfactorily with and incorporate somatechnologies. As I have described, for bodies-with/in-somatechnologies to count as human, they must achieve material and visible anonymity thus perform (compulsory) healthy able-bodiedness. As showed in the experiences and practices of people living with somatechnology, processes of dis/ablement are material-discursive and result in mis/fitting and differently articulated bodies. When living with somatechnology not only one's intercorporeality but also one's entanglement with the broader material environment is experienced intensely. As showed by chapters five and six, not only becoming intimate with somatechnology and with one's materiality but also becoming intimate with one's intercorporeal dimension and experiencing rather intensely one's entanglement with other (human and nonhuman) bodies, with the broader material environment, and with the norms that make up putative humanness constitute what it means to be human with/in somatechnology.

The Relevance of Somatechnology and Bodies with/in Somatechnologies

Based on the work of excavation and exploration done in this thesis, to what extent can somatechnology as a heuristic tool and my enquiry into the intimate relations between humans and somatechnologies contribute to shed (new) light on what is at stake and what it means to be human with/in enhancement technologies?

What it means to be living with/in somatechnology is at odds, to say the least, with the ways in which both bioconservatives and transhumanists have apprehended and constructed human enhancement as the technological enhancement and straightforward improvement (for the latter) or debasement (for the former) of human beings. While informed by and reiterating modern liberal humanist worldviews, their

respective viewpoints are linked, as I have explained, to an instrumental understanding of technology (in transhumanists' case) and a substantive understanding of technologies (in bioconservatives' case). While the technologies stemming from the fields of nanotechnology, biotechnology, information and communication technology, and the cognitive sciences (or the convergence thereof) are conceived as neutral tools to reach post/huMan-determined ends, namely the attainment of a perfected humanity – posthumanity – they are regarded as autonomous systems geared towards the enslavement or domination of human beings by bioconservatives.

As demonstrated in this thesis, encapsulated in somatechnology as heuristic tool and illustrated when exploring the (intimate) relations between somatechnologies and human beings in practice, both conceptions are onto-anthropologically flawed. In fact, what both the elaboration of somatechnology as a heuristic tool and the exploration of somatechnologies in practice contribute to show is that the terms and scope of the debate about human enhancement are inappropriate and misconceived: at issue with putatively enhancement technologies is not to so much whether we are to live longer, stronger and upgraded – to become posthuMans – or whether we are to remain the uncreated creators of our life – and retain the fiction of the huMan – but it is rather about entering into intimate relations with technologies. Human enhancement is a matter of intimate relations between humans and technologies. Somatechnology precisely encapsulates this dimension. What appears to be at stake in the intimate relations between humans and somatechnologies is not the abstract idea of the enhancement of humanity, but the quality of the very concrete way in which people are constituted as bodily beings in relation to technologies, and via these technologies to the people and things around them.

Assuredly, spinal cord stimulation and lower- and upper-limb prostheses, that both ground my exploration of somatechnologies, would not be regarded as enhancement technologies by transhumanists and bioconservatives, at least not unreservedly. In my endeavour to leave the speculative realm of transhumanists and bioconservative discourses and enter the field of practices, pragmatic reasons have underlain this choice of somatechnologies: while supposedly enhancement technologies are still emerging hence not yet lived with, which renders the exploration of what it means to be human with/in enhancement technologies rather unfeasible – at least without silencing the voices of allegedly 'enhanced' people – my encounter with gate-keepers in the field of spinal cord stimulation and upper- and lower-limb prostheses opened a space of possibility for conducting fieldwork. More importantly, the somatechnologies I investigated display characteristics and instigate processes that are relevant for an account of (putatively) enhancement technologies and what it means to be human with/in (putatively) enhancement technologies. Spinal cord stimulation and upper- and lower-limb prostheses, like reputedly enhancement technologies, are somatechnologies: they act on and interact with bodies; they are intimate technologies.

Contra transhumanist and bioconservative understandings, bodies are neither a set of functions or functionalities to be enhanced nor a biological or genetic substrate. Rather, bodies are agential and ground the relations that can unfold with somatechnologies: as my analysis of spinal cord stimulation and upper- and lower-limb prostheses has shown, bodies are pivotal in the becoming-transparent and intimate of somatechnologies, the latter resulting from an intensive learning and groping process wherein movements and gestures are crucial. Contra somatophobia and its correlated dreams of flight from the body and fictions of immaterial bodies (and disembodied minds), living with somatechnologies brings a renewed sense of (one's own and the world's) materiality. Bodies do not disappear with somatechnologies. Rather, living with somatechnologies means becoming intimate not only with one's materiality but also one's intercorporeality, the density of 'the texture of a "technosphere" within which we undertake our daily affairs' to use Ihde's formulations (1979: 7), and more generally one's entanglement in material-discursive networks of relations. People living with somatechnologies resemble neither transhumanist visions nor bioconservative fears concerning the posthuman. Rather, with somatechnologies, post-humanism is not only done in practice but becomes what it means to be human.

