Chapter 8
Facts or Fiction? A Critique on Vision Assessment as a Tool for Technology Assessment

Nicole C. Karafyllis

Abstract This essay questions the concept of vision assessment as an appropriate tool for technology assessment on methodological, anthropological and ethical levels, and shows its epistemic neighbourhood to the scenario-techniques. In general, the central idea of a "future technology" is critically analyzed, backed with central examples drawn from nanotechnology, human doping techniques, and social neuroscience. Main concepts that are used for critique are (a) feasibility and desirability, (b) discourse and debate, and (c) vision and utopia. In addition, the essay reflects on the new genre of pop science, a mixture of science and popular writing on which the concept of vision assessment heavily depends.

Keywords Vision assessment · Pop science · Social neuroscience · Doping · Nanotechnology · Technology assessment · Utopia · Imagination · Desirability · Discourse

8.1 Methodological Inquiry on Vision Assessment

Vision assessment is a method that focuses on technologies of the future and debates about future(s) in general. The time seems to be right for "assessing visions" because at present, in the age of mass media culture and virtual simulation, the epistemological border between materially designing science futures and narrating science fiction has become more and more invisible (see, e.g., Pethes and Schicktanz, 2008).

This blending is a challenge for philosophers. In this article, some of the methodological, anthropological and ethical weaknesses of *vision assessment* will be outlined – stressing, however, that envisioning good futures remains at the core of ethical expertise. At the outset (Part 1), I will outline four basic arguments against vision assessment, particularly in relation to the field in which vision assessment has already been applied, i.e. nanotechnology. Then (Part 2), I will focus on related

N.C. Karafyllis (✉)
College of Humanities and Social Sciences, United Arab Emirates University, Al Ain (Abu Dhabi), United Arab Emirates
e-mail: karafyllis@t-online.de

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terminologies that deal with future(s), e.g. “technological future” and “future technology”, in order to show their discontinuities with classical utopian thinking. In addition, I will ask about their different normative implications, particularly regarding modes of participation and approaches to objectify individual futures. In order to show the multirole purposes that the reference to “nature” and “technology” can fulfil within public discourses about the anthropological future of the human being (Habermas, 2001), I will focus on the example of *techno-doping* in Part 3. This should clarify the limits of a vision assessment that seeks to embrace a society’s vision on technological progress. The latter section is followed by a second example (Part 5), which outlines an experiment in social neuroscience which is put forth for the sake of a better future society, emphasizing the early stages of experimental design in which values already enter without being made explicit. The overall aim of the second example is to show how the genre of *pop science* (Part 4) triggers (not only) neuro- and nanotechnology as “hot topics”, thereby underlining that the strategic role of the scientists (the experts) and media within the methodology of vision assessment has to be thoroughly revised. Finally (Part 6), I will summarize my thoughts and ask about the opportunities that vision assessment might have to offer within established approaches of technology assessment.

That individuals proactively “react” on envisioned futures is one of the basic assumptions within *vision assessment* (Grunwald, 2004, 2007), a newly proclaimed tool within the old toolbox of technology assessment (TA). The latter is a conglomerate of methods enabling scientists to analyze the development and implementation of new technologies and their impact on society (VDI, 1991; Skorupinski, 2000). Aiming to gain knowledge for orientation and political decisions by interdisciplinary scientific research, TA is normatively based on both the *feasibility* and the *desirability* of new technologies. Whereas the study of feasibility concentrates on acquiring sufficient technical data of present prototypes and exploring possible breakthroughs in basic research, e.g. by interviewing experts, the study of desirability is even more complex. Desirability is based on the assumption of individual *potentials* – which follow psychological and social dynamics – rather than on technological *possibilities*, i.e. the measurement of desirability partly resists statistical methodology and even hard empirical analysis.

At this point, vision assessment sets in. Particularly the difficulties in assessing *nanotechnology*, assembling different techniques and disciplines (Nordmann, Schummer and Schwarz, 2006), gave rise to the idea that analyzing the *discourses* on these techniques might clarify its desirability.

First, let us ask if there already is something like a discourse on nanotechnology. In the case of nanotechnology, the wider TA-community including ethicists has faced and still faces a new situation. They are strongly encouraged (and financed) by national and international science policies to assess and evaluate nanotechnology even *before* the object of assessment is defined (see e.g. BMBF, 2004; EGE, 2005; ESF, 2007; Schmid et al., 2006; TA-Swiss, 2006). For instance, a thorough risk assessment is impossible at this stage. Nanotechnology is still in its infancy. Apart from nanomaterials (nano-tubes, nano-ceramics) there are hardly any products ready to be assessed. Of course, this is not a new situation for TA. However, at the same time as the need for assessing nanotechnology was politically articulated, nano-particles were already aggressively marketed and they were even used in cosmetic products as carriers to transfer vitamins into deeper skin layers, without any TA before. This situation is new. Nevertheless, ethicists and TA-researchers publish excessively on nanotechnology, and even a new journal with the title *NanoEthics* was launched in 2007. There definitely is an *academic* discourse on the factual "non-presence" of nanotechnology (for a critique, see Nordmann, 2007, 2008; Karafyllis, 2008) – an academic discourse to which philosophers also contribute in terms of a negative self-fulfilling prophecy: the more you write about it, the more nanotechnology seems to already exist; but does this already count as a societal discourse?

