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Abstract

Seeking for broad and inclusive ways of framing ethical debates on emerging technologies, in this article the authors explore imaginaries of body enhancement as encompassed in the science fiction (sci-fi) literature. They provide in-depth descriptions of three sci-fi novels: *Neuromancer*, *The Player of Games*, and *Kéthani*. They explore how ethical concerns are framed within the imaginary world of these novels, emphasizing that this framing is usually ambivalent, embedded within lived narratives, as well as future and collectively oriented. Because they evoke shared imaginaries, sci-fi novels appear as useful to trigger debate on new technologies.

Keywords

science fiction, imaginaries, emerging technologies, ethics, enhancement, public debate

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Molly by Ed Zumba

“I Guess It’s Just the Way I’m Wired”: Imagining Enhanced Bodies and Minds

She shook her head. He realized that the glasses were surgically inset, sealing her sockets. The silver lenses seemed to grow from smooth pale skin above her cheekbones, framed by dark hair cut in a rough shag. The fingers curled around the fletcher were slender, white,

tipped with polished burgundy. The nails looked artificial. "I think you screwed up, Case. I showed up and you just fit me right into your reality picture."

"So what do you want, lady?" He sagged back against the hatch.

"You. One live body, brains still somewhat intact. Molly, Case. My name's Molly. I'm collecting you for the man I work for. Just want to talk, is all. Nobody wants to hurt you."

"That's good."

"Cept I do hurt people sometimes, Case. I guess it's just the way I'm wired." She wore tight black gloveleather jeans and a bulky black jacket cut from some matte fabric that seemed to absorb light. "If I put this dartgun away, will you be easy Case? You look like you like to take stupid chances." (*Neuromancer*, Gibson, 1983, pp. 24-25)

The passage above is from *Neuromancer*, a novel that has been largely celebrated as one of the masterpieces of contemporary sci-fi (Bukatman, 1993; Tomas, 2007; Vint, 2007). The passage evokes the image of a female, enhanced, catlike body. Molly is enhanced to be a Ninja warrior in a world of high tech and corruption. Her movements and actions are conditioned by the way *she is wired*; this is why she sometimes hurts people. Case, the male main character of the novel is a "cyberspace" cowboy. By connecting himself to a deck, he can jack into the virtual reality of "the matrix," enhancing his capacities for acting and going beyond the limitations of the body (the "flesh" as referred to in the novel). Back in 1983, William Gibson presented his readers with a fictional future world in which people can enjoy and suffer from their virtual existences. In the imaginary future world of *Neuromancer*, the central image of body enhancement is the *body as information*. For the first time, Gibson's novel evokes and projects a vision of *cyberspace*, a word that was later adopted and reconceptualized by computer scientists and hackers. The possibility of having a virtual existence was problematized in *Neuromancer* at a time in which computer science was becoming increasingly important but was still at an early stage of development. Within the imagined world of *Neuromancer*, future visions of body, mind, and technology were presented raising a number of questions about what it means to be a human: To what extent are Molly and Case entirely human? Should they be treated as such? Which are the connections between their modified humanity and their degraded lifestyles? To what extent can the human body and mind be modified without transgressing the moral borders of humanity? The image of the

body as information encompassed in *Neuromancer* opens up for ethical questioning about the body–technology relation in a way that is accessible and possibly appealing for large parts of the public.

In this article, we look at imaginaries of body enhancement in science fiction (sci-fi) literature and we suggest that sci-fi novels could be used to open up the way for more inclusive ethical debates on emerging technologies. The arguments of the article build on the idea that existing modes of framing ethical debate on emerging technologies in general, and enhancement in particular, are insufficient for dealing with the scale and complexity of developments and so need to be supplemented. Applied to the enhancement of the human body, emerging technologies such as ICTs (information and communication technologies), nanotechnology, and bioengineering are threatening and to some extent redefining the physical and moral borders of “humanity,” having a great potential impact in citizens’ lifeworlds. As body, mind, and technology converge in unlikely ways, the future of “humanity” becomes perhaps more uncertain and fragile than ever before. Citizens should have a say in defining those fragile futures (Nowotny, 2008). In this article, we will argue that being a product of the popular culture, sci-fi has a potential for providing alternative and comprehensive ways of framing ethical issues. Sci-fi novels evoke imaginaries of body, technology, and society. These imaginaries are broad frameworks that refer back to the lifeworlds of individuals and are shared by many. In this sense, they can be seen as encompassing citizens’ concerns; thus, sci-fi can potentially be used to enhance communication between experts and nonexperts and to allow for more inclusive ethical debates. This kind of inclusion can be seen as enabling a socially robust governance of emerging technologies (see European Commission 2001; Nordmann, 2004; Nowotny, Scott, & Gibbons, 2001).

Emerging technologies are here defined as being future oriented and having the “potential to revolutionise our lives or a demonstrated potential to be controversial” (Wickson, Delgado, & Kjølberg, 2010, p. 758). This is clearly the case of cyberspace as introduced by *Neuromancer* back in 1983. The penetration of lifeworlds by computers and ubiquitous systems challenged long-held conceptions of who we are, how we relate to others, and what we can do. For a robust development of emerging technologies, broad societal debates on how they will meet social needs and values are just as needed as they are difficult to instigate (Delgado, Kjølberg, & Wickson, 2010; Felt & Wynne, 2007; Nowotny et al., 2001). As we argue in the next section, in those areas of policy making and public debate where ethics has become central, it is still hard to see how this type of “upstream”¹ debate can be facilitated.

Being future oriented, emerging technologies, and especially body enhancement technologies, are frequently presented as futuristic and promising (see Miah, 2008). Postindustrial economies typically invest heavily in new and emerging technologies, inscribing them with hopes and expectations that often are not redeemed (see, e.g., Krinsky, 2003). Still, in the media but also in “reality,” fiction may become fact (Milburn, 2002; Petersen, Anderson, & Allan, 2005) before regulatory frames are settled and before ethicists or regulators have the time to reflect on the implications of emerging technologies. Interestingly in this regard, while subfields such as nano-ethics are very young (less than 10 years old), sci-fi writers have imagined worlds in which this technology and the human enhancement they enable have been questioned for more than two decades now.²

In considering sci-fi as a means for facilitating ethical debates on emerging technologies, we focus on imaginaries of body enhancement encompassed in a number of novels. We explore how ethical concerns are framed within the imaginary world of the novel, emphasizing that this framing is usually ambivalent, embedded within lived narratives, as well as future and collectively oriented. These imaginaries are intersubjectively shared and enable consideration of the future from the present. Because of these features, sci-fi may be seen to open the way for and facilitate ethical debates on emerging technologies in which not just experts can be included. The arguments of the article are structured in three sections: first, a reflection on imaginaries, the ethics of body enhancement, and sci-fi. The second section of the article is an analysis of three main sci-fi novels encompassing key imaginaries of body enhancement. The last section is a concluding discussion in which we point out how sci-fi can be used to facilitate ethical debates on emerging technologies of body enhancement, potentially contributing to a more robust governance of these technologies.

Science Fiction, Imaginaries, and the Ethics of Body Enhancement

Ethical issues of bodily enhancements have been a topic of modern literature at least since Mary Shelley’s *Frankenstein*. However, as an organized field of scholarly exploration and debate, it only came with the nascent field of bioethics in the 1970s (Jonsen, 1998), which were also the early days of the “biotech revolution.” Paul Ramsey’s *Fabricated Man* counts as one main early bioethical work and dealt extensively with issues of control/loss of control in relation to recombinant DNA technologies. More recently, as other technologies and issues emerged, the field has been joined by other approaches, such as nano-ethics (Kjølberg & Wickson 2007) and the ethics

of ICTs (Tavani, 2007). Bioethical analyses³ have focused on a number of aspects, such as the status of the body, the nature of enhancement, and distributive justice: Is embodiment neutral or does it imply certain values? What counts as an enhancement, as opposed to, for instance, treatment, cure, or therapy? Many debates have also dealt with wider issues of political frameworks: Is the basis of (Western) societies liberalism, libertarianism, or possibly other models? How do we value and discuss the wider implications of enhancement, such as distributive justice and responsibility for harm (see, e.g., Buchanan, Brock, Daniels, & Wikler, 2000)? In addition to such general questions, one may also single out distinct phases of ethical debates about enhancement: As the ethics of enhancement gained momentum, one may identify an “early stage,” stretching from approximately 1980 to 2000. Within this period, debates would revolve around many of the above issues, with the treatment/enhancement nexus as prominent. This was a “posthumanist” phase, importantly because of its emphasis on the human being as one among other entities, natural and technological (Haraway, 1991; Hayles, 1999). Posthumanism opened up a number of perspectives, many also celebrating enhancements. It also allowed for an alternative to the classical view of the liberalist tradition, according to which human is at the apex of all creation.⁴ Artificial intelligence (AI), increased networking, and ubiquitous computing challenge the anthropocentric view of the human being. So, of course, does the creation of cyborgs through enhancement drugs, prostheses, or sensors applied to the human body (Hayles, 1999). Notably, since around 2000, a shift in the discourse can be observed in which an emerging “transhumanist”⁵ strand supervenes on, redefines, or even replaces posthumanist conceptions. Whereas many (not all) posthuman positions would have some affinities with the postmodern deconstruction of central Western tropes (the Subject, Science, Rationality), transhumanism firmly *reinstates* an extreme faith in the capacities of humankind to move beyond given limitations (Schummer, 2004). This could be seen as parallel to the constitution of a new scientific field of possibility—that is, converging technologies. The potential of the technology, taken by its proponents to be great (Roco & Bainbridge, 2003), has introduced issues that go beyond the *limits* of the earlier debate, such as the normativity of the body or treatment versus enhancement, toward issues such as engineered immortality and the Singularity (http://en.wikipedia.org/wiki/Technological_singularity). A debate has emerged between transhumanists on one side and “bioconservatives” on the other (Boström, 2005).

