

Chapter 2

Responsibility and Visions in the New and Emerging Technologies

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2.1 Introduction

One of the most evident but problematic features of the current normative debate on new and emerging technologies is the lack of explicit acknowledgement of the visionary character of many anticipated applications of technology. Although the ethical debate on existing applications and on applied research in nanotechnology is rather developed (cf. Bos and van Lente in this volume) and focuses mostly on the implications of the risks posed by products containing nanoparticles or other potentially dangerous materials (cf. Fleischer et al. in this volume), the most ethically contentious part of these technologies consists in the applications possible in the distant future as well as in visions. As, for example, MacDonald and Boyce (2008) have pointed out, nanotechnologies have been described as technologies that could potentially provide solutions to problems such as clean, affordable, secure energy (e.g. nanosolar), stronger, lighter, more durable materials (e.g. nanoceramics), low-cost filters to provide clean drinking water (e.g. polymeric nanofiltration), sensors/devices to detect/clean up harmful biological agents or hazardous chemicals in the environment and the means to trigger a revolution in medicine, which will become more ‘predictive, preemptive, personalized, and participatory (regenerative)’ (cf. Schmidt 2006). Although the ethical literature on nanotechnology acknowledges the nature of this potential and refers to the question of hype (cf., among others, Gordijn 2005), for the most part it continues to discuss these topics in terms of the possible threat to various ethical principles, such as equity, autonomy,

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privacy, data protection, safety and responsibility (cf., among others, Ebbesen et al. 2006). The technological determinism presupposed in these ethical discussions leads to what has been criticised in the debate as ‘speculative ethics’ (cf. Nordmann 2007; Nordmann and Rip 2009), a normative reflection detached from a thorough analysis of the state of the art of scientific and technological developments, which leads to biases and problematic discussions (cf. Ferrari et al. 2012).

The same is true of the debate on technologies for human enhancement, a primary topic in this paper. What is meant by the expression ‘human enhancement technologies’ is, however, far from being clear for two reasons: first, because human enhancement is used as an umbrella term referring to a wide variety of new, emerging and visionary technologies, and second, because the concept of human enhancement is itself controversial and fundamentally normative since it implicitly or explicitly entails the reference to a starting point (which can be a biological status or a parameter), to criteria for judging if something has been raised or not, to the target of the improvement as well as to the subject which realizes it (Grunwald 2008). In this paper we adopt a definition of enhancement originally developed in the STOA¹ project and then used in the EPOCH² project. This definition attempts to avoid any intrinsically positive connotation and any dichotomous approach to conceptualizing enhancement interventions and therapeutic interventions. Human enhancement is then taken as referring to any modification aimed at improving individual human performance and brought about by science-based or technology-based interventions in the human body. The use of the technologies in question can be classified on a continuum stretching from non-therapeutic enhancement to restorative therapy (cf. Selgelid 2007).

Talking about the future is something inevitable in the context of the ethics of technology, since scientific programs are always inspired by goals and visions. With Hans Jonas (1979) finally it became clear that the technological and scientific power of human actions extends far beyond the immediate past, having far-reaching implications for future generations and for nature. This is especially the case given the development of biotechnology, by means of which we can change fundamental properties of living beings. With the development of science and technology studies (STS) and technology assessment (TA), it has become increasingly clear that the projections of future scientific and technological developments can be different from what actually occurs. The rise of foresight studies and of the sociology of expectations, which include a range of perspectives such as of the sociology of technology and science, history, economics and innovation studies, has resulted in a description of the influential role that expectations and visions play in shaping the discourse on technology. As Mads Borup and his group have pointed out:

Such expectations can be seen to be fundamentally ‘generative’, they guide activities, provide structure and legitimation, attract interest and foster investment. They give definition

¹ See Coenen et al. (2009).

² Ethics in Public Policy Making: The Case of Human Enhancement (EPOCH) is a European Commission FP7 Science in Society funded project, grant number SIS-CT-2010-266660 (<http://epochproject.com>).

to roles, clarify duties, offer some shared shape of what to expect and how to prepare for opportunities and risks. Visions drive technical and scientific activity, warranting the production of measurements, calculations, material tests, pilot projects and models. (Borup et al. 2006, pp. 285–286)

Despite various efforts to incorporate the lessons learnt about the complexity and unpredictability of (socio-) technological developments in ethical reflection, we think that the current normative influence of technological visions in the debate has been largely ignored (cf. Ferrari et al. 2012). In this article we want to explore another extension to the consideration of responsibility with respect to the one advocated by Jonas, which comes from disentangling the current role of technological visions in informing experimental research and calling for funding.