Enhancing the Human Enhancement Debate

To apprehend enhancement technologies as somatechnologies not only complicates but also refines the concept of enhancement. Enhancement is anything but straightforward. Assuming that to amount to an enhancement, technologies must become transparent – transhumanist conceptions tend to be underpinned by this postulate – as seen in chapter five, a compromise between magnification and reduction (of bodily powers, abilities, sensations) informs the embodiment of somatechnologies. Furthermore, assuming that to qualify as enhancement, technologies must become part of the body – a premise that would be shared by both transhumanists and bioconservatives – as made manifest in my account of what it means to be living with somatechnologies, incorporation is a highly relational process. Incorporation not only enacts intercorporeality but is also entangled with norms concerning putative humanness – what and who counts as human. As seen in chapter six, while not every body matter with/in somatechnology, bodies with/in somatechnologies are also subjected to material-discursive practices of dis/ablement – practices all the more violent that they are underpinned by compulsory healthy able-bodiedness. Even though somatechnologies supposedly turn misfits into fits, airport's screening technologies, stares and sanctioning looks, or the foreseen possibility of being perceived as not a healthy-abled body, to name a few, participate in one's disablement – and correlate enablement, or shall I say enhancement? Enhancement is neither a property of somatechnologies nor of bodies with/in somatechnologies but is rather the product of their entanglement with other apparatuses of bodily production and more generally power relations. In this frame, somatechnology alerts once more to the normation potential and power-laden quality of human enhancement – cui bono? whose bodies are to matter within enhancement technologies? – while recognising them as situated and relational, non-homogeneous but highly intricate. In fact, with somatechnology, the relevance and value of the concept of enhancement is thrown in doubt. Shouldn't we rather write of and be concerned with processes of enablement and dis/ablement? I shall leave this question open for further research.

Towards a Somatechnological Turn?

By foregrounding bodies and technologies, exploring their mundane, intimate relations, and accounting for their entanglement with humanness, somatechnology as a heuristic tool provides a more accurate – less speculative –, more grounded and ultimately more accountable exposition of what is at stake and what it means to be human with/in enhancement technologies. Human enhancement and the way it is framed and enacted is not the sole area to which the concept of somatechnology can contribute.

First, a possible confusion needs to be addressed. To underline that an understanding of somatechnologies cannot dispense with acknowledging and accounting for bodies with/in somatechnologies and their entanglement within broader material-discursive practices does not mean that the technologies and what they do for individual people deserves less attention or become irrelevant. On the contrary. (Soma-) technologies, their design and their usability are critical for people to be able to

interact with them, embody them, incorporate them and ultimately live satisfactorily with them. What it means however is that the elements that matter with respect to what the technological artefact does do not stop at its visible borders. Technological artefacts are part of broader material-discursive practices, and engineers, designers, medical practitioners should be careful not to rely on a generic or prototypical human but to think about the norms they are convening and conveying, the bodies they are allowing or enabling to materialise with/in these technologies.

Likewise, to bring to the fore bodies' entanglement with other human and nonhuman bodies and more generally with material-discursive practices that might constitute as many instances of dis/ablement does not amount to downplaying bodies and their reality. Being a body in chronic pain is different from being a pain-free healthy body. As voices in disability studies (e.g. Siebers 2008; Wendell 2001) have recently alerted to, and as this thesis has drawn attention to, this reality must (also) be recognised and accounted for.

As this thesis has been grounded in philosophy of technology, its elaboration and exploration of somatechnology also has implications for this field. While emphasising the importance of interdisciplinarity, somatechnology not only calls for an empirically-grounded philosophy of technology but also for another 'turn' within it. In the wake of the so-called empirical turn (Achterhuis 2001), technological artefacts, the materiality and agency thereof, have been at the forefront of philosophical analysis in general and postphenomenological approaches to technology in particular. While necessary, such a turn has nevertheless also had some adverse side-effects: while materiality through technological artefacts is given agency, bodies in their (very) materiality are denied such agency. When bodies are reduced to a perceptual locus, humans – their material dimension – are blackboxed.

Such blackboxing also materialises in postphenomenology's tendency to solely focus on human-technology-world interaction(s), that is, on the interaction(s) between a human and a technological artefact, and the way in which the world is disclosed in this interaction. In doing so, they not only blackbox humans by disregarding or downplaying (bodily) materiality but also by setting the limits and boundaries of what matters in human-technology-world relations to the (visible) contours of the individual human actant and agential technological artefact. While the relations between bodies and technologies need to be accounted for, as evidenced by my exploration of bodies with/in somatechnologies, other relations and elements matter in the intimate relations between humans and technologies. By approaching the interviews and stories of people living and working with somatechnology as 'material memoirs' – I borrow the term from Stacy Alaimo (2010: 87) insofar as it emphasises that the materialising bodies with/in somatechnologies also result from their entanglement with e.g. other human and nonhuman bodies, financial considerations, apparatuses of bodily production – it is possible to delineate the elements and relations that matter (e.g. the gaze and touch of loved ones, insulin pumps, transplanted organs, compulsory healthy able-bodiedness, the performance of heteronormative white femininity) when living in intimate relation with somatechnologies.