To the contrary, nanotechnology hardly makes it to the front pages of daily newspapers or TV news stations (other than genetic engineering, neuroscience or nuclear energy) because the majority of people are not (yet?) interested in it. Similarly, most scientists themselves refuse the new labeling within academia, and they do so for good reasons. As it is far from clear which techniques or products might result from basic research on the nano-scale (i.e. $<10^{-9}$ meters), the majority of possibly involved scientists have already decided not to become "nanoscientists" or even "nanotechnologists". Instead, they still work under the disciplinary headlines of microelectronics, physics, biology, chemistry, genetic engineering, neuroscience, medicine, mechanics and material science. Whereas the diversity and interdisciplinarity of a nanotechnology in the making still imposes methodological problems for TA and ethics, the concept of vision assessment seems to offer at least a stopgap. If as of yet there are no prototypes to assess and evaluate, then can one not at least assess and evaluate visions of future applications – or even the future(s) in which they might be embedded?

Thus, second, the basic terms and methods of vision assessment have to be critically analyzed. Armin Grunwald's and his Karlsruhe colleagues' key steps of vision assessment concentrate on (a) collecting the visions on *one specific future technology* in the present debate, (b) analyzing their content and strategic role *within* the debate, (c) evaluating the normative implications involved, and (d) scrutinizing the practical impact of the transported visions on present society. Note that the protagonists first speak of "debate" in steps (a)–(c) rather than "discourse", a term that is reserved for (d), i.e. the societal level on which the findings are finally projected. At first sight, the thrilling idea is to *delegate the process of evaluation* directly to the public sphere, as *media analysis* is suggested as one instrument of vision assessment, though the methodology as a whole remains unclear (e.g., which specific media are analyzed?). Particular when expert knowledge and popular science writing merge into "pop science" (see Part 4), the analytical difference between descriptive and normative "facts" becomes blurred, though the resulting vision of the future might be alluring. Almost hidden, the strongly normative premise of Grunwald's approach is that the technology to be assessed (e.g., nanotechnology) actually *is* a "future technology". But how do TA-researchers, scientists, journalists, or "the public" know that? What, if the majority of people do not want this technology? What if it causes, for example, irreversible harm and/or huge social disparities? What, if it turns out to be too costly? A "future technology" only is one if it will be bought and used by today's *and* tomorrow's people, meeting their needs and/or fulfilling their desires. Moreover, focusing on one specific "future technology" shows a methodological mangle of science practice, as any development of new technologies heavily depends on synergies with other fields. At least the scientific rhetoric already incorporated these possible synergies. For example, an all-embracing "nanoworld" is based on the premise that it will gain surplus value not only for material science but also for microelectronics, prosthetics, gene therapy or neuroscience. It is not far-fetched to assume that nanotechnologies will succeed to provide solutions for some fields of applied research, but not for all that are proclaimed today.

Vision assessment should be situated in a background theory of "prospective knowledge", or "outcome knowledge", as Grunwald (2007: 54) puts it (in the German original: "Folgenwissen"). This means that only individuals who can proclaim to have this knowledge, i.e. researchers, can contribute to this theoretical background. In the best of all worlds for TA-researchers, all members of society would follow the discourse rules set up by discourse ethics when debating about their competing visions of the "future" (ibid: 57). At first sight, this seems to be a participatory element. But upon closer inspection, the aim is to reach consensus on *one* future for one society, depending on one specific technology – a highly exclusionary approach which is, moreover, unlikely to be productive for political decision-making in democratic societies. As it seems, public participation in the societal discourse is substituted by persuasion from actors that are professionals in both mass communication and science. However, before this very special TA-vision of complete participation or persuasion might become true one day, at least the experts' visions should be analyzed, according to the protagonists of vision assessment. In this understanding, both the expert and the journalist are seen as a watchdog for society. This is a rather idealistic view of their professional roles. Scientists and journalists seem to be a perfect match, consisting of the *analyzer* (of empirical technological data *for* the future) and the *sensor* (of normative implications of technologies *in* the future, on a meta-level). For example, empirical socioeconomic data on present inequalities which are triggering a technology's desirability in the real world remain a blind spot from the very beginning of vision assessment – at least, if the interviewed scientist does not have a strong moral interest in these issues, commonly referred to as an "ethos". As the third party on a politically powerful meta-meta-level, the TA-researcher becomes the *interpreter* of this conglomerate of facts, visions, fears and wishful thinking. That all three also have to sell their products on linguistic and visual markets (Bourdieu, 2005) is tacitly ignored. Neither does the scientist, when interviewed, only *describe* technologies and thus not represent only the empirical level of research (moreover, he/she has only one single voice within the pluralist scientific community), nor does the journalist completely represent the normative level of interpreting future technologies, or societies' pluralist opinions on these technologies as a whole. In consequence, the very idea of powerfree discourse and achievable consensus within a pluralist society, most prominently put forward by Jürgen Habermas, is slimmed down to a low-calorie "discourse light" for the leading elites of high-industrialized societies. One is reminded of Habermas' early work, *Toward a Rational Society* (engl. 1970, Chapter 6), in which he criticized science and technology as ideology: by reducing practical questions about the good life to technical problems for experts, contemporary elites eliminate the need for public, democratic discussion of values. Thus, the society becomes depoliticized by its elites which ignore the dialogical principle implied in practical reasoning.

Third, in order to understand the strategic value of the new method, let us look at the contemporary history of vision assessment. The roots of this idea can be found in the mid 1990s, where the concept of TA had to face a major crisis in political perception and implementation (first in the USA, then in Western-Europe) as it was regarded too critique-driven, thereby appearing to slow down technological progress. The concept of vision assessment heavily depends on the *scenario-approach*, developed newly in the 1990s as a less critical method of TA. Rather than criticizing a technology in the making, different scenarios should envision societal options in which the new technologies could make more or less sense and create different kinds of benefits. The scenario-approach has been used quite frequently for envisioning energy-scenarios of the future and determining benchmarks for funding research on, e.g., regenerative energies or nuclear energy. Scenarios of future technologies were envisioned even if experts doubted the technical feasibility, based on the premises of data present at the time when scenarios were created. There, the "fictionists" and the creators of "facts" have not been identical, which has been a reason why the scenario-approach did have some fruitful outcomes for designing socially acceptable futures (e.g., regarding energy futures that depend on renewable resources), and it still does.