We believe that normative analysis referring to the technological future has to be different from just an application of ethical and political theories to a particular technological case, since it should involve considerations on how socioeconomic structures and cultural elements frame the values which inspire technological visions. The normative force of visions in the present is reflected both in how the interaction between technologies and future generations is framed as well as in how the reference to the future is used to justify the allocation of resources in the present. Last but not least, being responsible for the future without falling into the pitfall of technological determinism also means taking responsibility for the values and goals which frame these visions.

After having showed how the current ethical debate has failed to engage with the role of technological visions in the present (Sect. 2.2), we will offer insights into the etymology of the word ‘responsibility’ necessary for understanding the different normative dimensions of technological visions (Sect. 2.3). Then we will sketch an alternative framework in order to catch the normative issues of new and emerging technologies. We will do this by discussing some examples of the so-called human enhancement technologies (Sect. 2.4). Finally we offer some conclusions (Sect. 2.5).

2.2 A Normative Appraisal of Technological Visions in the Present

What does it mean to be responsible for technological developments which may or may not take place? Although the current approach to conducting ethical studies of the new and emerging technologies includes some important ideas, such as a certain degree of openness toward concrete technological developments and a need to develop a normative analysis as preparatory research, i.e. before it is too late, critical voices have been raised against debates over human enhancement, converging technologies and nanotechnologies, described as leading to impasses and dead-end streets.

Looking at the current debate on nanoethics, for example, we can notice that a large part of it has been reduced to a checklist of the various issues common to other

fields of technology, making it in some sense boring, since many issues are simply repeated (cf. Dupuy 2007). Patenaude and his group ask indeed:

How are we to understand the fact that the philosophical debate over nanotechnologies has been reduced to a clash of seemingly preprogrammed arguments and counterarguments that paralyzes all rational discussion of the ultimate ethical question of social acceptability in matters of nanotechnological development? (Patenaude et al. 2011, p. 285)

A similar dynamic can be seen in the ethical debate over converging technologies. Béland et al. (2011) have talked of an impasse in the ethical debate over Nano-Bio-Info-Cogno (NBIC) for four main reasons. First, any given argument deployed in the debate can serve as the basis for both the positive and the negative evaluation of NBIC; second, it is impossible to provide these arguments with foundations that will enable others to deem them acceptable; third, it is difficult to apply these same arguments to a specific situation; and fourth, the moral argument is ineffective in a democratic society. Although these kinds of discussions are valuable because they reveal different normative positions on the concept of a good life and on the role of technological development in society, they run the risk of staying at a very general level precisely because of the lack of concreteness in describing technologies which do not yet exist.

Much speculation and faith in the technological developments to come are very visible in the current debate on technologies for human enhancement. As Ferrari et al. (2012) have argued in particular for the debate on pharmacological cognitive enhancement (PCE), the lack of thorough study both of the empirical facts around the safety and efficacy of the substances used for cognitive enhancement as well as of the existing data on the social relevance of this phenomenon has led to a problematic ethical debate. Precisely because the empirical evidence for the safety, efficacy and the social relevance of PCE is scarce, an ethical and political discussion of PCE has to be reframed by fully acknowledging the ‘visionary’ nature of the technological developments being discussed, that is their role as imagined entities and projections in the future that, at the same time, is also active in the present (Ferrari et al. 2012).