With somatechnology, humans are no longer apprehended as abstract or generic, even hygienic, entities interacting with a technological artefact. Rather, somatechnology as a heuristic tool foregrounds both the material and normative dimensions of humans and technologies while encapsulating their intimate relations. As such, and as performed by this thesis, the concept can enable more fine-grained analyses and understandings of the relations between humans and technologies, especially as technological artefacts are entering into ever more intimate relations with human beings. A 'somatechnological turn' might be timely in philosophical approaches to human-technology relations.

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Summaries

Français

L'avènement de la technoscience et plus particulièrement la convergence des nanotechnologies, des biotechnologies, des technologies de l'information et de la communication et des sciences cognitives (NBIC) ont donné naissance au projet de l'augmentation ou de l'amélioration humaine (human enhancement). Cette perspective de l'amélioration technologique des êtres humains, laquelle s'est cristallisée dans la figure du « post-humain », a fait l'objet d'un vif débat polarisé entre d'un côté, les bioconservateurs et de l'autre, les transhumanistes. Or, ce débat est profondément clivé et figé, et néglige des dimensions essentielles permettant de comprendre ce qui est en jeu dans la (présumée) augmentation humaine. Bien que les technologies (supposées) d'amélioration soient appréhendées comme étant un défi considérable à relever ou comme étant révolutionnaires pour les êtres humains, les relations entre les humains et ces mêmes technologies sont ignorées, tout comme la possible émergence de nouvelles configurations entre ces derniers. En fait, une conception générique mais très normative et exclusive de l'humain informe les conceptions portées par les bioconservateurs et les transhumanistes sur l'augmentation humaine. Au vu de cette situation, comment appréhender et conceptualiser les relations entre les humains et les technologies d'augmentation (enhancement technologies) pour nourrir et améliorer le débat actuel sur l'augmentation humaine ?

Telle est la question qui guide cette thèse ; et comme le soutient celle-ci, c'est en s'intéressant – et en tentant de répondre – à la fois conceptuellement et empiriquement à cette interrogation qu'il devient possible de comprendre ce que signifie être humain au sein des technologies d'augmentation, à savoir au sein de technologies qui se rapprochent de plus en plus des corps (humains) qu'elles se proposent de modifier. Dès lors, cette recherche propose de concevoir des technologies (supposées) d'amélioration en tant que somatechnologies. Si les somatechnologies sont des technologies qui agissent sur et en interaction avec le corps, le concept de « somatechnologies », en tant qu'outil heuristique (et posthumaniste), permet à la fois de penser les relations intimes entre les humains et les technologies et de mettre en avant leurs dimensions matérielles et normatives, et plus particulièrement l'enchevêtrement dynamique des corps, des technologies et de ce qui compte comme humain. La question n'est pas de savoir si ces technologies constituent une menace ou améliorent « l'être humain », mais plutôt de comprendre comment les corps se (re-) configurent avec ces technologies et quel(s) corp(s) est/sont façonné(s) par elles. La notion de somatechnologie, parce qu'elle permet de mettre en lumière les processus d'incarnation (embodiment) et d'incorporation (incorporation), les pratiques au travers desquelles sont créés différentes in/capacités (dis/ablement practices) et le/s corps qui compte/nt comme humain/s, contribue non seulement à complexifier mais aussi à délier la question de l'augmentation humaine : ce qui semble être en jeu dans ces relations n'est pas l'idée abstraite de l'augmentation (et d'amélioration) de l'humanité, mais les manières très concrètes par lesquelles les individus se constituent en tant qu'êtres corporels en relation avec les technologies, et via ces dernières, avec les gens et les choses autour d'eux.

Dans le premier chapitre, j'introduis la notion d'augmentation humaine, les technologies qui la composent ainsi que son bornage théorique, comme (re-)présentant un enjeu pour la nature humaine et l'avenir de l'humain à travers les discours des transhumanistes et des bioconservateurs. Dans la mesure où ces derniers incarnent les voix dominantes de la définition de l'amélioration humaine et de celle de l'humain qui y est corrélée, j'expose leurs positions respectives. J'attire plus particulièrement l'attention