Fourth, compared with the scenario-approach, in vision assessment the professional role of TA-researchers themselves vastly changes, and so do their modes of responsibility. They *select*, *aggregate*, *combine* and *interpret* both data and values from experts and media rather than designing their own scenarios, based on their own formulated values, for which they could be held responsible. The new element within this process is to assess the media, i.e. to distract oneself from the established meta-level of scientific discourse by reaching higher, on the level of a meta-meta-analysis, which appears to encompass society as a whole. Within the Karlsruhe approach of TA, we can thus find a normative shift towards the creation of *future facts* (empirically based on present data and values) instead of painting a picture of *possible futures based on certain and possible facts and values*. Possible value shifts are not taken into account at all, at least not explicitly. Overall, this tendency of hiding value-discussion is not only dangerous, but counterproductive for TA. Because: What we desire *for* the future has to be imaginable now – a reason why Grunwald (2007) speaks of the "immanence of presence". But what humans will desire *in* the future might be completely different. The same is even true for what humans decide for the future now, particularly, as the example of nanotechnology shows, when the basic premises for decision-making (e.g., consistent and coherent information) are not even given. Moreover, without explicitly formulating values, the process of TA will remain on the reduced level of a mere assessment (implementing hidden values, though) rather than reach the stage of evaluation.

To sum up: In the case of nanotechnology, science and technology assessment is dealing with a bunch of techniques that relate to other fields and which are not yet (and maybe never will be) reality, such as “meta-brains” and “smart skin”, and it often uses images and narratives of the science-fiction genre (Coenen, 2006). Communication on nanotechnology embraced “the future” much more than, for example, genetic engineering (see, e.g., Drexler, 1986). The concept of vision assessment goes further in normatively describing futures than the scenario-approach as it uses value-laden tools (media analysis and expert interviews) without highlighting these a priori imported values. Vision assessment seems to offer the long-wished-for tool of cultural appropriation of technological developments. Close up, neither the concepts of “public”, “discourse”, “culture”, nor “society” are defined, nor is the theoretical problem solved that evaluation necessarily depends on assessment, and, last but not least, on a priori information ready to use for assessment. Fiction cannot be evaluated without facts; and facts on future technologies do not emerge without artifacts. *As it seems, the main thesis of vision assessment is that desirability can be assessed without sound knowledge about feasibility*.

Let us take stock in order to raise more methodological doubts. Is the concept of vision assessment applicable on technologies in general, or is it bound to the specific case of nanotechnology? Vision assessment, I argue, is epistemologically still linked to the case of assessment for which it was developed, i.e. nanotechnology. Therefore, it is not a general concept for TA. Under premises of ethical judgment (e.g., the precautionary principle), it might not even be a concept for evaluating nanotechnology. As a consequence, currently feasible (e.g. carbonfibres on the nano-scale) and non-feasible techniques (nano-robots) are united within the designed futures. However, vision assessment is also applied in the area of ubiquitous/pervasive computing. It might soon also be used in the field of neurotechnologies, as the related semantic field of one’s own biographical future is more than alluring (see Part 5). Astonishingly, however, the method of vision assessment has not yet been used to design futures based on predictive genetic testing, an area that like no other influences the shape of future societies on a material level.

In the following, I will sketch other influential approaches dealing with “the future” and show their normative backgrounds. The overall aim is to critically reflect on the recent tendency to transform TA into vision assessment, thereby tacitly transforming the participatory element embodied by present social actors into technology- and economic-driven wishful thinking of academic experts.

8.2 The Pasts and Futures of the Future: Utopy and Vision

The idea that visions can be assessed and evaluated emerges in a specific cultural mentality, driven by the idea of (technological, economical, cultural, individual) *progress*. In modern times, the future is envisioned as both open and individually designable, including the future of one's own body, brain and social relationships. The mentality of present Western societies is powered by the idea that individual potentials can be – and have to be – detected, explored and shaped for the sake of a "better" future, both in the individual and societal sense. In this mentality, long known time- and space-related categories ("world", "individual life") have changed and are becoming "more open" and sometimes even unlimited on the semantic level (e.g., the visions of outer space, cyberspace, physical enhancement and anti-aging). Examples are the continuous biomedical enhancement strategies for the human body and the concepts of life-long learning and emotional intelligence, just to name three out of many. The latter were triggered by brain research on neuroplasticity since the 1990s, and developed as psychobiological tools to train the brain in order to become economically and socially more successful (Karafyllis and Ulshöfer, 2008).

A crucial part of these "self-technologies" is to constantly assess one's own visions, compare them with those of others, and reflect on their future realizations. Underlying this are reality-checks which encompass the present potentials and achievements, including the access to technical means for enhancements. The modern subject seems to be individually responsible for her/his future and is encouraged to enhance "natural" potentials. Against the normative background of an assumed *competition* of both societal visions and individual potentials, this definitely can make sense. Futures still seem to be something subjectively defined, but thought as achievable against a socially objectified background.

On the other hand, the future itself has turned out to become an object, as Bill Joy's famous article "Why the future doesn't need us" (2000) might illustrate. The concept of a "technological future" meets this rhetoric. But how can "the future" have needs? Is "the future" a competitor, and with whom or what is it competing? With the presence? With the past? With nature? By proclaiming a technically upgraded future in which human beings (and their present needs) are dispensable, nothing less than the anthropological self-image of being human is under attack. Underlying this is a reference to a holistic concept of nature, and that this abstract nature does not necessarily need humans – an argument that, if taken seriously, would also account for the present. Thus, instead of debating individually competing futures within society (e.g., regarding job opportunities or access to healthcare and education), the mentioned terminologies allow for change of the normative battlefield to the species level, as if the whole human race is under threat when resisting technological progress.