The fact that certain technological developments are presented in the literature as being parts of reality at some indefinite point in the future is further complicated by another peculiar character of the new and emerging technologies. Many of them cover very heterogeneous fields, are often characterized by the lack of a common accepted definition (such as in the case of nanotechnologies³), or by the fact that sometimes they

³To the present day there is no commonly shared and general definition of nanotechnology beyond a general identification of the study and control of matter at the molecular and atomic scales (i.e. a definition which gives a precise range or which refers to fields of application). With very few exceptions, it is difficult to find any kind of matter that would not qualify as an object of such nanoscale research: every branch of experimental science and technology nowadays deals with material objects structured at the nanoscale. There are various efforts in different continents to find a definition, which are influenced by the topics regarded as the most important in the local context. In October 2011 Europe adopted the ‘Recommendation on the definition of a nanomaterial’: ‘According to this recommendation, ‘nanomaterial’ means: ‘A natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and

are defined by the goal pursued (such as the case of ‘human enhancement’) or by the methodological framework used (such as the case of converging technologies). The lack of clarity and heterogeneity in the characterization of new technological fields together with an implicit embrace of technological determinism act to reduce the depth of the analysis of the normative dimensions, which are often reduced to sophisticated risk assessments (cf. Ferrari 2010) or depoliticized in their nature (cf. Felt et al. 2007), and serve as a distraction from concrete questions (such as the allocation of resources).

That similar frustrations and disappointments are present in the ethical debate over different new and emerging technologies is not a coincidence. Indeed, despite their differences from a technical point of view, their goals and visions are deeply interwoven. Nanotechnology is the newest of the converging technologies, at least in the original formulation of NBIC convergence, and is itself multidisciplinary, capable of embodying the perspective of interdisciplinary convergence⁴ (cf., among others, Coenen et al. 2004; Saage 2006). In many publications, the ethically contentious part of the idea of converging technologies lies in the goal of human enhancement, as demonstrated by the criticism of the NBIC’s framework on converging technologies by their European version (Converging Technologies for the European Knowledge Society – CTEKS; cf. Nordmann 2004). Whereas the credo of NBIC convergence is that we need technological innovation to realize human potential, the credo of CTEKS is, in contrast, that we need social innovation to realize technological potential. Supporters of the NBIC’s vision highlight the need for overcoming the bodily and mental imperfections, thus defending the idea of engineering the mind and the body. In contrast, the idea underpinning the European CTEKS’s vision is

where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1–100 nm. In specific cases and where warranted by concerns for the environment, health, safety or competitiveness the number size distribution threshold of 50 % may be replaced by a threshold between 1 and 50 %. By derogation from the above, fullerenes, graphene flakes and single wall carbon nanotubes with one or more external dimensions below 1 nm should be considered as nanomaterials.’ This recommendation states that, by December 2014, the EC will review the definition ‘in the light of experience and of scientific and technological developments. The review should particularly focus on whether the number size distribution threshold of 50 % should be increased or decreased.’ The absence of a commonly accepted definition of nanotechnologies has precise epistemological implications, because it influences the setting and legitimisation of scientific research areas and therefore the scope of the research. The setting of goals clearly has ethical implications, because goals and aims are shaped by society and because goals are matters of research policy-in particular through priority-setting. The definition of ‘nanotechnology’ varies depending on research priorities of different countries: (unlike the US, Asian countries such as China, Japan and Korea tend to emphasise material sciences and electronics, while African and Latin American countries focus on environmental sciences and medicine). Furthermore, the lack of a commonly accepted definition is ethically relevant because it opens the ethical discourse indefinitely and, as we will see, many authors tend to associate with nanoethics different kinds of problems (cf. Ferrari 2010).

⁴Since in the project of ‘converging technologies’ the level of atomic manipulation is taken as the ultimate one and as the basis for creating a new world, the ‘integration from the nanoscale’ of these technologies is seen as determining a ‘tremendous improvement in human abilities and societal outcomes’ (Roco and Bainbridge 2002).

that technology adapts the world to the requirements and needs of frail and limited human bodies (engineering for body and for the mind; see Nordmann 2004; Roco and Bainbridge 2002).

Despite the varieties of publications on new and emerging technologies and the fact that utopian and dystopian discourses are acknowledged and analysed historically and culturally (cf. Garreau 2005; Berloznik and Casert 2006; Coenen 2010), the lack of concern for the specific normative dimension of technological visions is striking. The current debate rests on a speculative level and concentrates too much on an indefinite future, because it does not acknowledge either the measures in the present necessary to eventually transform a vision into a reality (such as resources and the criteria of experimental research) or the goals and the values pursued in different research programs. We believe that there is a fundamental difficulty in framing normative analysis, and in particular the analysis of responsibility, in terms of an application of ethical principles to technological visions due to their specific nature. Whereas this method can be fruitful for already existing technologies or technologies in the pipeline, technological visions require a different framework, which starts with the acknowledgement of their specific nature as programs, i.e. as expressions of values and ideas of their promoters which, in order to become concrete, have to pass through a series of steps (from setting up of research programs and different experimental phases including clinical research) (cf. Ferrari et al. 2012).