sur d'une part, la façon dont ils envisagent les impacts des technologies d'augmentation sur les êtres humains, et d'autre part, je rends compte de leurs hypothèses à l'égard de l'ontologie des êtres humains et des technologies.. En effet, outre le fait que les technologies d'augmentation soient imprégnées, dans les conceptions transhumanistes, d'une neutralité instrumentale et « presque magique », et qu'elles soient appréhendées comme étant aliénantes et déshumanisantes par les bioconservateurs, l'humain qui informe ces deux positions est renvoyé à une figure abstraite et générique, voire même hygiénique. Mieux, c'est le sujet moderne et désincarné de l'humanisme libéral, lequel est hermétiquement séparé des technologies, qui sous-tend à la fois les plaidoyers transhumanistes pour un avenir post-humain et les mises en garde bioconservatives énoncées au nom de la nature humaine. Au final cependant, les humains, les technologies et l'augmentation (humaine) sont des catégories qui constituent autant de « boîtes noires » dans les écrits bioconservateurs et transhumanistes ; l'amélioration humaine n'est pas conçue comme une relation entre les êtres humains et les technologies. Plutôt, le posthumanisme équivaut à un hyper -humanisme.

Dans le deuxième chapitre, je continue cette exploration critique du posthumanisme, ou plus exactement, de l'augmentation humaine et du post-humain tels qu'ils émergent dans un cadre moderne et humaniste libéral. Plus précisément, c'est la dimension normative et chargée de valeur de « l'humain » tel qu'il transparaît dans la notion de l'augmentation humaine qui est à l'étude. Après avoir présenté certaines des questions éthiques qui ont été soulevées à l'égard de l'amélioration humaine ainsi que la façon dont celle-ci a pu être perçue comme ranimant le spectre de l'eugénisme, j'examine l'amélioration humaine comme une instance de normation (Foucault 2009a). D'une part la mise en lumière des relations – qui sont autant de d/évaluations – qu'entretient la notion d'augmentation humaine avec les in/capacités des corps (humains) et d'autre part l'introduction de la figure du normate (Garland-Thomson 1997) me permettent de souligner la centralité de normes concernant ce/ux qui compte/nt comme humain/s (humanness) dans la définition et délimitation de l'augmentation humaine. Cette exploration rend possible non seulement de percer et d'ouvrir le concept d'augmentation (humaine), mais aussi de faire apparaître à quel point les corps, les technologies et ce/ux qui compte/nt comme humain/s sont enchevêtrés dans le phénomène de l'amélioration humaine. Je m'appuie sur la chirurgie esthétique pour illustrer ce point. Enfin, j'indique qu'il faut considérer l'augmentation humaine comme la matérialisation de certains corps – ceux qui viennent exister et à compter – au sein de et avec les technologies (supposées) d'augmentation. De ce fait, et en particulier en raison du risque que, dans un cadre hyper-humaniste, l'amélioration humaine devienne une instance de normation, j'alerte sur la nécessité d'élaborer un nouveau cadre conceptuel – qui ne soit ni moderne ni humaniste libéral – pour appréhender les relations intimes entre les humains et les technologies d'augmentation.

Dans le troisième chapitre, je m'avance dans cette direction en offrant une généalogie différente au post-humain et au posthumanisme. Il marque non seulement une rupture avec les précédents, mais il revisite également ces derniers. Grâce à un détour par la cybernétique et la technoscience, les artifices nécessaires à la subsistance du sujet moderne et désincarné comme archétype de l'être humain ne sont pas seulement mis à jour, mais l'humanisme moderne et libéral se révèle comme anthropologiquement erroné et incapable d'expliquer ce que signifie être humain dans un monde technologique. Ce chapitre propose une nouvelle manière d'appréhender les relations entre les humains et les technologies: ceux-ci ne sont pas hermétiquement séparés mais onto-anthropologiquement imbriqués. Dans ce contexte, le post-humain et le posthumanisme (ré-) apparaissent métamorphosés et prometteurs pour appréhender les relations de plus en plus intimes entre les êtres humains et les technologies. Cependant, le post-humain, son ancêtre et contemporain le cyborg (et, dans leur lignée, la conception de l'humain comme être prothétique) ont été victimes de leur succès : réduits au statut de métaphores dont l'usage est devenu excessif et abusif, ils ne permettent pas de comprendre ce qui en en jeu dans les technologies d'augmentation.

Dès lors, dans le quatrième chapitre, parce qu'elles ont considéré et pensé les relations entre les humains et les technologies, je me tourne vers les approches issues de l'anthropologie philosophique pour concevoir un outil heuristique posthumaniste qui puisse me permettre d'appréhender les relations intimes entre les humains et les technologies – ces dernières étant, comme je le discute, la clé pour comprendre les technologies d'amélioration et ce que signifie être humain en leur sein. Après avoir examiné le potentiel des concepts de projection et d'extension d'organes et de ceux d'anthropotechnologie et de technicité originaire, je propose la notion de somatechnologie comme outil heuristique permettant, d'une part, de saisir les relations intimes entre les humains et les technologies et, d'autre part, de rendre compte de la matérialisation des corps avec et dans les technologies (d'augmentation) dans la mesure où elle souligne l'enchevêtrement des corps, des technologies et de ce/ux qui compte/nt comme (proprement) humain/s. Un outil heuristique, les somatechnologies sont également des technologies intimes. Avec ce chapitre, je ferme mon exploration conceptuelle du posthumanisme et des relations entre les humains et les technologies.