It is precisely this mentality of self-objectification and the ideology of technical progress with a life of its own, the latter competing with a holistic nature with a life of its own, in which the concept of an overall *vision assessment* as a tool for TA has recently been able to emerge. At present, individual visions associated with future technologies, e.g. nano- and neurotechnology, not only become decisive factors for science policies but also a tradable commodity on established "vision markets" in which holistic (some might say totalitarian) concepts of nature, technology, society and also future are merged. This development has already hit the radar of Science and Technology Studies which scrutinize how "science futures" are made up.[1] Not rarely, these envisioned science futures centre on only one specific "future technology".

Getting back to our initial example: The academic debate about nanotechnology was accompanied from its early beginning by visions and religious symbolisms comparable to the field of space flight, superconductivity, or nuclear technology (see Coenen, 2006 for details). Scientists were actively communicating with the media and delivered persuasive images of the future technology in the envisioned state of application (Lösch, 2006), for instance images of nano-bots cruising the inside of human veins and arteries. The latter were visualized as approachable and, more or less, empty spaces. The imagination of "another" world in relation to modern high technologies is often put forward in the spatial rather than the temporal sense. The viewer is persuaded to already *be* in this microcosmic world rather than *have* it one day. This approach of envisioning phenomenal corporeality is supported by metaphoric language such as "nanoworlds", "nano-landscapes" and "meta-brains".

This imaginary skeleton of science visions differs from the classic utopias of Francis Bacon and Thomas Morus (see Saage, 2001–2004, Schaper-Rinkel, 2004). The early modern utopias, most prominent in Bacon's *Nova Atlantis* (1627), were also backed-up with contemporary science and social experiences, but located on unknown places within *this* world and time. They were both there and not there. Theoretically, these utopias could be detected by a captain that finds the courage to sail in unknown waters and finds ways to deal with the many uncertainties and risks involved. At that time, the sailing ship, a long-known metaphor for individual human life, was semantically transformed for addressing the process of scientific endeavour, reaching out for the new worlds (in plural!) on the micro- and macroscale that are hidden parts of this world. For example: When the microscope was established as a new tool of scientific observation, one of Bacon's heirs and member of the Royal Society of London, the botanist Nehemiah Grew, introduced his groundbreaking *The Anatomy of Plants* (published: London 1672) with a dedication to King Charles II: "In sum, Your Majesty will find, that we are come ashore into a new World, whereof we see no end. It may be, that some will say, into another Utopia."

Classic utopias believed in the advancement of science and learning for the sake of a better society. On the contrary, however, they offered a chance for the critique of present boundaries that emerged due to imbalances of power and dominion (Saage, 2001, Vol. 1: 30). This is but one of the reasons why the utopian society had (and still has) to remain in this world. Hence, a technical artifact (e.g., the microscope) did not have a future of its own other than contribute to a society's future as a new method for learning about nature's secrets and finding tools to use them.

[1] Recent examples are the international conferences "Science Futures" at the ETH Zurich (6.–9. February 2008; http://science-futures.ch) and "Szenarien der Zukunft. Technikvisionen und Gesellschaftsentwürfe im Zeitalter globaler Risiken" at the RWTH Aachen (18.–19. October 2007; http://szenarien.rwth-aachen.de). (Last visit for both: 28 January 2008).

Time-related utopias emerged during Enlightenment. Modern utopias related to high technologies envision future worlds (often related to other planets or outer space) in future times, thereby transforming the idea of "future". The future is no longer something one hopes for today. As already mentioned, the future becomes part of an objectification process instead. In some scientists' visions, it seems to have become an agent of its own and implies the meta-perspective. In consequence, the human individual is terminologically merged into a human race (which also implies a meta-perspective) whose present outfit seems to be dispensable for both the subjectified futures and the objectified future as a whole. As Edmund Husserl once put it: "Mere fact-sciences make mere fact-humans" (Husserliana IV, 4; transl. N. K.).[2]

The question of the normative background of a future society, i.e. the wished-for social norms and modes of participation which might (de)motivate individual training at present is rarely being asked. It is an old topos of utopian thinking, though, ranging from the works of Francis Bacon to those of Karl Marx, Karl Mannheim and Ernst Bloch (Bloch, 1964; Zyber, 2007). From both an ethical and an anthropological point of view, social utopias and technological utopias cannot be discussed separately. As technological innovation itself is envisioned to pay off for society, its idealtypic member in modernity is constituted as both *Homo faber* and *Homo utopicus*. Thus, envisioning a better future and actively working for it go hand in hand (Ropohl, 2008). Conversely, denying the chance of a better future is accompanied by a loss of motivation to design, to work and to consume – an increasing phenomenon that is regarded as pathological and termed as "depression" in highly industrialized societies.

Therefore, envisioned futures are important also in a socioeconomic sense. In reality, better futures are not merely "there" for everyone, due to economic, political and social limitations; rather they are actively generated for what is regarded to be the normal consumer and market participant, mostly based on the data of present economies. This artificial genesis happens by means of science policies and technology marketing, often supported by science writers, fiction authors and film directors who are melting assumptions on "the average" (e.g. the future individual's annual income, age, body and health status and even gender) and "the exceptional" (e.g. the emergence of biotechnical enhancements). The main contents of envisioned futures (e.g., humans who live longer) are often embedded in elitist visions of the future as they are based on experts' knowledge of technologies' potentials and, e.g., the prognosis of future scarcities. This is well known from the scenarios developed with regard to sustainability issues, for instance on future resource scarcities and limits to growth.