At the same time as human enhancement has thus been vividly discussed in science, literature, and ethics for 40 years, this article argues that ethics, in

many of its forms, may also tend toward a “bracketing out” of certain dimensions central to the communication and deliberation of human enhancement. In most cases, this is connected to the ways in which ethical issues are framed and discussed. We specifically mention the following points:

First, a general tendency of academic ethics literature about body enhancement is that it is relatively disconnected from the concrete science and technology applications in question.⁶ Insofar as ethics (and policy) aim to engage with science and technology development, science and technology cannot be black boxed but must be opened up for questioning. Where such opening up is not accommodated and encouraged, communication may suffer: Scientists define the facts, ethicists define the values, and the “public” then has to make up its mind based on these framings. But how do we know that the facts and values of the debate thus established correspond with the concerns of lay publics and citizens?

Second, there is a need to address the strong future orientation of science and technology. Large-scale research initiatives such as the European Union’s framework programs are predicated on the creation of visions and scenarios as to desired future developments, which are articulated by policy makers, entrepreneurs, and scientific visionaries. However, there is precious little time, space, and opportunity open to wider groups and citizens for imagining alternative futures (Sardar, 2010) or for embedding ethical concerns within futures visions (Rommetveit, Gunnarsdottir, et al., in press). We think ethics debates would do wisely in considering such communicative aspects and not just the “goods” or “bads” of enhancement technologies.

Third, there is also a tendency, introduced in the early days of ethics, of maintaining a strong focus on individuals. Insofar as large-scale technological developments, such as converging technologies, also reconstruct whole communities and groups, the collective dimension should be brought to the fore (Rommetveit, Gunnarsdottir, et al., in press).

We do not claim to have provided a comprehensive overview or critique of the ethics of human enhancement. We do claim, however, that these “framing problems” touch on a number of issues relating to practices of debating and governing human enhancement technologies. With this in mind, we now turn to a closer description of the central proposal of this article: to alleviate some of these shortcomings by the provision of culturally broader framings of ethical issues. We do this through a reading of ethical issues as they emerge in sci-fi literature, using the concept of the imaginary.

Sutrop (2002) says that “fiction has its origins in the act of imagining” (p. 333) and that fiction is an “expression of the authors’ imagination” and, at the same time, “it involves an imaginative response” (p. 343). The act of

imagining, we emphasize, is not the same as speculation or fantasy but is rather a primary way of making sense of the world. In what follows, we will refuse the cultural pull to deal with sci-fi as “literature,” since this risks falling into cultural trap where literature is assigned to the “subjective” and “speculative.” Isaac Asimov (1952) has defined sci-fi as “the only form of literature that consistently considers the nature of the changes that face us, the possible consequences, and the possible solutions, that branch of literature which is concerned with the impact of scientific advance upon human beings” (as cited in Idier, 2000, p. 259). This goes some way in pointing to the “reality dimension” of the genre. However, Asimov’s definition implies that this “reality” resides in predicting the future and the consequences of technology. Instead, we will subsume sci-fi under the philosophical and sociological category of the (social) imaginary. This means treating it as embedded in popular culture *and* as a way to explore sci-fi possible futures. The outcome of treating it as part of popular culture is the potential to see it as referring (back, as it were) to issues, concerns, and developments, not in the future but in the present. This is a broader frame than “the possible consequences and the possible solutions” of technology. Sci-fi, then, becomes one way among others for situating oneself in the present but looking toward the future. It differs from prominent approaches, such as scenario building, insofar as it deviates from the notions of rationality, predictive capacity, and control, implicit in such futures approaches. Sci-fi explores but rarely aims to predict.

Social imaginaries arise when ways of imagining the world and relations in it take on relatively stable collective forms. The “social imaginary” can be defined as collectively imagined forms of communal life that also serve as repositories of meaning and direction for the projection of future action and development (Calhoun, 2002; Taylor, 2004). It is thus a concept that serves to reflect not only existing forms of the social but also ongoing (reflexive) renegotiations and creations of collective trajectories as interlinked pasts, presents, and futures. Frequently (and increasingly), new technologies enter into such creations and negotiations, thus also technologically (re)shaping them. This aspect takes on especially prominent forms in the shaping of technological futures, as implied by Jasanoff’s notion of “sociotechnical imaginaries” (Jasanoff & Kim, 2009).

In sum, the imagination, seen as decoupled from emerging cultural and technological trends, may be assigned to the realm of private fantasy, or “the subjective.” But as we have argued, insofar as it is capable of eliciting imaginative responses, it should also be seen as potentially referring to something more—that is, the social imaginary. Any such relation to reality is not a matter of providing “true prediction” but of exploring complex technological

futures in ways that resonate with the ways in which individuals and groups imagine themselves, others, science, and technology in possible futures.

Imagining Enhanced Bodies and Minds: Cybernetics, Bioengineering, and Nanotechnology.

In this section, we explore imaginaries of body enhancement as they appear in the sci-fi literature. We first performed an exploratory mapping (see the appendix). This mapping led us to two main conclusions. First, we observed a fundamental ambivalence regarding the meanings and value of technologies and body enhancements. Whereas in most novels risk and control appear as crosscutting themes of concern, these novels are not purely utopian or dystopian. The combination of utopian and dystopian narratives can be recognized in sci-fi novels such as *Dawn*, *Do Androids Dream of Electric Sheep?*, *Interface*, *Kéthani*, and *Neuromancer* (see the appendix). This is interesting, we will argue, to the extent that ethical issues emerge in a multiappraisal fashion. Second, our mapping suggested an interesting thematic shift in the sci-fi imagination of body enhancements. In general terms, the sci-fi narratives encompassed within that mapping were concerned about what it means to be human and how the limits of humanity may be transgressed through technological applications on the human body and mind. This comes together with a manifested concern with “freedom of choice,” as a general theme. It can be said that these novels share a thematic posthumanist focus (see also Bukatman, 1993; Hayles, 1999; Vint, 2007). But as already noted, a significant thematic shift has taken place: During the late 1990s and 2000, “freedom of choice” is emphasized and a renewed focus on “immortality” can be observed.⁷ This has gone together with the emergence of the transhumanist movement and a new technological field, converging technologies. In a sense, while the 1980s was the time of the cyborgs, the 1990s and 2000s seem to be the time of the superbodies and superminds. As mentioned above, a similar emergence can be mapped within the ethics literature with the appearance of a transhumanist focus since around 2000. Taking this observation and our point of departure, we selected three novels from our mapping (see the appendix): *Neuromancer* (Gibson, 1983), *The Player of Games* (Banks, 1988), and *Kéthani* (Brown, 2008). These novels correspond with the emergence of three specific technological fields: cybernetics, bioengineering, and nanotechnology. We provide in-depth descriptions of these

three novels, focusing on imaginaries of body enhancement, and we explore how ethical issues are framed through those imaginaries.

Neuromancer: "The Disembodied Self"

Being a widely acknowledged and celebrated novel, *Neuromancer* anticipates a prominent image of a postindustrial society: a corrupt world dominated by large corporations in which control over information is crucial. In 1983, Gibson for the first time used the concept of "cyberspace," defining it as a "collective hallucination," a matrix of virtual reality. The central narrative of *Neuromancer* tells the story of Case, a "cyberspace cowboy." The "disembodied body" is a key image in the unfolding of the narrative and the dual realities of cyberspace and the material world central elements in the sociotechnical imaginary evoked by it. When Case connects to his deck and jacks into cyberspace, he is liberated from the limitations of "the flesh" (the body). Hacking into cyberspace is digital enhancement, as it allows for increased capacities and agency in the material world also. Through cyberspace, Case tries to recover the "value and meaning" (Csicsery-Ronay, 1992, p. 221) of his existence. Gibson's novel brings to mind suffering, risks, and moral dilemmas related to that disembodied existence. Notably, Case's girlfriend, Linda Lee, has been killed, and he can only reunite with her in cyberspace. But of course she is not the *real* Linda. Case is addicted to cyberspace as well as normal drugs, and for this he suffers. Cyberspace appears as a mixed metaphor for freedom, resistance, control (Tomas, 2007), and fate.