One main topic around which the debate on human enhancement, and thus on converging technologies and partly on nanotechnologies, has developed through an explicit reference to the future is that of justice. Indeed, it is a matter of projections in the future whether we can argue that some technologies can increase or decrease inequalities among people using them. Whereas the opponents have argued that the introduction of any enhancement technology is that it will create inequality (Annas 2002; McKibben 2003; Fukuyama 2004), proponents have argued that fairness and justice require enhancement, since technologies are there in order to re-establish the inequalities posed by the natural lottery, which randomly distributes capabilities and disabilities (Savulescu 2006, cf. Harris 2007).

But what does it mean in concrete terms to imagine a future society in which some people or even everybody will be enhanced in some way? Although the exercise of imagination is of course not per se something wrong, just as questions regarding the possible impact of the distribution of these technologies are permitted, quite everyone reading this rich literature is left with a sense of dissatisfaction. In their analysis of the discourse, Patenaude and his group have identified seven categories of moral arguments⁵ in the debate on human enhancement which appear to be irreducible and lead to an impasse. This irreducibility is due to the presence of different meta-ethical positions, i.e. opinions on the possibility of knowing moral obligations or the human condition as a moral fact and of different conceptions of practical reasoning that correspond to the epistemological positions (Patenaude et al. 2011). These quite general problems in the ethical reflection are exacerbated by two important

⁵These arguments are: nature, dignity, the good life, utility, equity, autonomy, and rights (Patenaude et al. 2011).

points which characterize the debate: first, the fact that what is taken as being a human enhancement technology is matter of controversy, and thus something very fuzzy, as already pointed out at the beginning, and second, the fact that in many cases ‘human enhancement technologies’ do not yet exist, being far-reaching visions and thus not foreseeable in concrete detail.

If we have a look at the examples provided in the literature referring to genetic engineering, we can see that authors engage in major speculation about, for example, enhancing memory by manipulating one’s genome. If we have a look at the results of the experiments conducted on animals that are usually quoted in the debate, we can see the materialization of the thesis that empirical facts are not neutral but always subject to interpretation. Julian Savulescu, for example, argues that genetic memory enhancement has been demonstrated in rats and mice and refers to experiments like the ‘doogie mice’. But if we accurately analyse the scientific literature, we see that the situation is more complicated: the overexpression of one particular receptor (NMDA receptor 2B) in the precortical frontex of the genetically modified mice has led to an increase in the synaptic activity under electric stimulation, to an improvement of some properties of memory and to a better score on the water maze test. However, these mice have shown different welfare problems, since they suffered from chronic pain, whose origin has not yet been understood, were stressed and have manifested abnormal fear reactions to relatively harmless stimuli, which would constitute a big problem for a life outside the laboratory (Lehrer 2009).

Furthermore, it is still largely unknown how this increase in some properties of memory interrelates to other cognition-related properties. Adding to ethical considerations about the justifiability of such animal experiments as well as to the epistemological problems connected to the transferability of these results to human beings, it is hard to see how these results can be seen as a demonstration of genetic memory enhancement. If we then want to start to make some meaningful analysis of the possible implications of enhancing memory for the distribution of capabilities in a future society, the level of speculation becomes high. Indeed, to do that, we not only need to imagine how the social, economic and political structures of the society would be, but also how a technology would work in very concrete terms.