However, there is an important difference. In the case of sustainability-related scenarios, the problem of a conglomeration of scarcities induced the setup of scenarios (and most often belong to the scenario-approach already outlined). The imported norms and values (e.g., intragenerational and/or intergenerational justice)

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[2] In the German original: "Blosse Tatsachenwissenschaften machen blosse Tatsachenmenschen."

were formulated *before* the scenarios were modelled. As a consequence, the scenario allowed envisioning possible consequences of present activities under the premise of set values and empirical data (with the persistent problem of an overload of non-knowledge, particularly regarding future technologies). The result is a construct that allows to think the following: "*If* I want (= have the value that) other/future people to have at least as much freshwater and functioning ecosystems as I have at present, *then* I have to reduce my consumption of x." At the same time, at least a rudiment version of one's own values is transported onto other/future humans or generations. These values do not resist an ethical analysis.

In contrast, a scientist's scenario ("vision") which is motivated by basic research follows a different construction. There, the scenario is sort of "built around" his or her vision of future applications of this basic research, such as Eric Drexler's early vision of self-replicating and self-creating nanobots – an almost religious vision deeply connected to those of the artificial life-community. Neither one's own values nor the values of future societies necessarily have to enter; they can be an add-on, though. Conversely, they can enter unconsciously, as value-orientation is not a defined obstacle at the very beginning. Thus, visions from single experts are much more likely to be technologically determined than "public visions" of futures, or expert groups' visions. They become "technological futures", in contrast to futures bound to a value-framework in which a specific technology is embedded. Of course, a technological future affects the anthropological concept of the imagined human being ("Menschenbild"). In a technology-driven future, the human being, including his/her brain and body, will also have to be more "technically upgraded" – a fact that is supported by the imagery of science fiction.

As Grunwald (2007: 55) rightly argues, the problem of extrapolating technological and social determinisms on a time scale by means of scenario-techniques (to which the concept of vision assessment belongs) is evident. I would like to add the underestimated *biological determinisms* that can accompany both, as for instance in the case of biomedical enhancement and social neurosciences. With the assistance of experts and new technologies, one's life can, on the one hand, theoretically be enhanced in very different ways. On the other hand, the theoretical vision of one's own technically enhanced future has to be adaptive to specific social contexts which might not be covered by scientific debates. Present norms, related to normative concepts of nature, technology and society, can function as exclusionary filters for better futures for some members of society, as the following example shows.

8.3 Example: The Social Boundaries of Techno-Doping

Since August 2007, the South-African sprinter Oscar Pistorius has been in the public media nearly every day. The 22 year old Pistorius, also known as "the fastest man on no legs", was born without fibula bones. As a consequence, an amputation of his lower legs was performed while he was still a baby. Nevertheless, by means of specially designed carbon fibre prostheses, he is able to walk; he is even able to run about as fast as "normal" sprinters who were at that time qualifying for the Olympic Games in Beijing 2008. Athlete Pistorius is holding the double amputee Paralympics' world records for 100, 200 and 400 meters. In 2008, he wanted to rise to a new challenge. However, the Olympic Committee and the public media have been raising doubts about this new kind of "techno-doping", enabling a disabled person of the Paralympics to become a sportsman within the Olympics, i.e. the contest for the "normal".

While I am writing this article, the discussion whether Pistorius should be allowed to take part in the Olympic Games or not is still vivid. A decision of the *International Association of Athletics Federations* (IAAF) on 14 January 2008 prohibited Pistorius from taking part in the Olympics. German scientists had analyzed his prostheses in order to find out if he might have an unfair advantage over able-bodied athletes (e.g. concerning the width of his steps). In fact, they found he indeed does have a "mechanical advantage", as Gert-Peter Brueggemann, professor for biomechanics in Cologne, had put it in his expertise in November 2007. On 16 May 2008, the IAAF-decision was revised by the *Court of Arbitration for Sport*, pointing out, however, a lack of sufficient evidence for the proclaimed mechanical advantage and thus allowing Pistorius to be eligible for the Olympics. In the remaining six weeks, Pistorius failed in qualifying for the Olympics 2008. He again took, however, the gold medals for the 100, 200 and 400 meters sprints in the Paralympics 2008.

Whereas most officials of sports, allied with scientists, argue that the purity of sports, its fairness, and its ideal of nature is endangered, the public opinion on the Pistorius-case is completely different. That a disabled person is able to overcome certain natural limits by means of technology and gain more ranges of personal freedom cannot be wrong – and: isn't this the crucial argument for the vision of technological progress and human enhancement? Obviously, public acceptance of technically enhancing potentials contrasts normative ideals of (professional) sports and nature, moreover starting at the time when the *Tour de France* continuously offered an unseen amount of doping cases (see Wehling, 2003). The societal consequences of this schizophrenic situation (not only) within sports, i.e. to reject specific bodily interfaces of humans and artifacts (Orland, 2005) but, at the same time, to establish human biofacts (Karafyllis, 2003) by constantly manipulating biological growth, fitness and development, remains to be seen. The same ambivalence is true for science and technology. Some scientists support highly normative concepts such as posthuman idealtypes of power, success and well-being on the species level, whereas in the individual case of Pistorius it is the scientists who are engaged in proving and maintaining an athlete to be "normal". One might argue that professional sport is a very special case. However, it functions as an illustrating example of how public acceptance in the case of technical innovations can differ from experts' and strategic elite's opinions, particularly based on normative grounds. This type of public disagreement that is not (or insufficient) backed-up by scientific analysis can be found in other technology discourses, not last in the ones about genetic engineering of food crops in Europe which differ from the ones in the USA (Levidow, 2001).