Bien qu'il soit un point de départ nécessaire, le concept de somatechnologie ne permet pas d'appréhender pleinement les dimensions pratiques des relations intimes entre les humains et les technologies, à savoir la façon dont les corps et ce/ux qui compte/ent comme humain/s sont transformés et (re-) créés dans leurs relations intimes avec les technologies. Dès lors, dans les quatrième et cinquième chapitres, je me tourne vers les pratiques. Ou plutôt, j'explore les relations intimes nouées entre les humains et les somatechnologies au quotidien. Dans le cinquième chapitre, je rend compte dans un premier temps des technologies sur lesquelles j'ai réalisé un travail de terrain, à savoir le système de stimulation de la moelle épinière (spinal cord stimulation ou la modulation de l'activité nerveuse de la moelle épinière par l'administration de courant électrique) et les prothèses des membres inférieurs et supérieurs (les remplacements ou les ajouts d'ordre technologique à un bras et/ou une jambe amputés ou congénitalement « manquants »). Dans un second temps, après avoir abordé des questions d'ordre méthodologique, j'explore ces technologies comme des instances de médiation (technique). Indiquant d'abord plusieurs limites à cette approche (postphenomenologique) pour appréhender les somatechnologies, j'entreprends dans un troisième temps l'analyse du devenir-intime des somatechnologies et de la transformation des corps avec les somatechnologies. Bien que proches des corps, les somatechnologies ne sont pas naturellement et directement des technologies intime. Au contraire, comme je l'explique, elles deviennent intimes en étant faites corps (embodied), cette « incarnation » (embodiment) consistant non seulement en un processus d'apprentissage et d'entraînement, mais aussi en une réalisation par les corps avec les technologies. On apprend à vivre avec une somatechnologie au cours d'un tâtonnement dans lequel les gestes et les mouvements sont essentiels. Avec les somatechnologies, les corps et les technologies ne peuvent pas être appréhendés séparés les uns des autres : non seulement les corps se trouvent transformés avec / dans les somatechnologies (comme, par exemple, l'adoption de nouveaux gestes, des exercices permettant le renforcement des muscles, des changements morphologiques), mais ces technologies engendrent des corps différents, composés de signaux et déclics myoélectriques ou en-paresthésie et en-souffrance. Je montre par ailleurs que vivre avec une somatechnologie implique de devenir intime avec sa propre matérialité et ce que son corps peut faire.

Dans le sixième chapitre, je poursuis l'exploration de ce que signifie vivre avec une somatechnologie. Alors que le chapitre précédent explore les relations intimes entre les corps et ces technologies en se concentrant en particulier sur la dimension matérielle des humains et des technologies, dans celui-ci, je continue non seulement cette étude, mais j'entreprends aussi de démêler leur dimension normative en m'intéressant particulièrement aux corps qui émergent et surtout comptent comme étant (prétendument) humains avec / dans les somatechnologies. Comme je l'explique dans ce chapitre, un processus d'incorporation – en plus du processus d'embodiment – est en jeu avec les somatechnologies et leur devenir-intime. Incorporer une somatechnologie – c'est à dire la concevoir comme faisant partie de son corps – est très relationnel. L'incorporation se réalise avec d'autres humains et non-humains; et, dans une certaine mesure, elle donne naissance au corps en tant qu'inter-corporéité – ou du moins, celle-ci se fait savoir intime. Comme je l'adresse également, la capacité et la possibilité de chacun d'incorporer une somatechnologie est enchevêtré avec ce/ux qui compte/nt comme proprement humain/s. Les normes esthétiques contemporaines, les facteurs financiers et liés à la couverture sociale, les pratiques liées au genre et à l'âge (vieillissement) contraignent non seulement les corps qui peuvent compter avec / dans les somatechnologies, mais ils génèrent aussi différentes situations d'in/capacités (dis/ablement) et d'in/adaptations (mis/fitting). Vivre avec une somatechnologie engendre en effet des corps articulés différemment.

Enfin, en conclusion, je reviens à ma question initiale en discutant comment les somatechnologies – en tant qu'outil heuristique – ont contribué et peuvent contribuer à mettre en lumière ce qui est en jeu et ce que signifie être humain avec / dans les technologies d'augmentation. Le concept de somatechnologie nous oblige à abandonner l'idée abstraite d'augmentation ou d'amélioration de l'humanité (vers une prétendue posthumanité) pour apprécier la qualité des relations à la fois très concrètes et intimes qui se créent entre les humains et les technologies. Rendre compte de ces dernières ne s'arrête pas aux contours visibles des objets technologiques et des corps. Les corps avec / dans les somatechnologies sont étroitement liés aux autres (qu'ils soient humains ou non humains) et à ce qui compte comme (proprement) humain – ils sont des articulations de ce que signifie être humain. Quant aux conséquences de ce travail pour la philosophie des technologies, le temps est peut-être venu pour un « tournant somatechnologique ».