Assessing whether a modification affects the welfare of a being positively or negatively depends largely on which capabilities are modified and how these capabilities are evaluated. This does not mean, however, that it is not possible to say anything about these experiments. Quite the contrary is true: what has to be discussed is rather which kind of motives and values have led someone to set up the research programs, to pose these questions and to develop arguments pro and contra for the need to ameliorate memory. This becomes something politically very concrete when it comes to initiating a research program. Is a sort of genetic engineering of particular properties of memory on the basis of a poor understanding of cognition-related networks in the brain something we want to pursue at the moment? Who is going to be the subject of such experimentation? Why is it good to allocate money to this research instead of spending money on other purposes? While there is therefore space for considering the normative framework of

technological visions, in order to become effective it should be related to questions which link technological visions (the future) with their role in the present. This means exploring the interface between the ethical and political spheres that consider the values which frame current regulatory systems. Together with the ethical principles guiding the allocation of resources and the values guiding the preferences in setting up these visions, these regulatory systems constitute the basis for the introduction of certain technologies.

Appraising this interaction means taking responsibility for the technological visions created. This is a first step toward a fruitful normative analysis of technological visions. However, we can go deeper, firstly by disentangling the different ways in which responsibility can be understood and secondly by showing how this new framework can discover further pathways of reasoning.

2.3 Etymology of the Word *Responsibility*

Investigating and knowing the origins of words can enhance our perspectives about their effective use. For example, by clarifying the original meaning of a term and understanding how it has been transformed over time, we could discover its semantic richness and learn new meanings of the word in question. This kind of investigation is particularly appropriate for a key concept in technological development, namely responsibility, towards which different etymologies have been suggested. Nevertheless, the goal of the following analysis of the word *responsibility* is not to verify the philological correctness of these etymologies, but to explore an alternative account of *responsibility* in the debate on new and emerging technologies.

Although the word *responsibility* is rather modern as it appeared for the first time at the end of the eighteenth century in the context of discussions of *ministerial responsibility*,⁶ the adjective responsible has a longer history and it derives from the Latin verb *respondere*, to respond, to give an answer. Even the initial analysis of this verb raises some important considerations concerning the meaning of the term ‘responsibility’ (Turolto 2009, p. 7). Indeed, it should firstly be stressed that an answer always follows a certain question or appeal. Quoting Fabrizio Turolto: ‘I respond if someone poses a question, never in general or in the abstract’ (Turolto 2010, p. 174) and ‘obviously answering is a consequence of listening’ (Turolto 2010, p. 178). As a matter of fact, an answer requires both that there is a question and that the content of the question is being listened to.

Secondly, answering can occur in different ways because, for example, to ‘respond to someone’ differs from ‘respond for someone’. In addition to listening, the former requires the recognition and acknowledgement of others as well as the

⁶According to the Oxford English Dictionary, the first use of the word ‘responsibility’ is in issue 63 of the ‘Federalist’ (1787), a text attributed to Alexander Hamilton. For a web version see: <http://foundingfathers.info/federalistpapers/fed63.htm>, accessed October 2, 2012. As regards the history of the term ‘responsibility’, see Villey (1977) and Henriot (1977).

respect for individuals and their choices. In this regard it is interesting to note that the term responsibility may also have been derived from the Latin verb *respicere*, which means ‘to look back at’, ‘to gaze at’, ‘to consider’ (Turolto 2009, p. 8), and then implies acknowledgment of the other person. Furthermore, the word ‘respect’ has also its origins in *respicere* and consequently, already at the etymological level, a connection between responding to someone and respecting him/her is inevitable.

Unlike the expression ‘respond to someone’, ‘respond for someone’ is used in cases involving people who are vulnerable, unable to understand or express their will and need not only listening and respect, but also someone who takes care of them. Moreover, a further distinction can be made between ‘respond for someone’ and ‘respond for something’: for example, if a 5-year-old baby (Mary) breaks a fragile object in a store and hurts her hand while her mother (Jenny) is paying the bill, Jenny responds for her daughter and for her injuries (as parents respond for their children). But, if a toy company covertly manufactures toys with dangerous items that endanger children’s safety and Jenny buys one of them for Mary, the company responds for injuries to Mary caused by the product because the company responds for the object it has produced.

Consequently, from this first analysis of the word responsibility, we could say that a responsible person is someone who is able to give a response, to answer for something, to or for someone. In this regard, it could be stressed that the link between being responsible and giving an answer is clearly present within the German language as the word *Antwort* (answer) is part of the term *Verantwortung* (responsibility).