Neuromancer evokes rich imaginaries of future technoscientific developments by combining technological celebration with a "future shocking ambivalence" (Bukatman, 1993, p. 146). Case's story is situated in the future world of the "Sprawl" a high-tech corrupted society in which big corporations compete for the control of cyberspace. Consoles, neon lights, pink temperfoam, fiberoptics, carbon sockets, and "mimetic polycarbon" suits are just some of the "Sprawl" images evoked throughout the novel. Detailed descriptions of the virtual reality of cyberspace are also provided by Gibson (1983):

a forest of mathematically generated ferns, demonstrating the spatial possibilities of logarithmic spirals [. . .]. A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. (p. 51)

These detailed descriptions may produce a “convincing” effect on the reader; nevertheless, in these descriptions, the technology remains underdetermined. Indeed, Gibson defines cyberspace as “pure possibility,” its implications as highly uncertain. Accordingly, the value and role of this technological development are presented in an ambivalent fashion. On the one hand, cyberspace enables corruption; on the other, through cybernetic disembodiness, hackers can get rid of the limitations of the “flesh,” increasing their capacities to fight the big corporations. Cyberspace comes through as a symbol of freedom and oppression.

Neuromancer includes rich descriptions of body/mind enhancements. The novel starts by describing how Case once had a better life as a cyberspace cowboy. However, when he stole from his employees, they retaliated by damaging his nervous system. As indicated in the fragment introducing this article, Molly, the ninja razor girl, gives Case an offer that is just as desperate as it is hard to refuse: “I’m collecting you for the man I work for [. . .] You look like you like to take stupid chances,” she says. Case will make his choice, accepting to start working for a suspicious character (Armitage). This triggers a number of problems and ethical dilemmas. Armitage’s body has been taken over by Wintermute, a highly powerful AI. He fixes Case’s nervous systems. But when Case is operated, the surgeons implant sacks of dangerous chemicals in his blood vessels. This modification is the means Wintermute uses to ensure that Case will conform to its plans. *Neuromancer*’s other main character, Molly, also has a modified body (see the introduction). Both Molly and Case work for Wintermute. At the same time, they desperately try to fight it and escape from it. They can communicate through “simstim,” a technology through which Case can “jack” into Molly, flipping into her “sensorium.” Molly becomes the body that carries Case’s disembodied consciousness. Some scenes in *Neuromancer* evoke even more extreme images of disembodiness as a kind of problematic enhancement. This is the case for the other two characters that, together with Molly and Case, make up the team working for Wintermute: Riviera and Dixie. Riviera has had extensive brain implants, and he can create symbols to communicate with and manipulate others. He projects holograms onto his victims’ retinas. Dixie, an ex-cyberspace cowboy, has become a “flatline construct.” During a “run” in cyberspace, he went too far and got his brain “fried.” Now he is just a virtual existence in cyberspace. This character serves as a kind of reminder of the limits of cybernetic disembodiment.

Looking at the stories of these four characters, it can be argued that “*Neuromancer* does show the consequences of forgetting that we are embodied human beings” (Vint, 2007, p. 112). Even more, it addresses this issue as

a complex problem, approaching it from multiple points of views and life experiences. Yet, we will argue, it allows for ethical questioning while avoiding giving definitive answers. This can be seen in connection with the ambivalence in presenting the role and value of technology indicated above.

Disembodiment being a key topic, *Neuromancer* provides multiple images of enhancements in a future society, the Sprawl, in which the body has become a matter of free choice, “an infinitely malleable accessory” (Vint, 2007, p. 23). In the Sprawl, cosmetic implants are easily affordable; there are all kinds of drugs to provoke and treat deficiencies; cryonic technologies allow immortality for the wealthy classes and memories can be uploaded to computers; and software programs can be installed so that people can select their memories and mind processes, to mention just a few examples. Related to these technological developments, a number of ethical concerns are explicitly articulated or implicitly suggested by the narratives. These are related to addiction to virtual reality, immortality, drug abuse, individualism, property, and patenting. For instance, while working for Wintermute, Case is interrogated by the “Turing Police,” a special AI surveillance division: “We know how you were repaired in Chiba,” Michèle said, “and that may have been Wintermute’s first mistake. The process employed on you resulted in a clinic’s owner applying for seven basic patents. Do you know what that means?” Gibson poses the questions and leaves it open to the reader. In a different episode, Molly recalls how before she was enhanced to be a razor girl she was a prostitute. In the Sprawl, prostitutes at work are switched to virtual reality programs so that afterward they cannot remember what they did during working hours: “You aren’t in, when it’s all happening. ‘House’ has software for whatever the customer wants to pay for . . .” Molly recounts. To what extent is this practice ethically acceptable? Gibson does not formulate this question explicitly, and even less does he provide any definitive answer to it. He presents an “as if” situation, pushing the reader to ethical questioning by displacing the issue of prostitution to the world of the Sprawl, particularly through Molly’s personal experience.

Molly’s story is a good example of how ethical issues are framed within *Neuromancer*’s imaginaries. Gibson imagines possible technological developments, and he suggests links between them and a number of ethical questions (individualism, addiction, prostitution, etc.). These issues are already known to the reader. The air of familiarity becomes even more apparent as they are translated into personal concerns, embedded in the life experience of particular characters. However, these issues are displaced and resituated in a future world, taking on new meanings and allowing for new ethical questions to emerge. Displacing these issues and resituating them in the future world of

Neuromancer “makes sense” insofar as reader and author share, at least to a certain extent, an imaginary of a society in which having a virtual life through cyberspace and software developments is increasingly part of everyday life.

The Culture: “Freedom of Choice, Freedom of Morphology”

“Freedom of choice, freedom of morphology” is the key imaginary of body enhancement in the novels of “the Culture.”⁸ The theme had appeared before in novels such as *Neuromancer*, but in the novels of the Culture, and particularly in *The Player of Games*, it becomes central. In a sense, this can be interpreted as being a transhumanist series of novels for they suggest that bodies and minds of the future will be perfect, perfection being a normal state of being.

The Player of Games is situated within an imaginary civilization called “the Culture.” This is a utopian high-tech civilization, the imaginary landscapes being inspired by bioengineering and geoengineering. Nature is modified and recreated to the extreme: new islands, mountains, and planets being man designed. The imaginaries of “the Culture” are much more organic-like than those of *Neuromancer*. “Genofixing” is a normal practice in the Culture: Bioengineering methods enable citizens of the Culture to freely choose their body shape. In this future civilization, there is no pain, no old age; and ugliness is merely an exotic characteristic that can be fixed at any time. Citizens of the Culture have been enhanced with glands that enable them to produce drugs when they feel sad or depressed. The Culture’s members can even choose to change their sex regularly. The novels of The Culture bring the reader back to a theme that is also central in *Neuromancer*: “getting rid of the flesh.” However, in the novels of the Culture, the body–mind dualism is articulated through a different imaginary, as freedom of choice is the central ruling principle of The Culture.

In the Culture, bodies are contingent, they have a precarious status. The mind is the stable niche of human identity, where the possibility of rational choice resides. The result of this extreme freedom of choice is extreme diversification of body shapes and, therefore, an eradication of social distinctions based on biological differences. For instance, there is no gender distinctions, since male/female is just a temporary state. But, as Vint (2007) has argued, under this surface narrative, the reader can recognize a number of less explicit counternarratives that problematize the Culture’s extreme freedom of choice and body modifications. First, the main characters of these novels are presented as feeling uneasy or bored with this perfect and overnormalized society. Furthermore, the Culture shares the galaxy with other

less technologically advanced societies that are presented as morally inferior. The Culture aims at expanding its empire, the colonizing plan being justified by moral and technological superiority. Vint argues that “the tension between the ideals ‘the Culture’ represents and the narrative focus on its periphery suggests that part of what these novels are doing is critiquing the limitations of this sort of liberal humanist utopia” (p. 84). Yet, even whenever challenges, conflicts, and dilemmas are presented, no definite answer “is ever provided” (p. 87).