Nederlands

Onlangs, met de komst van technoscience, en vooral de convergentie van nanotechnologie, biotechnologie, informatie-en communicatietechnologie en de cognitieve wetenschappen (NBIC), is het vooruitzicht gekomen van human enhancement (het verbeteren van de mens via technologie). Hoewel de technologische verbetering van de mens zich heeft samengevoegd in de figuur van de "posthuman" – leidt het onderwerp tot een verhitte, gepolariseerd en uiteindelijk vastgelopen debat tussen bioconservatieven en trans-humanisten. In deze discussie worden de cruciale dimensies die nodig zijn om te begrijpen wat er op het spel staat omtrent human enhancement weggelaten: deze vermeende enhancement technologieën worden weliswaar gezien als dramatisch uitdagend voor de mensheid, een revolutie zelfs. Echter, de relaties tussen mensen en technologieën en de opkomst van nieuwe mens-technologie configuraties worden genegeerd. Integendeel, een generieke maar zeer normatieve en exclusieve opvatting van de mens informeert het bioconservatieve en transhumanistische begrip van human enhancement. De vraag is hoe, in deze context, de relaties tussen mensen en enhancement-technologie te begrijpen en conceptualiseren, zodat de huidige discussie over enhancement verbeterd kan worden?

Dit is de vraag die dit proefschrift begeleidt. Door middel van het analyseren – en proberen te beantwoorden – van dit deze vraag op zowel conceptueel als empirisch niveau wordt het mogelijk om rekening te houden met wat het betekent om mens te zijn in een context van enhancement technologieën. Anders gezegd, in een context waarin dit soort technologieën steeds dichter bij de mens komen.

Binnen de heuristiek van mens-technologie relaties wendt ik me tot somatechnologie-en om deze ontwikkeling te beschrijven en te analyseren. Deze term behelst de intieme relatie en zet daarbij de materialiteit van deze relatie op de voorgrond. Wat mijns inziens het debat over human enhancement vastzit in eerder beschreven tegenstellingen, biedt het concept van somatechnologie-en mij de mogelijkheid om ook de normatieve aspecten en de dynamische verstrengeling van lichamen, technologieën en menselijkheid te duiden.

Hierbij is het niet aan de orde of deze technologie-en de mens en het mens-zijn bedreigen of verbeteren, maar eerder hoe en op welke manier ze materialiseren.
Het doel is om een nieuw licht te werpen op de processen van uitvoering en integratie, de praktijken van dis / ablement. Het concept van somatechnology bemoeilijkt niet alleen, maar verfijnt ook de kwestie van human enhancement: wat er op het spel lijkt te staan in deze mens-technoconfiguraties is niet het abstracte idee van de verbetering van de mensheid, maar te meer de kwaliteit van de zeer concrete manieren waarop mensen "worden" als lichamelijke wezens met betrekking tot technologieën, en via deze technologieën met mensen en dingen om hen heen.

In hoofdstuk 1 introduceer ik human enhancement en de onderbouwing van technologieën die ik zal bespreken. Ook zal in het onderzoeksgebied afbakenen met betrekking tot de menselijke natuur en de toekomst in het discours van transhumanisten en bioconservatieven. Tot op heden zijn transhumanisten en bioconservatieven de dominante stemmen met betrekking tot human enhancement en de vraag wat het betekend om mens te zijn; ik heb hun opvattingen blootgelegd in dit hoofdstuk. Aan de ene vestig ik de aandacht op de manier waarop zij de gevolgen van enhancement technologieën op mensen voor ogen hebben en aan de andere kant heb ik hun veronderstellingen benadrukt omtrent de ontologie van mensen en technologieën. Naast het feit dat door de transhumanisten (enhancement) technologieën worden doordrenkt van een instrumentale, bijna magische neutraliteit en worden opgevat als vervreemdend en ontmenselijking door bioconservatieven, is de mens die beide discoursen informeert een vrij abstract en

algemeen, zelfs hygiënisch figuur. Voor beide kampen is de mens een onstoffelijk en modern liberaal onderwerp dat hermetisch is afgescheiden van technologieën. Deze representatie van de mens informeert zowel transhumanistische pleidooien voor een post-humane toekomst als bioconservatieve klaagzangen over de menselijke natuur. Uiteindelijk worden in beide discoursen mensen, technologie, en (menselijke) enhancement ge-blackbox-ete categorieën binnen; in beide discourses wordt human enhancement niet opgevat als een geval van mens-technologie relaties; posthumanisme komt voor deze dominerende kampen neer op hyper - humanisme.