One reason for giving doping a preference above techno-doping is related to phenomenology, highlighting the immanence of the human body. As long as technology does not show *phenomenally*, as in the case of conventional doping and genetic engineering of living beings, it *might* still be nature. But techno-doping shows the artificial element, the prosthesis – a reason why Pistorius is also called "blade runner" by the public media, which reminds one of the famous 1982 science fiction movie with Harrison Ford as cyborg-protagonist. Science, including science-driven sports, seems to accept the aforementioned self-deception more than the (Western) public itself. In a Habermasian perspective, this special way of self-deception among, e.g. scientists, is one limit to public discourse as it undermines standards for a "self-correcting learning process" (Habermas, 2005: 89–91).

This relates to one anthropological thesis of this essay, highlighting that the phenomenal visibility of the border between nature and technology is anthropologically important; moreover, that neither the concept of nature nor technology alone can form a normative argument, rather than its specific relation when being applied to a social context. When vision assessment ignores this immanence of the visible it can hardly give recommendations for future public perceptions or even visions of future actors in science and technology. With its present methodology, vision assessment excludes the phenomenal sphere of the life world, where technology can affect the senses. In the case of nanotechnology, this invisibility of technical interference with nature might lead to a similar resistance as has already emerged against genetic engineering.

I would like to point out one sentence which Pistorius said quite angrily to the journalist Judith Reker (of the Swiss weekly DAS MAGAZIN 34, 2007),[3] after being asked if he identifies himself as a "cyborg". Pistorius responded: "*I hate Science Fiction*." For him, the problems are more than real, and his disability is a fact, no fiction. The open question is, how different parts of society deal with it in regard to different contexts. Pistorius argues that the prostheses enable him to walk in normal everyday life, so why can a high-tech version of this not be used to run in a sports competition? Why isn't he allowed to enhance himself?

As the Pistorius example should exemplify, in technology discourses the reference to "nature" is most often used in a twofold sense: to overcome the limits of nature and to maintain nature as an inert reference at the same time. So inferring about "nature" implies both inclusionary and exclusionary elements, the latter relating to social stratification and status that should appear to be "naturally" given. In consequence, one could estimate a future society that strictly votes for the visibility of technology as nature's "other" (Ropohl, 1983), and thus resists technologies on the nano-scale. Therefore, as philosophers engaged in technology assessment we have to ask reversely: Which and whose visions are *not* assessed by vision assessment, though they might be already debated in public and even in science? To answer this question in the next part, we will take a look at the role of journalists and science writers and, above all, at the successful genre of pop science.

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[3] Judith Reker. "These und Prothese", *DAS MAGAZIN* 34, August 2007.

8.4 The Genre of Pop Science and the Genesis of "Public" Visions

Public media play a key role in communicating science and shaping public acceptance of specific scientific theories, as sociologist Peter Wehling (2006: 254f) argues. Media convey and transform the knowledge claims and ignorance claims of science. Thus, they model systemic knowns and unknowns at the public level by means of filtering what is, presumably for everybody, relevant to know and what is not. With reference to *memoro*-politics[4] (Hacking, 1998: 215ff): They also model what has to be remembered and what can be forgotten. According to S. Holly Stocking (1998: 169), journalists' own *interests* are a crucial part of this filtering process. Journalists are not only watchdogs but also gatekeepers, often even facilitators for transporting information to the public sphere. This personal handwriting which is normatively inscribed in a journalist's work is but one of the reasons why an assessment of visions that have been transported by journalists has to fail for the overall aim of TA.

On the content level, the modern idea of the *public relevance* of scientific knowledge and nonknowledge is based on heterogeneous concepts such as progress and innovation, economic well-being, health, social justice, security, and human nature, all of which have to be mediated as particularly relevant for individuals in order to be read and "taken in." Scientific knowledge of the human brain seems to assemble all of the above-mentioned target concepts for public relevance. Connecting scientific propositions with terms traded in already existing "linguistic markets" (Bourdieu, 2005) and cultural stereotypes (as part of an act called "framing") eases public acceptance by upholding the notion that laypeople and experts do not differ substantially in their scientific knowledge capacities. Referring to the institutional dimension of science, this notion can be used for conveying the impression of existing participatory elements in political decision making concerning new (and old) research areas in science and technology ("scientific citizenship"; see Wehling, 2006: 259). Since it itself already uses linguistic market terms (e.g., "cyborg", "future", "health"), symbolic images (e.g., neuroimages and images of nano-landscapes), and stereotypes (man/woman, female/male, black/white), the mediating process gains in efficiency and effectiveness, which is also necessary for successful science fundraising.

However, this efficiency contains reactionary elements, and it functions at the cost of envisioning a normatively "better" society by means of scientific progress. Hence, it undermines the idea of cultural progress. In addition: that many individuals resist the lure of a discourse on a "future technology" might not always be a result of ignorance. Public ignorance of science and technology can be a social reflection of this contradiction and normative disillusion rather than merely exemplifying the "knowledge deficits" of society. The crucial question for processing

[4] *Memoro*-politics relate to the cultural history of the concept of soul and are empowered by the introjectionistic idea that there is a deeper (and higher) knowledge of the self than is actually experienced in everyday life.

effective science policies is: How can these “ignorant” people be addressed in order to become part of a “public discourse”? One possible method is to blend the border between facts and fiction by authority, as is happening in pieces of work that experts themselves have written and that fall into the category of pop science.