We will focus now on one of the novels of the Culture: *The Player of Games* (Banks, 1988). Games are central to the social organization of the Culture. Game players have an important status in this society. They enjoy a special type of enhancement for the particular purpose of playing games:

Sharp Blue was a game player’s secretion, a product of standard genofixed Culture glands sitting in Gurgerh’s lower skull, beneath the ancient, animal-evolved lower reaches of his brain. The panoply of internally manufactured drugs the vast majority of Culture individuals were capable of choosing from comprised up to three hundred different compounds of varying degrees of popularity and sophistication; *Sharp Blue* was one of the least used because it brought no direct pleasure and required considerable concentration to produce. But it was good for games. What seemed complicated became simple; what appeared insoluble became soluble; what had been unknowable became obvious. A utility drug; an abstraction-modifier; not a sensory enhancer or a sexual stimulant or a physiological booster. (Banks, 1988, p. 9)

Gurgerh is the main character of this novel. From the very beginning of the novel he has to face a dilemma: as presented above he is enhanced, but using this enhancement in certain settings will be considered as cheating. Gurgerh cheats in an important game. He is discovered by an agent of the government (a droid). The droid starts blackmailing Gurgerh. He could compromise Gergeh’s reputation if Gurgerh does not take part in an important mission. Gergeh accepts not only because of the blackmailing but also because he is bored of his unsubstantial existence in the Culture. Hence, he gets enrolled in a 3-year trip toward the Azad Empire. During this long space journey, Gurgerh is trained by “a Mind” (a supercomputer) to understand the Azad Game. The game organizes the whole Azad society by placing different

people in power positions. In the last instance, the game determines who will be the next emperor of Azad.

The Azad civilization is presented as a contrast to the Culture: It is primitive, totalitarian, and brutal. Azad people are determined by their bodies: sex and skin color being main marks of social distinction. The Azad also have a developed knowledge on gene modification, but they have used it in a way that differs to a large extent of the “freedom choice/freedom of morphology” uses of the Culture. Gene modification was used by Azad authorities to eradicate undesirable body features and with the aim of creating an idealized Azad race. The imaginary confrontation of the novel can be read as a metaphor of old versus new eugenics. The body, either as something to be repressed and stabilized or as infinitely malleable matter, is at the core of the ideological confrontation between the Culture and the Azad Empire. This ideological confrontation manifests in the course of the Azad Game, as played by Gergeh. As the game progresses, he realizes that at the basis of each player’s movements and strategies reside their fundamental values and ideological commitments. Sending Gergeh to play the great game of Azad is a colonizing strategy of the Culture. However, at least in the beginning of the game, Gergeh is attracted by the playing styles of the Azad. This introduces a reflexive moment in the narrative: Gergeh is skeptical of his own culture, which nevertheless becomes his ultimate choice. Enacting the liberal ideals of the culture, he beats the Azad.

The central technology of enhancement presented in the Culture is “genofixing”; this is an imagined future technological development, inspired by extreme bioengineering. The book speculates on how society would be if genofixing becomes a normal practice. In emphasizing extreme bioengineering, the novels of the Culture seem to anticipate some current trends and approaches in synthetic biology. For instance, the glands that allow people to produce substances to control their moods call to mind the personalized therapies projected by some schools of synthetic biologists. As described in the literature, these therapies often rely on a sensor-response mechanism: Synthetic sensors will allow the release of certain chemical substances when cells need therapeutic treatment (Church, 2010). Of course, synthetic biology is still at a very early stage of development, and personalized therapies are still no more than promises. However, written in the late 1980s, *The Player of Games* can be seen as raising important ethical questions regarding the development of this type of extreme bioengineering.

Interestingly enough, in *The Player of Games* as in other sci-fi narratives,⁹ broad-scope ethical questions on human nature and the human condition often come shaped as particular concerns (presented as problems and dilemmas) embedded within personal stories. In this novel, Gergeh's concern about "doping" in games raises further general questions of justice and equality. Generally, sci-fi narratives do not present definitive answers to those problems and dilemmas, but they present them in complex ways, bringing together individual and collective dimensions. In the next section, we elaborate on this point by providing a thick description of the novel *Kéthani*.

Kéthani: "The Immortal Body"

The imaginary world of *Kéthani* is the Earth in a near future. The "Kéthani," an alien civilization, are colonizing the entire galaxy. The Kéthani towers are main symbols of this colonization. In the imaginary landscapes of the book, thousands of these icelike towers are standing on the surface of planet Earth. The Kéthani towers are white, sharp, metallic, and powerful and of a "nonhuman" beauty to which humans feel magically attracted. The towers are "stations" where dead people are brought for their resurrection. The so-called returnees are brought back to life with bodies and minds enhanced. Trained in Kéthani Zen philosophy, they are calm and peaceful young people who are sent as ambassadors of the Kéthani to other planets and stars. Within the narratives of Kéthani, the immortal body emerges as the key imaginary. Immortality is presented as the "gift" of the Kéthani. Nanotechnology implants are the technological development that makes this gift possible. The novel projects an imagined future development of an already existing technology: The nanotech devices can store people's memories and DNA so they can be resurrected. Interestingly, the novel does not provide a factual description of nanotechnology implants. They are presented as metaphors: as the symbols of immortality. Within the narratives of Kéthani, the technology remains indeterminate; its possible implications are suggested, but still uncertain. When individual persons are offered the possibility of being implanted, they are pushed into making a choice that will radically change their lives. Embedded in the life world of a number of characters, the book presents a series of problems and dilemmas articulated on the basis of a fundamental tension: Is death a limit to human freedom or is it the *sine qua non* condition of humanity? What is the meaning of life when there is no death? In several passages of the book, this tension is articulated as a confrontation. On the one hand, there are those who believe that "it is a paradox: it took an alien race

to invest us with humanity” (p. 166)—meaning that the returnees are indeed enhanced humans. On the other, there are those who argue that the returnees are “less human,” as basic features of the human condition, such as emotional attachment, unconditional love, fear and the capacity to commit oneself “forever,” are distilled or have simply disappeared within the aseptic world of the Kéthani.

As in *Neuromancer* and *The Player of Games*, general issues related to what it means to be human are often presented as individual concerns, embedded in personal narratives. The main characters of *Kéthani* are a group of friends from a rural village in Northern England. They have weekly meetings in the local pub in which they talk about how the new Kéthani implants have changed their life and the new social problems and advantages that they are bringing about. In their everyday life, these friends relate to the new technology in a variety of ways: For instance, Lincoln, a 40-year-old melancholic man, becomes a “ferryman.” He transports the dead corpses to the Kéthani station. Because of his job, he encounters the family of the dead and has conversations with them about how they have experienced the nanotechnology implants. Another example is Khalid: As a medical doctor working in the county hospital, he has specialized in implanting the Kéthani devices. He is confronted with a series of dilemmas, the life of some of his patients being at stake. At some point, all of these friends have to face the personal dilemma of whether they want to be implanted. They respond to the implants in a variety of ways, using a set of different arguments to justify their choices. Distrust, religious beliefs, and fear of a superfluous existence are presented as main reasons against the use of nanotech implants. Another recurrent reason is identity loss: To what extent are people changed through the resurrection process? Are identities just standardized, all the returnees taking on the same calm, peaceful, and wise personality? As indicated above, freedom of choice leading to a society free from social diversity and distinctions is a central theme in *The Player of Games*. In *Kéthani*, this utopia is also questioned, by contrasting it through a number of counternarratives. For instance, in a fragment of the novel, Elisabeth, one of the main characters, explains why her mother refused to be implanted: “I think she foresaw humanity becoming complacent, apathetic with this life when the stars beckoned” (p. 243). In a variety of ways, the narratives of *Kéthani* invite reflection on what human life could be without death.

In *Kéthani*, as in *Neuromancer* and *The Player of Games*, ethical concerns take on a complex framing. The narratives of the novel bring together individual and collective dimensions of ethical issues in at least three ways: First, by the use of personal narratives, the reader is invited to consider

ethical concerns from the “estranging” point of view of the other. This kind of perspective shift can be seen as stimulating reflexivity. Furthermore, ethical concerns are frequently framed from the different perspectives of a number of individual characters that have to deal with the same general problem (i.e., immortality). Embedded in the particular lifeworlds of these persons, general ethical issues appear as particular ethical concerns. Particular concerns may also be approached from a range of viewpoints. Even when these stories are articulated as personal narratives, they are also frequently approached from a collective perspective. For instance, in *Kéthani*, the group of friends sometimes talks about specific personal dilemmas (i.e., nano-implants as hope for the father of an ill child; the mother of the child being a religious person, she does not allow the child to be implanted) and sometimes about immortality as having a more collective dimension (is it “a gift for humanity”?). Seen through this kind of “multidimensional appraisal,” the different angles and complexities of an issue may become more apparent.

Finally, most sci-fi novels are future oriented, which adds more layers of complexity to the multidimensional appraisal presented above. In *Kéthani*, the framing of ethical issues is future oriented in at least two ways: First, the book speculates about future developments of an already existing technology. Second, in *Kéthani*, ethical issues are framed in innovative and speculative ways (differing from how these concerns usually appear both in everyday life and in the ethics literature). For instance, issues and concerns referring to immortality converge with issues of colonization and split identities. To sum up on this point, sci-fi novels confront the reader with “what if” situations: What if we can live in cyberspace? What if we can freely choose the shape of our bodies? What if we become immortal? In doing so, these narratives open up ethical debates on social issues that may be still to come but are already a matter of public concern, echoed in collective sociotechnical imaginaries to which we now turn.