Further considerations on this topic could be provided by a deeper analysis of the verb *respondere* because it is derived from *spondere*, another Latin verb meaning ‘to promise’, ‘to guarantee’, ‘to ensure’, ‘to make a commitment’ (Garcia 1989, p. 51). It may be surprising to note that this verb was used in wedding ceremonies:

Spondeo (I promise) was used in the father’s speech in which the father made a commitment to the bridegroom (*sponsus*), giving his daughter (*sponsa*) in marriage in the ceremony of *sponsalia*. The *sponsus* in turn, responded to the father’s commitment (*respondeo*), from which responsibility is derived, guaranteeing against the possible uncertainties of the future with a solemn promise (*sponsum*) (Turolto 2010, p. 180).⁷

As a consequence, following the derivation from *spondere*, *respondere* means not only ‘to respond’, but also ‘to promise something in return’ (*re-* ‘back’ and *spondere* ‘to pledge’) and one who makes a commitment by means of a promise is then responsible for fulfilling it and should be ready to face the difficulties this may imply.⁸

⁷The theme of mutual commitment is also confirmed by the Greek verb *spendo*, which means ‘to pour out as a drink offering’, ‘to make a solemn libation’ to the gods, hence ‘to engage oneself by a ritual act’, but also ‘to enter into an agreement’ as the gods are called to guarantee an action too (for example the victory in war).

⁸In this respect, it could be noted that the term responsibility may also have been derived from the Latin verb *responsare*, which means ‘to be able to go against the mainstream’. Consequently, responsibility is the capacity to face the difficulties that could raise in fulfilling the assumed commitment, going also against the mainstream.

Taking the previous etymological analysis into account and acknowledging the wide range of meanings covered by the word responsibility, it would be reductive to consider responsibility as the ability to assess the results and the consequences of our actions, which is the main meaning generally recognized. Indeed, being described as responding, responsibility calls for listening to the question that needs an answer as well as acknowledgment and respect for others. Moreover, responsibility in the sense of ensuring requires awareness of the assumed commitment with the intent to fulfil it.

2.4 Disentangling Responsibility for Technological Visions

In order to catch the different normative dimensions of technological visions and to highlight their force at the present, in this section we will analyze the main meanings of responsibility addressed above (responsibility as responding for something, responsibility as responding to/for someone and responsibility as ensuring) by discussing some examples provided in the literature and considering the challenges of human enhancement. The methodological choice and the focus on this topic are not accidental. Firstly, we believe that the current ethical debate on human enhancement lacks explicit acknowledgement of the visionary character of many enhancing technological applications. Secondly, we think that this debate underestimates the role of expectations and visions in shaping discourses on these technologies and in driving our actions and activities.

Going back to the development of genetic engineering technologies and in particular to those aimed at enhancing memory through the manipulation of the genome, as already noted above, advocates use scientific results in a very easygoing way just to support their political research agenda. However, this is problematic because it skips the reference to technologies (in this case the reference to some scientific experiments) as expressions of research visions and not as realities. Since the debate on this topic generally refers to the results of experiments conducted on animals and/or to human enhancement technologies that do not yet exist, there is a responsibility in the sense of to respond for something that is a responsibility for the created technological visions and for their impact on scientific research. Indeed, the creation of these visions leads to certain research programs being set up, which calls for a justification of the allocation of these resources in these specific areas of research.

Furthermore, as pointed out above, an answer always follows a certain question or appeal and is a consequence of listening. Consequently, being responsible for technological visions means that social requirements have been taken into consideration, and that such visions translate society's interests. In this sense, the meaning of responsibility as responding to someone is at stake because, for instance, technological visions inasmuch as they provide orientation for research, need to be based either on robust empirical data or on broad social desires or on both, if they do not want to be just the expressions of particular interests which use speculation to push research agendas. The lack of reference to these kinds of data has been pointed out as a problem in

particular in the debate on pharmacological cognitive enhancement (cf. Outram 2011; Quednow 2011; Racine and Forlini 2010). As argued by Ferrari et al. (2012), the tendency towards using stimulant drugs for the purpose of cognitive enhancement appears to be greater among academics and students, namely among social groups that consider cognitive capacities particularly relevant in their work. In this way, the technological visions related to cognitive enhancement respond to the desires of members of a social minority group, which calls for the motives which drive technological development in this direction rather than in another to be justified.