The particular influence of pop-science literature – written by scientists rather than journalists – on the mediating process of scientific knowledge has not yet been sufficiently scrutinized, and I can do nothing but offer a rough sketch here. The genre of pop science developed back in the middle of the nineteenth century, and was related to the new concept of public life (and its counterpart: private life), as well as to the ideas of publicity and civil society. It was instantiated by an enormously expanding newspaper and journal market for mass distribution and the building of museums. From its very beginning, scientists trivialized pop science because of its simplifications and viewed pop science as an add-on within an imagined two-phase approach of scientific writing, which, nevertheless, was regarded as necessary for the advancement of science. In fact, science and pop-science literature offer complementary ways of understanding scientific knowledge. Pop science established unique transformations of knowledge (Daum, 2002: 26), particularly related to holistic ideas of “nature” and the “world,” and it still does. According to Andreas Daum, European pop science started (at least in the German and French contexts) with Alexander von Humboldt’s *Kosmos* (1 vol. 1845), at about the same time as the 1848 revolution was breaking out. At present, “nanoworlds” and the world of “the” brain is under pop-scientific scrutiny. Present examples of this genre are the pop-scientific essays on neuroscience, artificial intelligence, evolutionary theory and other “hot topics” which have been written by “big name” scientists and, for example, merged into John Brockman’s editorial works (e.g, Brockman, 1995, 2006). The US-American literary agent and media activist John Brockman puts forth pop science by means of a specific marketing discourse concerned with two questions: First, what is science? Second, what is reality? He is on a mission to implement a “third culture” between sciences and humanities (the latter of which he ignores, however), and this third culture seems to be ruled by journalists and science writers. In terms of media studies, Brockman does *agenda setting*. One of his admirers, Frank Schirrmacher who is editor of the influential daily newspaper *Frankfurter Allgemeine Zeitung*, followed his example in the German contexts and published bestselling books on Darwinism, the aging society, and nanotechnology (Schirrmacher, 2001).

In the pop-science literature, the author speaks both as scientist and journalist. In so doing, he or she is able to perform a double filtering process of knowledge: First, the author speaks as scientist (backed by his or her personal authority), clearly describing what is known within his or her scientific community (and, implicitly, what is not known); second, the author gives voice to the lay reader, individually selecting what is important (according to the author’s set of norms and values) to know and reframing this knowledge within the cultural perspective as to *why* it is worth knowing. Descriptive and normative arguments are intertwined. Typical writing styles of pop science include a first-person perspective (singular: “I”) in the introductory passages to stress scientific authority, a third-person perspective in the middle section as typical for classical science writing, implying an objective meta-level, and, again, a first-person perspective at the end (both singular and plural, and the "we" most often outweighs the "I"). As a result of this rhetorical strategy, both the "known unknowns" (disguised by generalizations and abstractions during scientific modeling) and the "unknown unknowns" of science (often related to scientific paradigms, in the tradition of Thomas S. Kuhn) are less likely to become part of public "ignorance claims" (Wehling, 2006), compared to the mediating process instantiated by serious science journalists. It is important to remember that science, in general, is not only exporting terms and symbols from laboratories into the public sphere but is also importing them from public issues which crop up in society, for example, in social movements (e.g., the animal rights movements, or the women's rights movements) or religions. In pop-science literature, both scientific knowledge and ignorance can be actively constructed in tacit accordance with features of existing social and political conditions – for instance, concerning issues of social exclusion and divisions of labor.

8.5 Example: Social Neurosciences and "the Future" of Society

The purpose of this second example is to broaden the understanding of strategies of defining and controlling *one* future for *one* society, and to show how pop science contributes to the legitimization of this totalitarian type of research. So far, there is no TA or Science Assessment of Social Neurosciences. However, there is a valuable TA-study on Neuroimaging (Hüsing et al., 2006). In addition, topics covered by Social Neurosciences receive vast media support. Stories about "the" brain – an entity described as a single world of its own – sell, as they seem to address social relationships like love, sexuality and stigmatization (see Karafyllis and Ulshöfer, 2008 for details). We might imagine the day when the visions of both experts and journalists about "the brain future" find their way into vision assessment. So, let me contribute to a "vision assessment of vision assessment" and look at the normative settings of today's research in the Social Neurosciences.

Social neuroscience can be highlighted as an example of basic research, where the design of a *future society* is already inscribed in early stages of research. Other than in the case of nanotechnology, there definitely is a discourse on "the brain", supported both by scientists, the media, and researchers from the humanities. As in the case of nanotechnology, however, scientists continue to provide colorful and symbolically contaminated images (mostly deriving from the method of fMRI – functional magnetic resonance imaging) that are printed in daily newspapers, weekly journals and shown on television. However, an academic debate on the visions of researchers engaged in Social Neuroscience, that is *their visions* of how a future society should be, is still lacking.

This lack does not become obvious because the brain seems to be omnipresent in public debate already. Claudia Wassmann argues that the brain became an *icon* as a normative instance especially in the years 1984–2002, due to several highly recognized TV programs on brain scans: “a gap has opened between the representation of brain imaging in the lay press and the properties brain scans acquired within the neurosciences. This gap has widened since the beginning of the new century” (Wassmann, 2007: 153). It is the idea that one is responsible for both one’s brain future and one’s own social future, for instance by means of lifelong learning and training of one’s emotional intelligence, which is normatively relevant.

Within the same time period, the brain as icon has also become influential in the humanities and social sciences, as the emergence of new sub-disciplines show (e.g., neuroethics, neurophilosophy, neurotheology, neuroeconomy). There, the relationship between emotion and intelligence, the former topoi of the (potentially) irrational and the rational, are being (or already have been) reconfigured. According to neuroscientists (e.g., Damasio, 1994), emotions now seem to have an original cognitive content and ensure rationality, at least in the brains of “normal” people. “Cognition”, in the cognitive sciences, has a meaning which is quite different from its typical understanding within philosophy (i.e. a conceptual and propositional structure). Rather, in the cognitive sciences, it is “used for any kind of mental operation or structure that can be studied in precise terms” (Lakoff and Johnson, 1999: 11). In this view, a “cognitive unconscious” exists, which, moreover, opposes psychological traditions and their ontologies of soul and mind. In recent years, models and terms from the field of neurosciences and cognitive sciences have colonized the epistemic cultures of many other disciplines, in the process transforming some of their ideas about what is normal, what is human, and, not least, what determines a functioning society.