Concluding Discussion

In the previous sections, we have singled out a range of ethical issues and concerns as found in the sci-fi literature. Our interest focused on *how* concerns appear framed within this literature. In this section, we point out how sci-fi could provide a different approach to the discussion and communication of ethical issues and concerns. We have highlighted two related factors: First, it provides wider frames than those normally found in ethics. Second, it may do so in ways referring to something that is nevertheless real and intersubjectively shared, that is, the collective imaginary. We must now expound some more on these two points.

Concerning the framing, we found an interesting distinction and relation: In sci-fi novels on body enhancement, general ethical issues are frequently articulated as particular concerns embedded within lived biographic narratives. Inversely, particular concerns refer to larger ethical issues. We shall take this argument a bit further: sci-fi narratives (as other fictional subgenres, e.g., myths and tales) oscillate between “private” concerns (i.e., Molly’s personal concern about her profession) and “public” issues (i.e., prostitution). Thus, sci-fi imaginaries can be seen to provide a multilevel translation between different spheres of social life, which often remain disconnected within conventional ethical approaches to enhancement and emerging technologies. This, then, may counter the overtly individualistic framing frequently provided within conventional ethics of enhancements.¹⁰

A second general remark: Through the imaginaries of body enhancement that we have considered, issues and concerns are often articulated in ambivalent and unspecified manners. The articulation in question frequently remains implicit and so leaves much to be defined by the reader himself or herself. The metaphorical character of even the most vividly described sociotechnical landscape both constrains and enables ethical questioning. This may be seen as a shortcoming and one that further accentuates the tendency noted within ethics: distancing oneself from the science and technology by black boxing it. However, in the case of sci-fi this is not necessarily so. One should note on the future orientation of the genre: It is obviously difficult to give concrete content to a technology that is, as yet, nonexistent or barely thought of. However, there are no built-in hindrances in sci-fi from delving into technical issues; the “triggering function” of sci-fi, then, may also invite imagining and debating concrete technical questions as they might emerge in future applications. Especially the tech-savvy reader is then invited to “fill in” the black box rather than leaving it closed and this at stages of development where the facts of the matter are not (yet) hardened so as to seemingly exclude normative concerns.

Thus, and this should hardly come as a surprise, sci-fi does provide an alternative, in the sense of broader and more encompassing framing of ethical issues of science and technology. We now turn to the second of our claims, namely, that its reference to the social imaginary enables this function. The imaginary provides such wider frames with reference points to shared experiences, perceptions, and visions of sociotechnological developments. This claim, along with the conception of imaginaries as many-sided and complex entities, can only be substantiated through interpretations that aim toward situating the imaginaries studied in this article within broader sociotechnical trends. To demonstrate this, we can only proceed

by *hinting* at some of the ways in which sci-fi refers or points to “real-world issues.”

Let us first return to *Neuromancer*, which may indeed prove the easiest case in point, the proof being its role in calling into life the concept of cyberspace. But the relevance of the book stretches further. Whereas the knotty lives of Case and Molly are indeed what make up the general story line, the problems they meet are only instantiations of a more general problem complex related to perceptions of disembodiment and information control. There are good reasons for claiming that the world(s) described in *Neuromancer* prefigured central aspects of the reality that we are now living, more than 25 years later. Again, we are not only referring to cyberspace as image and concept but to a whole cluster of technoscientific developments that has come along with it: Through genetics and genomics, embodied being is commonly and unambiguously understood as information and code. These developments were intimately tied to the emergence of the computer (Kay, 2000). At a later stage, thought, personality, and identity have come to be seen as attributes of information processing (Pinker, 1997). Human processing of information, where it cannot be directly related back to its genetic origin, is increasingly located in the brain through new imaging technologies (Dumit, 2003). There is little room for irony or attention to metaphor to be found at the center of this discourse: Bodies and minds *are* information. This view we also find in more speculative proposals, such as that of “uploading” human consciousness to computers.

For us, the crucial point is not whether Gibson was able to foresee or predict a number of technological developments. The relevant issue is the extent to which *Neuromancer*’s images and imaginaries, and the ethical questions they trigger, can be recognized as existing in other parts of institutionalized and popular cultures. We believe they do. For instance, in the academic literature we find increasing discussions about the role and status of “data doubles” (Poster, 1990). These are digital versions of people’s selves made possible mainly through large databases with far-reaching real-life implications (see, e.g., Lyon, 2001). On the side of popular culture, it is not difficult to track the imaginary of disembodied selves as invoked by *Neuromancer*. The novel has been widely recognized as a main catalyst for the cyberpunk movement, strongly related to the development of informatics and the “cyberculture.” Guided by ideals of “high-tech and low life standards” it actively opposes megacorporations and information control. The flashy Times Square in New York can be seen as an example of cyberpunk aesthetics in urbanism. In music, there has been a proliferation of cyberpunk bands

during the 1990s such as Atari Teenage Riot¹¹ and Sigue Sigue Sputnik. As can be seen from these examples, and as with the narratives of *Neuromancer*, this “movement” ambiguously combines technological celebration and contestation, confirmation of power, and subversion. Interestingly, as part of the “cybercultural” emergence, a number of new “publics” have emerged, such as gaming and hacker communities. Such fluid communities and publics have led actions against private databases and the privatization of information. New online communities are coming into being on a daily basis, and people construct alternative lives and avatars. New identities are constructed promoting a kind of free-floating, separate existence (Second Life) in cyberspace. As in *Neuromancer*, virtual existence is becoming a need, in some cases even an addiction.

Ian Banks’s (1987, 1988, 1990) novels of the Culture evoke other images and associations. Written during the last half of the 1980s, the bustling consumer culture of that decade stands out as one reference point. Aspects of that culture are then extended to bodily culture more directly: The book makes the leap from freedom of choice as found in consumerism to the concept of “freedom of morphology.” Thus, in one sense, the Culture novels could be seen as mere linear intensifications of already-present tendencies: consumer freedom applied to the results of scientific and technological progress, to the extent that any body modification is up for grabs—tattoos, energy drinks, antidepressants, anti-oxidants, enhancement drugs, and so on. However, in at least one central point, Banks’s novel abruptly breaks with any simple linear extrapolation of the present onto the future and constructs a counter-story to consumerism. Banks’s utopian society is not one of present capitalist production, consumption, and competition over scarce and limited resources but rather one in which society is marked by an economy of abundance and sharing (mediated through a central computer brain acting as a kind of global manager). Just as its inhabitants have gotten “rid of the flesh,” so they have rid themselves of scarcity. The Azads, on the other hand, suffer because they are stuck in a strongly hierarchical society of limited resources and competition. Within this imaginary, many of the premises for discussing social justice and injustice as it appears in ethics debates of the present seem redundant. This invites us to see the ethics question in a new light: How would enhancements look in a society not marked by capitalist production, aiming for maximum profit and output, for outdoing competitors in something resembling a civilized state of war? The Culture novels (and other sci-fi novels) raise ethical questions through reference to something all too familiar—consumer society and capitalist relations of production and

distribution—but give it a new twist: Imagine that technology is freed from these restrictions and works for the good of all in a society of abundance. This, again, may sound speculative. But the fact remains that societies of so-called postscarcity have been discussed in sci-fi for a long time (http://en.wikipedia.org/wiki/Post_scarcity). What is more, established theoreticians, such as Anthony Giddens (1996), use the term to refer to tendencies he sees as present today, such as the preoccupation with “life politics.” Finally, if one searches the Internet, the number of people seriously arguing that the present economic crisis marks a decisive step from scarcity to abundance and postscarcity is significant.

Finally, coming to *Kéthani*, we must ask the question: What could the current fascination with *enhancement as immortality* possibly mean? The question is anything but new: It is the continuation of the age-old alchemist dream of eternal life. Immortality is much more likely to evoke religious connotations than scientific ones, and so the specific configuration of immortality through transhumanist discourse promoted through science and technology may be seen as novel. Thus, one interesting question is this: Why this collapse of boundaries between science and religion at the outset of the 21st century? Because of its relative novelty, the question is difficult to entangle; it is certain to have connotations beyond the confines of this article. Let us just briefly point to two possible issues: First, there are the enormous powers imagined to be inherent to the intentional convergence of powerful but mainly separate technologies, already mentioned earlier in this article. Second, links may be drawn to a number of technologies relating to aging. Indeed, it has been suggested that we live in “The Era of Anti-Aging Technology” (Hepler, 2006). Some of these technologies are explicitly aimed at alleviating problems related to increasing aging populations and a lack of care personnel in the West, such as care robots and telemedicine. One may also point to other, more profane technologies, such as antiaging cosmetics and antiaging treatments. Medical doctors of a humanist bent have long noted (and criticized) the tendency within Western societies toward avoiding issues of illness and death (see, e.g., Cassell, 1991) and toward how science and technology may serve as means for avoiding topics with which we are uncomfortable through their rationalization. If it is true that old age and disease are on the increase in the West, a natural solution would seem to try and overcome it through technology. Thus, enhancement as immortality, we suggest, can be seen as residing at the interface of two strongly opposing social tendencies: the creative potential imagined in converging technologies and the facts of demography, according to which populations are growing older. To be

sure, we do not thereby claim to have unpacked the immortality imaginary; for instance, it would remain to ask why younger generations also take an interest in transhumanism.