Moreover, responding for something presupposes responding for someone. Going back to the example provided in the previous section, the toy company that manufactures toys with dangerous items responds not only for the object it has produced, but also for potential injuries to people caused by the product. Similarly, given that the technological visions act in the present and have an impact on the social context by driving our actions and activities, responding for these visions also means responding for the social, economic and political structures of society. For example, inasmuch as technological visions encourage an improvement in our abilities and capabilities, modifications of our social relationships toward disabled people or vulnerable persons take place that may, for instance, marginalize them or preserve architectural barriers. In this sense, human capabilities are evaluated in quantitative terms rather than in qualitative ones, and a discussion of these issues and of the reasons for the requested human enhancement appears to be scarce, or even absent, in the ethical debate on this topic.

Considering another example of human enhancement technologies, neuroenhancement in individuals under 18 years of age is often considered in the literature as a growing phenomenon. For Ilina Singh and Kelly J. Kelleher this phenomenon is socially relevant and will become more and more common with the availability of psychotropic drugs and pharmacological neuroenhancers (including methylphenidate, e.g. Ritalin, and dexamphetamine compounds, e.g. Adderall):

It is clear from a number of reports that neuroenhancement is actively practiced by adults and by young people in North America, Europe, and the United Kingdom [...] Informal polls and newspaper reports suggest that alongside growing evidence of neuroenhancement practices, there is also increased public tolerance of neuroenhancement using psychotropic drugs—at least among educated middle-class respondents [...] We think the current level of use of stimulants for purposes of enhancement among young people (which is almost certainly underreported) will also increase, not least because the use of psychotropic neuroenhancing agents will likely become normal in future generations. (Singh and Kelleher 2010, p. 3)

Furthermore, from Singh and Kelleher's point of view, although at present these psychotropic drugs are almost always prescribed to children and/or adolescents diagnosed for attention deficit-hyperactivity disorder (ADHD), there are suspicions surrounding the parallel increases in ADHD diagnoses and in stimulant drug prescriptions.

Stimulants have been shown to improve focus and attention in young people without a psychiatric diagnosis as well as in young people with ADHD [...] Consequently, there is widespread suspicion that the simultaneous increases in ADHD diagnoses and in stimulant drug prescriptions reflect in part an increasing use of stimulants to enhance young people's performance, rather than to treat a clearly diagnosed disorder. (Singh and Kelleher 2010, p. 5)

These considerations exemplify the fact that technological visions are not discussed *qua* visions but that they are taken for granted. Indeed, in Sect. 2.2 of this paper we noted that the empirical evidence for the safety, efficacy and social relevance of cognitive enhancement is scarce. Moreover, this kind of enhancement is presented in literature as an existing reality which must be regulated. As a matter of fact, shifting from the considerations addressed above, in their contribution Singh and Kelleher suggest specific research, practice and policy recommendations concerning the use of stimulant drugs for neuroenhancement in young people (Singh and Kelleher 2010, pp. 7–13).

What is missing in this discussion is the fact that the assumption that the growing use of psychotropic drugs and pharmacological neuroenhancers among young people is likely to be inevitable and that neuroenhancement is an increasingly common practice means implicating both practitioners in the medical field and parents. As a matter of fact the prescription of drugs for the purpose of neuroenhancement occurs within the context of a health professional-children-parents relationship. The relationship is always described in terms of an inequality of knowledge and skills because it is established between a person seeking assistance and another who professes to provide it. This understanding is suggested by the etymology of the word ‘profession,’ because it is derived from the Latin verb *profiteri*, which means ‘to declare aloud or publicly.’ The health professional declares that by using his knowledge and skills he will provide the necessary help to promote the interest of someone seeking assistance. As a consequence, the health professional is not a simple technician, but one who is involved in a particular human relationship making a professional commitment towards others that do not possess his knowledge and skills. Responsibility in the sense of ensuring is thus at stake, and it is extremely relevant concerning the prescription of stimulant drugs for neuroenhancement in young people, primarily for two reasons: (1) the uncertain decision-making capacity of children, adolescents and teens, and (2) the scarce empirical evidence for the safety, efficacy and the social relevance of cognitive enhancers. Within the health professional-children-parents relationship, responsibility in the sense of responding for someone is at stake as well because parents should respond for their child and for his/her possible request for neuroenhancement, thoroughly assessing the reasons behind this request and eventually questioning their conduct.