In hoofdstuk 2 vervolg ik deze kritische verkenning van posthumanisme, of liever, van human enhancement en de post-mens als opkomend binnen een moderne liberaal humanistisch kader. In het bijzonder is de waarden-geladenheid en normatieve dimensie van de mens van die menselijke verbetering die moet worden herzien. Na het analyseren van enkele ethische kwesties die zich voordoen met betrekking tot human enhancement en het behandelen van de vraag hoe human enhancement het spook van eugenetica doet herleven, onderzoek ik human enhancement als een geval van normation (Foucault 2009a). Door te wijzen op de relatie met - en d / evaluatie van - dis / vaardigheden en door de invoering van de figuur van de normate (Garland-Thomson 1997), benadruk ik de centraliteit van normen met betrekking tot die als menselijk (dwz menselijkheid) telt in de afbakening van menselijke toebehoren. Deze verkenning staat me niet alleen toe om het concept van (menselijke) enhancement uiteen te zetten, maar ook om naar de vervlechting van lichamen, technologieën en menselijkheid binnen human enhancement wijzen. Ik gebruik cosmetische chirurgie om dit punt te illustreren. Tot slot wil ik wijzen op hoe human enhancement gaat over de materialisatie van (bepaalde) organen met / in (vermoedelijk) technologieën voor verbetering. Op basis hiervan, en in het bijzonder vanwege het risico van human enhancement als een wederkerend voorbeeld van normation binnen hyper - humanisme, wil ik aandringen op de noodzaak om een nieuw kader te bedenken – anders dan de moderne liberale humanist – voor het duiden van de intieme relaties tussen mensen en enhancement technologieën.

In hoofdstuk 3 neem ik deze noodzakelijke stap door middel van het in kaart brengen van een alternatieve genealogie van de post-mens en posthumanisme. Als zodanig markeert dit hoofdstuk niet alleen een breuk met de vorige, maar het her-adresseert ze ook. Via een omweg langs cybernetica en technoscience, de kunstmatigheid, of liever de kunstgrepen die nodig zijn voor het levensonderhoud van het moderne liberale humanist subject als de ultieme mens, wordt de moderne liberale humanisme geopenbaard als antropologisch gebrekkig en niet in staat om rekening te houden wat het betekent om mens te zijn in een technologische leefwereld. Dit hoofdstuk is opgevat als een keerpunt in de duiding van de relatie tussen mens en technologie: de twee laatste zijn niet hermetisch van elkaar gescheiden, maar antropologisch verstrengeld. In deze context is de post-mens en posthumanisme een gemetamorfoseerd verschijnsel en potentieel veelbelovend voor het waarnemen van de steeds meer intieme relaties tussen mensen en potentiële of vermeende enhancing technologies. De post-mens en de aanverwante cyborg – hun afkomst ligt in de opvatting van de mens als prothetische wezens- zijn slachtoffer geworden van hun eigen succes; ze zijn gebruikt en uiteindelijk misbruikt als metaforische cijfers voor het vastleggen en het uiten van de intieme relaties tussen mensen en technologieën.

In hoofdstuk 4 wend ik mij tot filosofisch-antropologische benaderingen van mens-technologie relatie(s) om een (post-humanistisch) heuristisch instrument te ontwikkelen met als doel het begrijpen van de intieme relaties tussen mensen en technologieën. Dit instrument is de sleutel voor het begrijpen van technologieën voor verbetering en wat het betekent om mens met / in hen te zijn.

Na een exploratie van concepten als begrippen orgaan-projectie en orgaan-uitbreiding, anthropo-technologies en oorspronkelijke- techniciteit, stel ik somatechnologie voor als een verwijzing naar de verstrengeling van lichamen, technologieën en (vermeende) menselijkheid. Als een heuristisch hulpmiddel zijn somatechnologie-en ook intieme technologieën. Met dit hoofdstuk sluit ik mijn conceptuele exploratie van posthumanisme en mens- technologie relaties af.