Through the discussion of *Neuromancer*, the Culture novels, and *The Player of Games*, we have pointed out ways in which the imaginaries encompassed within sci-fi evoke and project toward the future ethical issues that already exist “out there” in society. These issues are framed in complex ways: presenting emergent technologies in an ambivalent and underdetermining fashion, embedded in imagined worlds and in personal narratives, bringing together individual and collective dimensions of ethics, oriented toward the future but relevant to the present. Because they evoke shared imaginaries, sci-fi novels appear as useful for triggering debate on new technologies: Citizens can potentially identify themselves with the technological choices and concerns presented in those novels, adopting, reframing, or contesting them. The latter is possible because sci-fi does not provide readymade answers. It is not based on facts, but rather it presents “as if” situations, allowing for inclusive and contextualized ethical debates. As argued, in discussions about new technologies with unknown implications, citizens are more likely to get engaged in broad debates on “what kinds of world do we want to live in? And what is the role of particular emerging technologies within those desirable and undesirable worlds?” than in specialized debates on the concrete developments of a certain technology (Wickson, 2008; Wynne, 2006). In that kind of broad scoped debate, sci-fi can be used as an ethical tool toward a more robust governance of emerging technologies.

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Appendix

In selecting these novels, we have applied criteria of public recognition and reception. We have included award-winning novels and authors, novels that repeatedly appear in Internet science fiction forums and wikis as well as novels from the Europe (mainly the United Kingdom) and the United States. We have included novels published from 1896 onward insofar as they are still best sellers.

Sci-Fi Literature Mapping

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>The Island of Dr. Moreau</i> (1896, Wells)	Shipwrecked protagonist meets hybridized animal/human experiments. Failure of conditioning vivisection as transgenetic technology.	Biotechnology ^a	Medical	Identity (transgressing the limits of the "human")
<i>Brave New World</i> (1932, Huxley)	In a futuristic society, social control is carried out through engineering. From embryos to adults, people are manipulated (stimulated or retarded) through the use of chemical substances. Traditional and family values have disappeared. Bernard and other unique characters struggle with this society.	Biotechnology	Medical and political	Social control (society vs. individuals, violence) Social inequality (class)
<i>Limbo</i> (1952, Wolfe)	Martine is a veteran of World War III and a neurosurgeon. Back home he proposes a new doctrine: The "new men" must amputate their arms and legs and substitute them with cybernetic prosthesis in order to avoid war. They will eventually find out that the body is not the source of aggressiveness.	Cybernetics	Political	Violence control

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>To Live Forever</i> (1956, Vance)	Galvin is an Amaranth, a superior class that has the privilege of immortality through clonation (they copy prototypes and keep memory banks). Galvin murders another Amaranth. Masquerading as his own (blameless) clone, he tries to find a place in society.	Biotechnology	Medical	Immortality Lost identity Class inequality Overpopulation Intergenerational disorders
<i>The Ship Who Sang</i> (1961, Caffrey)	Helva is a gravely ill girl. Her parents refuse euthanasia. They accept that the healthy mind of the girl was separated from her ill body. The mind of the girl will control a spaceship, so that the ship becomes the Helva's new body.	Cybernetics	Medical	Life span extension/ immortality
<i>The Immortals</i> (1962, Gunn)	A millionaire takes a blood transfusion. The donor is the first immortal, possessor of a mutation that produces an antiaging effect. Marshall, the immortal, knows that he will never die and so he will never live. The millionaire soon gets into trouble.	Biotechnology ^a	Medical	Immortality Class inequality
<i>Do Androids Dream of Electric Sheep?</i> (1966, Dick)	Androids have been created to serve humans. However, they have become so enhanced that they are not easily discernable from humans. Distinctively, androids do not have empathy (i.e., toward animals). Willing to be fully humans, a group of androids rise against their master, Rick Deckard must track and hunt those androids. Questions and doubts come to his mind when he falls in love with Rachel, one of the androids.	Biotechnology Cybernetics	Political/social	Life span extension "Humanity" status Identity (empathy) Social distinctions "Animals" status

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>The Left Hand of Darkness</i> (1969, Le Guin)	Genly Ai is an emissary from the human galaxy to Winter, an exotic arctic world in which there are no sex differences. Genly is sent to exchange ideas and technologies with them. He will have to understand their culture, overcoming his prejudices.	Biotechnology	Social/ political	Social distinctions (gender)
<i>Bug Jack Barron</i> (1969, Spinrad)	Barrow (popular TV presenter and Social Justice Coalition founding member) and Howards (billionaire director of the nonprofit Foundation for Human Immortality) get entangled in a political battle as Howards wants to get the legal monopoly of freezing people to turn it into a "public utility." Things get progressively more complicated and corrupted.	Nanotechnology (cryonics)	Medical	Immortality
<i>Cyborg</i> (1972, Caidin)	Steve is an astronaut pilot. He has an accident during a flight and gets gravely injured. He attempts to commit suicide. He is rebuilt and turned into a bionic being. As a cyborg agent, he is sent to the Middle East to fight Islamic extremism.	Cybernetics	Political	Social/violence control
<i>Riding the Torch</i> (1974, Spinrad)	Survivals from Earth travel in the last spaceship. They are searching for a new planet to inhabit. They discover there is no other inhabitable planet. They will have to communicate the news through the "senso."	Biotechnology Cybernetics	Medical Social	Communication Extinction

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>The Shockwave Rider</i> (1975, Brunner)	In a near-future society, a universal network of information is dominated by corporations. Everyone's information can be known and controlled. Nickie Hallinger is a computer genius. He plans to save the world, replacing the political system with direct democracy through the Internet. He uses his talents to switch his identity and escape the government.	Cybernetics	Political	Privacy/security (information control) Identity (mind/body)
<i>Man Plus</i> (1976, Pohl)	In order to explore Mars and adapt to its life conditions, homo sapiens must be biologically modified.	Biotechnology	Political	Expanding the geographical limits/conquering Marginalization of modified humans Corruption and information control Identity (disembodiment)
<i>Neuromancer</i> (1983, Gibson)	Multinational corporations with Artificial intelligence and biotechnology rule. Case is a computer hacker. Case meets the wrong people, he is deleted from cyberspace, and he loses his skills. He gets the chance of restoring his life by taking part in a conspiracy.	Cybernetics Biotechnology	Medical	

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>Blood Music</i> (1985, Bear)	Vergil Ulam, a genetic engineer, carries out a private research project. He injects himself with microscopic biological computers. By accidents these live computers take his body and, eventually, they spread out, infecting and transforming the whole planet. People who have been infected develop a new structure and consciousness.	Biotechnology Nanotechnology Cybernetics	Medical	Technology out of control (risk of extinction) Evolutionary transcendence
<i>When Gravity Falls</i> (1987, Effinger)	Dominant tech culture is Muslim, while Europe, Soviet Union, and the United States have disintegrated. Marid Audran is extensively enhanced to investigate series of crimes. He must track down the most brutal psychopathic killer.	Cybernetics	Political Social	Identity Violence control
<i>Great Sky River</i> (1987, Benford)	Background of "Mech" civilization, which is dominant and trying to wipe out human/bio civilization. Humans are mechanically and cognitively enhanced. Memories of dead are stored electronically and embedded in brains of live humans.	Cybernetics Biotechnology	Political/social	Political control (geographical expansion/extermination of human species)

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>Dawn</i> (1987, Buttler) ^b	Lilith is a survival of the almost extinguished human species. The Oankanli are an alien species. They enhance their bodies through advance genetic engineering. Because of extreme genetic enhancement, they have lost their genetic diversity and ability to adapt. They need to exchange genes with other species. Lilith faces the choice of trading her genes. In return, she and her half-Oankanli children would receive privileges of enhanced health.	Biotechnology	Medical Social	Evolution disorders/ extinction Adaptability Social differentiation
<i>Player of Games</i> (1988, Banks)	Gergeh is a brilliant player of games in The Culture, an egalitarian and peaceful society. He is sent as a special agent to the primitive Empire of Azad. Inequality and violence characterize this society. Social status is determined through the game of Azad. Gergeh agrees to play the game. Facing his opponents, he understands the logics of the game: The values of the players (equality/inequality) inform their strategies.	Biotechnology Nanotechnology Cybernetics	Social Political Medical	Cheating in games Hedonism Social equality Colonization
<i>Buying Time</i> (1989, Haldeman)	The "immortals" are wealthy people who can afford periodical medical treatment that would allow them to prolong their lives or even become immortals. Barr is one of them. He has the opportunity to become part of the immortals' elite, but as he becomes aware of the conspiracy to take control over the secret of immortality he runs away.	Biotechnology	Medical	Life span extension Class inequality