Another aspect of the meaning of responsibility in the sense of responding for someone concerns responding for future generations. In this respect, a paradigmatic example showing the normative force of technological visions in the present can be found in the debate on genetic enhancement, in particular in the normative theory proposed on this topic by Savulescu. Adopting an utilitarian approach, he argues that what matters is the promotion of human well-being, described as ‘the very essence of what is necessary for a good human life’ (Savulescu 2007, p. 530), and claims that enhancement promotes well-being because it increases the chances of leading a good/better life (Savulescu 2009, p. 222; cf. Savulescu et al. 2011). For Savulescu, our existence is better/good when it promotes the maximization of capabilities and the minimization of disabilities. Furthermore, in his opinion, enhancing our children by employing genetic engineering technologies is not only permissible

but also a matter of ‘moral obligation or moral reason’,⁹ such as in treating and preventing diseases. Given that genetic enhancement interventions can improve one’s native equipment and increase the opportunities for one to lead a better life, in Savulescu’s opinion we should promote well-being by means of enhancement. By affirming that we have a moral reason to enhance our children, he means that in the absence of some other reason for action, a person who has a good reason to improve his offspring is morally required to have the best child possible.

We believe that the normative approach proposed by Savulescu attests the visionary character of genetic enhancing technologies and its relevance not only in driving actions, but also in clarifying and/or creating moral duties. Indeed, although these technologies do not yet exist, at stake in the debate over affirming that genetic enhancement promotes human well-being are expectations and visions that have inevitable ripple effects into science’s agenda, public perception and resource allocation. The parents’ role is also implicated in this normative framework, by arguing for the existence of a moral duty to have the best child possible, which then become a duty to use these enhancing technologies. Furthermore, within Savulescu’s approach, responding for future generations raises a problematic issue, because to genetically enhance offspring means imposing the parents’ idea of well-being on their child, inscribing it in his or her own biological nature. Savulescu considers this when he asserts that reproductive choices must be based on ‘a plausible conception of well-being and better life for the child’ (Savulescu 2007, p. 527). Nevertheless, the concept of well-being is ambiguous, and the alteration of the gene pool cannot be carried out in accordance with the offspring’s concept of well-being.

2.5 Conclusions

The aim of this paper was to offer an alternative framework for addressing the normative implications of technological visions, in particular those referring to human enhancement. We believe that the current ethical debate on new and emerging technologies is trapped in an impasse because it lacks any acknowledgement of the visionary character of the technologies at stake and of the current normative influence of these technological visions. Indeed, as shown by the examples discussed above, these visions drive our actions, modify our roles (as parents, as citizens, as professionals, as policy-makers etc.), and influence research programs, scientific agendas and our understanding of our moral duties. By shaping our expectations, technological visions also influence our perception of the ethical issues at stake, for example by concentrating the debate on the legitimacy of modifying memory abilities in general instead of addressing interrelations with other cognitive abilities or the need to test devices and drugs on healthy subjects. Therefore we believe that a

⁹It should be noted that the expressions ‘moral obligation’ and ‘moral reason’ are not synonymous because the former expresses a stronger normative force than the latter. For a critical analysis of the use of ‘have a good reason to’ within Savulescu’s approach, see Marin (2012, pp. 113–115).

normative analysis should move from the question of meaning to disentangling the reasons and the values behind these visions.

This approach also encompasses the wide range of meanings covered by the word ‘responsibility’: responsibility as responding for something, as responding to/for someone and as ensuring. Nevertheless we are aware that it remains difficult to identify the subjects who are responsible for particular technological visions and for their impact on society. This points to a limit of ethical reflection and at the same time to the need for exploring the interface with the political dimension, since the reasons for the desirability of technological visions should be investigated in a particular sociopolitical (and cultural) context.

However, we also think that the suggested alternative framework opens a more fruitful course of debate on technological development, because paying attention to the different steps required to accept or refuse and to render a technological vision a reality makes it possible for us to grasp the main normative issues at stake and thus to conduct the debate in a responsible way.

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