Als zijnde een noodzakelijke uitgangspunt en een – zelfs mnemotechnisch – gereedschap, is het begrip somatechnologie (nog) niet gebruikt om in de gaan op de praktische aspecten van de intieme relatie tussen mens en technologie. Dat wil zeggen, de manier waarop instanties en menselijkheid worden getransformeerd en verworden in hun intieme relaties met technologieën. Als zodanig wend ik mij in hoofdstuk vijf en zes tot een verkenning van de praktijken van somatechnologie-en. In hoofdstuk vijf beschrijf ik de introductie van ruggenmerg-stimulatie (als somatechnologie), die bestaat in de modulatie van de activiteit van de nervus door de levering van elektrische energie rechtstreeks aan de dorsale kolom van de ruggenmerg. Daarnaast beschrijf ik protheses van de bovenste en onderste ledematen (eveneens als somatechnologie), te weten technologische vervangingen of toevoegingen aan een geamputeerde of deels 'ontbrekende' arm of been. Na het bespreken van een aantal methodologische kwesties, verken ik deze technologieën als voorbeelden van (technische) mediatie. Na vermelding van enkele grenzen aan een post-fenomenologische aanpak voor het analyseren van somatechnologies, wend ik me tot de steeds intiemer wordende somatechnologie-en en de transformatie van lichamen die leven met / in somatechnologie-en. Hoewel ze zich dichtbij lichamen bevinden, zijn somatechnologies niet ronduit en direct intieme technologieën. Integendeel, zoals ik beargumenteer, worden ze pas intiem zodra ze worden belichaamd, waarbij het de uitvoering van deze belichaming niet slechts plaatsvind tijdens een scholings- en opleidingsproces, maar tijdens het leven, het doen, met deze technologie-en. Men leert te leven met somatechnologie via een fysiek proces waarbij gebaren en bewegingen cruciaal zijn. In het geval van somatechnologies kunnen organen en technologieën niet van elkaar worden gescheiden: niet alleen zijn lichamen met / in somatechnologie-en getransformeerd (bijvoorbeeld met de vaststelling van nieuwe gebaren, actief versterkt spieren, morfologische veranderingen), maar deze technologie-en bestaan ook weer uit verschillende configuraties, zoals bijvoorbeeld uit myoelectric signalen en triggers. Leven met somatechnologie-en houdt in het steeds leren intiem te zijn met materialiteit en wat je lichaam kan doen.

In hoofdstuk zes blijf ik de verkenning van wat het betekent om te leven met somatechnologies. Waar hoofdstuk vijfde intieme relaties tussen lichamen en deze technologieën verkent door vooral te focussen op de materiële dimensie van mensen en technologieën wordt in dit hoofdstuk niet alleen dit onderzoek voortgezet, maar wordt er ook gepoogd hun normatieve dimensie te ontrafelen. Dit wordt gedaan via het volgen van de (vermeende) mens met / in somatechnologies. Zoals ik bespreek in dit hoofdstuk, staan niet alleen processen van uitvoering en praktijk (het doen), maar ook de processen van incorporatie op het spel als het gaat om somatechnologies en hun constante intimiteit. Integratie van somatechnologies – dat wil zeggen ze concipiëren als een deel van het lichaam – is sterk relationeel. Dit wordt gedaan met anderen en, tot op zekere hoogte tussen lichamelijkheden. Zoals ik verder zal beargumenteren, wordt het vermogen en de mogelijkheid voor somatechnologies om geaccepteerd te worden verward met vermeende menselijkheid. Esthetische normen, financiële en verzekeringstechnische factoren, geslacht en leeftijd zijn niet alleen van beperkende invloed, op mensen die leven met / in

somatechnologies, tegelijkertijd genereren ze ook singuliere processen van dis / ablement en mis / fitting. Leven met somatechnologie omhelst anders-geuitte lichamen.

Tot slot keer ik terug naar mijn eerste vraag door het bespreken hoe somatechnologie als een heuristisch instrument heeft bijgedragen en kan bijdragen om licht te werpen op wat er op het spel staat en wat het betekent om mens met / in enhancement-technologieën te zijn. Het concept van somatechnologie dwingt ons om het abstracte idee van de verbetering van de mensheid (richting post-menselijkheid) te laten varen en in plaats daarvan van de kwaliteit van de zeer concrete en intieme relaties tussen mensen en technologieën te waarderen. Juist deze laatste stopt niet bij de zichtbare grenzen van technologische artefacten en organen. Lichamen met / in somatechnologies zijn verweven met (menselijke en niet-menselijke) anderen en verstrengeld met vermeende menselijkheid – ze zijn articulaties van wat het betekent om mens te zijn. Het is tijd voor een 'somatechnologisch perspectief' in de filosofie van de technologie.

Recently, with the advent of technoscience, and especially the convergence of nanotechnology, biotechnology, information and communication technology and the cognitive sciences (NBIC), has come the prospect of human enhancement. Even though the latter – the technological enhancement of human beings which has coalesced in the figure of the posthuman – has been the object of a heated, polarised, and ultimately deadlocked debate between bioconservatives and transhumanists, crucial dimensions that are needed to understand what is at stake with human enhancement have been omitted. While putative enhancement technologies are assumed to be dramatically challenging, revolutionising even, for human beings, the very relations between humans and technologies and the emergence of new configurations are ignored. Rather, a generic yet highly normative and exclusive conception of the human informs the bioconservative and transhumanist understandings of human enhancement. In this context, how to apprehend and conceptualise the relations between humans and enhancement technologies so as to improve the current discussion on enhancement?

This is the question that guides this thesis; and as argued in the latter, it is by addressing – and attempting to answer – this interrogation both conceptually and empirically that it becomes possible to account for what it means to be human within enhancement technologies, that is, within technologies that are increasingly getting closer to the (human) bodies they offer to modify.