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>Frankenstein Unbound</i> (1990, Aldiss)	The 20th-century protagonist confronts the environment of Mary Shelly (creator of "Frankenstein") and issues of her time.	Biotechnology ^c	Medical Social	Immortality Technology out of control
<i>Use of Weapons</i> (1990, Banks)	The "Culture" is a colonizing and utopian interstellar society inhabited by humans, drones, and artificial intelligence machines. A large variety of enhancements are practiced in this society. Cheradenine, a citizen of a technologically underdeveloped civilization, is hired by the culture as a special agent to influence conflict in several planets. He reflects on his difficult past in his primitive society. He will have to measure the use of weapons.	Biotechnology Nanotechnology Cybernetics	Social Political Medical	Social equality Violence control Colonization
<i>Queen of Angels</i> (1990, Bear)	Mary Choi, a "transformed" policewoman, is extensively enhanced to help carry out her duties. She becomes the "ideal policewoman." She tracks down a famous poet and mass killer.	Nanotechnology	Political	Violence control Identity
<i>Stations of the Tide</i> (1991, Swanwick)	Miranda is an exotic world colonized by humankind. Technology is controlled by the state. Within a virtual reality system, civil servants delegate tasks to their virtual copies. "Te bureaucrac" is an official of the technology-regulating agency. He tracks down a magician who is using a forbidden technology. In the course of his investigation, the bureaucrat makes an incredible finding: The native species from Miranda is not extinguished as thought	Nanotechnology Cybernetics	Political	Social control Identity

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>The Turing Option</i> (1992, Harrison & Minsky)	Brian is a world-leading expert in artificial intelligence. A group of criminals steal his research and wound him gravely. His brain is recomposed and enhanced. He regains part of his knowledge and memories. His implant allows him to connect to external artificial intelligence systems. He tries to find out about the criminals.	Cybernetics	Medical	Identity (reconstruction)
<i>Moving Mars</i> (1993, Bear)	Enhanced human beings colonize Mars. Casseia, a student at the Mars University and a political leader, tries to fight the tyranny of the colonizers.	Nanotechnology	Political	Social inequality Colonization
<i>Permutation City</i> (1994, Egan)	Immortality is possible. "Emulations" of persons exist in a virtual reality program that is controlled by the "originals." Emulations have subjective conscious experience. Paul and other rich "copies" seek immortality by controlling the computing system.	Cybernetics	Medical Political	Life span extension Identity (autonomy)
<i>Interface</i> (1994, Bury) ^d	Gozzano is a presidential candidate. Through a biochip implanted in his brain, he is connected to a computerized polling system. He feels the mood of the citizens and acts accordingly. Nothing but his own mind can stop him in his race to the White House.	Biotechnology Cybernetics	Political	Social control

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>Necroville—Terminal Café</i> (1994, McDonald)	Resurrected people are used as labor force and have their own ghettos, called Necroville. Living and dead people cannot mix. Santiago, an artist, and four of his friends go to a Necroville to record Santiago's death and resurrection. In this encounter with the dead, they will change forever.	Nanotechnology	Social	Immortality Social inequality (class)
<i>Slow River</i> (1995, Griffith)	Lore belongs to a very powerful family. She is kidnapped and loses her identity implant. Her life falls into crime and deception. She has the choice to steal the identity implant of a death woman and get back a normal life.	Nanotechnology Biotechnology Cybernetics	Social	Identity (lost)
<i>The Terminal Experiment</i> (1995, Sawyer)	Dr. Peter Hobson, a brain scientist, experiments with the brain patterns of the dying and recently dead. He creates three duplicates of himself: The first is just virtual, the second is immortal, and the third is a control copy. The copies get out of control and one of them starts to commit a series of murders.	Cybernetics	Medical	Immortality Identity
<i>Holy Fire</i> (1996, Sterling)	Mia is a 94-year-old wealthy lady. She decides to take a treatment for rejuvenation. The treatment has physiological effects on her. Seeking stimulus and meaning, she travels to Europe.	Cybernetics Nanotechnology Biotechnology	Medical	Life span extension Identity Social inequality

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>The First Immortal</i> (1998, Halperin)	Ben suffers a grave disease and he is placed into cryonic suspension. This opens up for ethical controversy within his family. When Ben is reanimated more than 30 years later, he finds out that other members of his family have also been frozen.	Nanotechnology Biotechnology	Medical	Immortality Intergenerational disorders Eugenic selection
eXistenZ ^e (1999, Priest)	eXistenZ is a confusing computer game, more real than reality. The "hardware" of the game is like a living organism. The game links to a new artificial body orifice.	Biotechnology Cybernetics	Social Political	Extreme violence
<i>Vitals</i> (2001, Bear)	Hal is a scientist who is researching on bacteria that colonizes the human body and enables the prolonging of life. These bacteria may end up in the wrong hands, allowing social control by biological manipulation.	Biotechnology	Medical Political	Life span extension Social control
<i>Crescent City Rhapsody</i> (2001, Goonan)	Aliens attack Earth and bring the Silence. The Age of Information collapse, cities become organisms, and humans adapt to cities. Maurice is assassinated. She is resurrected and wants vengeance and to save the World. Dr Zeb understands that the Silence contains a message that will save humankind from extinction. All the characters face ecoterrorism and xenophobia.	Nanotechnology	Medical Political	Life span extension Xenophobia Violence Extinction

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>Ki'n People</i> (2002, Brin)	Albert is a detective investigating the murder of the inventor of a cloning technology. Humans can make cheap copies of themselves. The copies live for a single day to serve their owners (i.e., working for them, going through hurting experiences, etc.). The owner can choose whether or not to in-load the memories of the copy. In his search, Albert uses copies of himself.	Biotechnology Cybernetics	Social	Identity Social control (surveillance)
<i>The Skinner</i> (2002, Asher)	A distant planet, inhabited by exotic life-forms, is found and colonized. A virus provides life extension and biorepair. Infected by this virus, the longer humans live, the less human they become. Three travelers with different missions arrive on the planet. They face problems of immortality, mind expansion, and extreme violence.	Cybernetics Biology	Political	Life span extension Violence
<i>Broken Angels</i> (2004, Morgan)	Nano-biowarfare. Militarization of human enhancement. The protagonist is a militarized bio-nanofighting machine capable of "backing" up his memories and personality.	Nanotechnology Biotechnology	Political (military)	Extreme violence

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>Mindscan</i> (2005, Sawyer)	Jake fears he will inherit the genetic defect that destroyed his father's personality. But a new technology appears. It enables the patterning of everything in the brain and the transfer to a mechanical body. Copied minds are enhanced and immortal. While the originals are sent for a pleasant retirement to the moon, the copies take on their lives. Problems of reanimating the dead and "uploading" personalities and memories are raised.	Cybernetics	Medical	Life span extension Identity
<i>Glasshouse</i> (2006, Stross)	In a futuristic society, digitalization and recreation of people is possible. People wear new bodies and genders. But transferring brains to softwares has a dark side as it enables social control. A computer virus is a maniacal dictator. It infects the travelling channels, produces amnesia, and gets control. Robin, the protagonist, opposes this power and tries to reconstruct and understand the past.	Nanotechnology Biotechnology Cybernetics	Political	Social control Surveillance Identity
<i>Rollback</i> (2007, Sawyer)	An aging female cosmologist is the only person able to communicate with extraterrestrial being. It is important to keep her alive. She and her husband take a rejuvenate treatment. However, the treatment has no effects on her.	Biotechnology	Medical Political	Life span extension Relating with nonhumans

(continued)

Appendix (continued)

Title	Cyborg Imaginary: Narrative	Technology	Enhancement	Ethical Issues/ Concerns
<i>The Prefect</i> (2007, Reynolds)	High-tech thriller: Dreyful is a prefect in a futuristic interstellar society. Prefects must ensure the political order. He must fight an artificial intelligence to save his world. Body enhancement includes featuring digital "backups" of people's minds and memories.	Nanotechnology Biotechnology Cybernetics	Political	Immortality Social control
<i>Kéthani</i> (2008, Brown)	The <i>Kéthani</i> are an alien species. They have brought immortality to Earth. Humans can choose to be implanted with a Kethani device so that after dying they will be enhanced and resurrected. Khalid and his friends have to cope with the multiple dilemmas of being implanted or not.	Nanotechnology	Medical Social	Immortality Moral enhancement
<i>Night Sessions</i> (2008, Macloed)	Near future thriller set in the Scottish Republic. In a world where religion wars do not exist anymore, a catholic priest is murdered. A. Ferguson, an enhanced policeman, investigates the case. He discovers a terrorist act. He is assisted by a droid.	Cybernetics	Political Social	Religion and dogmatism Posthuman rights

a. As manipulated biology rather than as genetic engineering.

b. This novel was part of Butler's popular *Xenogenesis* trilogy (renamed as *Lilith's Brood*).

c. As manipulated biology.

d. Pseudonym for Neal Stephenson.

e. David Cronenberg's movie novelized by Priest.

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Notes

1. In the sense of “at an early stage of technoscientific development” (see Delgado et al., 2010).
2. See, for instance, *Blood Music* (1983) by Greg Bear and *The Diamond Age* (1996) by Neal Stephenson (see the appendix).
3. This section is based on a broader mapping of the ethics of enhancements carried out as part of the research of the European Union/FP7 project Technolife (Technolife Consortium, 2008). A fuller account can be found in the Technolife BODY line scoping paper, accessible at www.technolife.no.
4. This is far from a comprehensive definition. For a somewhat fuller account, see Hayles (1999, pp. 2-3).
5. Transhumanism has been defined as synonymous with human enhancement (<http://en.wikipedia.org/wiki/Transhumanism>). As described by Boström (2005), early conceptions of the field included terms such as *boundless expansion*, *self-transformation*, *dynamic optimism*, *intelligent technology*, and *spontaneous order*.
6. Further descriptions of this aspect of enhancement ethics can be found in a document preparing the writing of this article, the BODY line scoping paper from within the Technolife research project. The paper can be downloaded at www.technolife.no.
7. For instance, *Holy Fire*, *Necroville Terminal Café*, *The First Immortal*, *Crescent City Rhapsody*, *The Prefect*, and *Kéthani* (see the appendix).
8. Three novels encompass the stories of “the Culture”: *Consider Phebas* (Banks, 1987), *The Player of Games* (Banks, 1988), and *The Use of Weapons* (Banks, 1990).
9. See the appendix.
10. By this we do not mean that ethicists do not discuss politics; issues of social justice figure prominently in the literature. However, our point was different: In order to spark such a discussion on a broad basis, it might be helpful to enter into it on premises that resonate more strongly with widely shared cultural trends.
11. see www.youtube.com/watch?v=hkb3r9filcM.

References

- Banks, I. (1987). *Consider Phlebas*. London, England: Macmillan.
- Banks, I. (1988). *The player of games*. London, England: Macmillan.
- Banks, I. (1990). *The use of weapons*. London, England: Orbit.
- Boström, N. (2005). A history of transhumanist thought. *Journal of Evolution and Technology*, 14, 1-25.
- Brown, E. (2008). *Kéthani*. Nottingham, England: Solaris.
- Buchanan, A., Brock, D. W., Daniels, N., & Wikler, D. (2000). *From chance to choice: Genetics and justice*. Cambridge, England: Cambridge University Press.
- Bukatman, S. (1993). *Terminal identity: The virtual subject in post-modern science fiction*. Durham, NC: Duke University Press.
- Calhoun, C. (2002). Imagining solidarity: Cosmopolitanism, constitutional patriotism, and the public sphere. *Public Culture*, 14, 147-171.
- Cassell, E. J. (1992). *The nature of suffering and the goals of medicine*. Oxford, England: Oxford University Press.
- Church, G. (2010). 2020 Visions (Synthetic biology). *Nature*, 463, 26-32.
- Csicsery-Ronay, I. (1992). The sentimental futurist: Cybernetics and art in William Gibson's *Neuromancer*. *Critique: Studies in Contemporary Fiction*, 33, 221-240.
- Delgado, A., Kjølborg, K. L., & Wickson, F. (2010). Public engagement coming of age: From theories to practices in STS encounters with nanotechnology. *Public Understanding of Science*. Advance online publication. doi:10.1177/0963662510353054
- Dumit, J. (2003). *Picturing personhood: Brain scans and biomedical identity*. Princeton, NJ: Princeton University Press.
- European Commission. (2007). *Governance in the EU* (White Paper). Retrieved from http://ec.europa.eu/governance/index_en.htm
- Felt, U., & Wynne, B. (2007). *Taking the European knowledge society seriously* (Report of the Expert Group on Science and Governance to the Science, Economy and Society Directorate, Directorate-General for Research). Brussels, Belgium: European Commission.
- Gibson, W. (1983). *Neuromancer*. New York, NY: ACE Books.
- Giddens, A. (1996). Affluence, poverty and the idea of a post-scarcity society. *Development and Change*, 27, 365-377.
- Haraway, D. (1991). A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century. In *Simians, cyborgs and women: The reinvention of nature* (pp. 149-181). New York, NY: Routledge.
- Hayles, K. (1999, June). *How we become post-human: Virtual bodies in cybernetics, literature and informatics*. Chicago, IL: University of Chicago Press.
- Hepler, L. (2006). The era of anti-aging technology. *ThriveNYC: Life Begins at 60*, 1. Retrieved from <http://www.nycplus.com/nyc14/theeraofantiaging.html>

- Idier, D. (2000). Science fiction and technology scenarios: Comparing Asimov's robots and Gibson's cyberspace. *Technology in Society*, 22, 255-272.
- Jasanoff, S., & Kim, S.-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and North Korea. *Minerva*, 47, 119-149.
- Jonsen, A. R. (1998). *The birth of bioethics*. Oxford, England: Oxford University Press.
- Kay, L. E. (2000). *Who wrote the book of life? A history of the genetic code*. Palo Alto, CA: Stanford University Press.
- Kjølberg, K., & Wickson, F. (2007). Social and ethical interactions with nano: Mapping the early literature. *NanoEthics*, 1, 89-104.
- Krimsky, S. (2003). *Science in the private interest: Has the lure of profits corrupted biomedical research?* Lanham, MD: Rowman & Littlefield.
- Lyon, D. (2001). *Surveillance society: Monitoring everyday life*. Buckingham, England: Open University Press.
- Miah, A. (2008). *Human futures: Art in the age of uncertainty*. Chicago, IL: University of Chicago Press.
- Milburn, C. (2002). Nanotechnology in the age of post-human engineering: Science fiction as science. *Configurations*, 10, 261-295.
- Nordmann, A. (2004). *Converging technologies: Shaping the future of European societies* (Report to the European Commission). Brussels, Belgium: European Commission.
- Nowotny, H. (2008). *Insatiable curiosity: Innovation in a fragile future*. Cambridge: MIT Press.
- Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty*. London, England: Polity.
- Petersen, A., Anderson, A., & Allan, S. (2005). Science fiction/science fact: Medical genetics in new stories. *New Genetics and Society*, 24, 337-353.
- Pinker, S. (1997). *How the mind works*. London, England: Penguin Books.
- Poster, M. (1990). *The mode of information*. Chicago, IL: University of Chicago Press.
- Roco, M. C., & Bainbridge, W. S. (Eds.). (2003). *Converging technologies for improving human performance: Nanotechnology, biotechnology, information technology and cognitive science*. Dordrecht, Netherlands: Kluwer Academic.
- Rommetveit, K., Gunnarsdottir, K., Jepsen, K. S., Bertilsson, M., Verax, F., & Strand, R. (in press). The technolife project: An experimental approach to new ethical frameworks for emerging science and technology. *International Journal of Sustainable Development*.
- Sardar, Z. (2010). The namesake: Futures; future studies; futurology; futuristic; foresight—What's in a name? *Futures*, 42, 177-184.
- Schummer, J. (2004). Societal and ethical implications of nanotechnology: Meanings, interests groups, and social dynamics. *Techne*, 8, 56-86.

- Sutrop, M. (2002). Imagination and the act of fiction-making. *Australasian Journal of Philosophy*, 80, 332-344.
- Tavani, H. T. (2007). *Ethics & technology: Ethical issues in an age of information technology*. Hoboken, NJ: John Wiley.
- Taylor, C. (2004). *Modern social imaginaries*. Durham, NC: Duke University Press.
- Technolife Consortium. (2008). *A transdisciplinary approach to the emerging challenges of novel technologies: Life world and imaginaries in foresight and ethics* (Contract No: FP7-230381). Bergen, Norway: Centre for the Study of the Sciences and the Humanities, University of Bergen.
- Tomas, D. (2007). The technophilic body: On technicity in William Gibson's cyborg culture. In D. Bell & B. M. Kenedy (Eds.), *The cybercultures reader* (2nd ed.; pp. 130-144). New York, NY: Routledge.
- Vint, S. (2007). *Bodies of tomorrow: Technology, subjectivity and science fiction*. Toronto, Ontario, Canada: University of Toronto Press.
- Wickson, F. (2008). Narratives of nature and nanotechnology. *Nature Nanotechnology*, 3, 313-315.
- Wickson, F., Delgado, A., & Kjølberg, K. (2010). Who or what is the public? *Nature Nanotechnology*, 5, 757-758.
- Wynne, B. (2006). Public engagement as a means of restoring public trust in science: Hitting the notes, but missing the music? *Community Genetics*, 9, 211-220.

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