For instance, in a recent study entitled *The good, the bad, and the ugly: An fMRI investigation of the functional anatomical correlates of stigma*, neuroscientist Anne C. Krendl and her colleagues analyzed how feelings of disgust towards socially stigmatized groups are represented in neuroimages with reference to the brain’s capacity for controlling this disgust (Krendl et al., 2006). I explicitly chose this study to exemplify how transformations of models and terms from both sociology and the social world take place in the laboratory of the social cognitive neurosciences, as its experimental design is very thoughtfully conceived. Although these researchers are particularly sensitive to the underlying biases of Social Neurosciences and are aware of the impact of these biases on society, the study shows how difficult it is, methodologically, to keep to one’s own normative premises. In general, for social neuroscience the problem arises that if you want to measure the process of stigmatization (i.e. a categorization) in the brain, you must define a priori what stigma (i.e. a category) is and in which brain area(s) it might show, for instance, in the area responsible for feeling disgust.

The general hypothesis of Krendl’s et al. study is that control and disgust refer to two separate neural systems. The amygdala, the “organ” of emotions, is involved in the areas responsible for “feeling” disgust. The scientists were interested in both modeling and understanding how the process of social categorization takes place. Twenty-eight students were recruited from Dartmouth College (New Hampshire, USA). The implicit architecture of the experimental design, e.g. regarding the level of students' familiarity with the stigma-type, which I will not discuss here, was quite challenging.

Photographs of persons who had one of the following attributes: *being obese*, *extensively face-pierced*, *transsexual*, *generally unattractive* were selected and shown to students (both men and women) at random. They were supposed to rank the intensity of their feelings of disgust for each face in the photos on a special disgust scale. Previously, a scale for general attractiveness ("likeability") had been developed for every single volunteer, based on individual evaluative ratings of photographs with "control faces", in order to compare the brain condition for each individual when looking at photographs of "normal" people with the condition which developed while looking at the photos of the stigmatized. *That* these people are generally stigmatized was the scientists' decision (i.e. it was their categorization), even if Krendl et al. claimed that the chosen stigma categories are "widely acknowledged" (Krendl et al., 2006: 7). Their assessment was accompanied by the decision to take the photographs from social platforms of self-addressed groups, such as webpages of piercing artists or a dating website for overweight people. This means that they selected photographs of people who identified themselves as obese, pierced, transsexual, or unattractive, which does not necessarily mean that they view themselves as socially stigmatized.

Put in philosophical terms, in the study of Krendl et al., *acceptability* was modeled neuroscientifically, and this is a category of ethics. The category of "stereotype" (i.e. *acceptance*), on which, according to Krendl et al., social stigma is based, was considered as given. Here, already, the terms used are important for modeling knowledge, as the experimental use of "stereotype" provides a reference to previous neuroimaging studies on the stigmatization of race (to which Krendl et al. refer). This is what Ian Hacking – referring to Nicholas Jardine – called the "calibration" of instruments within scientific developments (Hacking, 1998: 98), i.e. that every new method introduced for measurement has to be calibrated against the old one, including the evaluation of how adequate the old one was. In psychological terminology, the concept of the "calibration of instruments" (e.g. clocks) is known as *validation* (of tests and questionnaires, i.e. constructs), which leads to other problems. Obviously, there is no awareness on the part of some scientists within the social neurosciences to calibrate their instruments, meaning *social concepts* like stigma and stereotype, with sociology or philosophy.

I argue that concepts like stereotype can be *instruments* in social cognitive neuroscience. They make it possible to technically generate hypotheses in the context of cognition and emotion, and these concepts differ from the concepts which result from the experiment. It is important to notice that this transformation differs from metaphorical use and the science/society cross-border trade of metaphors. How can concepts be instruments? Because within the experiment, their real meaning seems to be irrelevant. Instead, they just lend the experiment their linguistic skeleton, purified of metaphorical and social meanings and implications, for the purpose of social cognitive science. A cultural and social concept, like stereotype, which is binary coded, can be an extremely useful instrument on the practical level of doing science, because it can be combined with attributes which are also binary coded.

There is a clearly-established cultural stereotype of black and white, likewise of man and woman. Concerning the “old” and still intensively used instrument, i.e. the stereotype black/white applied in stigmatization studies of race, the concept of stereotype somehow made sense (this is not to suggest, however, that it made sense in the studies in which it was employed). But a stereotypic structure is not obvious in fat/slim, extensively pierced/not at all or not extensively pierced, unattractive/ attractive. They relate to aesthetic categories, which are highly heterogeneous. There is no objective beauty, moreover which is not related to a type, and even the idea of ugliness does not contradict the idea of attraction. All chosen types involve *continua*, and are not discrete attributes. Of course, black/white also involves continua of color, but color *can be more easily stereotyped*, e.g. by scientists’ choice of photographs, than attractiveness. And what is the binary other of transsexual? Not transsexual? Heterosexual? Same sex sexual? Taking a closer look, it appears that this study does not focus on stereotypes but on *normality* and its opposite, the construction of abnormality. This is an important difference. And it makes all the difference regarding the question of *who* shapes this normality – science or society, the scientist with her abstract categories or the individual within her life world of personal experiences?

During the experimental process, and by means of several abstractions and generalizations, predefined attributes of individuals’ faces on photographs were converted into properties of members of social groups. On the other hand, the idea of a social group emerged because one single attribute was seen as principal and thus made the essence of this social group. The social world was remodeled. Within the laboratory context, the individuals in the photographs became “targets” of social stigma, whereas the members of the indicated social groups became “bearers” of social stigma. The volunteers in the laboratory became “perceivers” of social stigma, and the photographs themselves “stimulus materials”. This setup is not an exception but the normal approach and terminology for social cognitive neuroscience.

According to Krendl and her colleagues, the disgust inspired by obesity is much more controlled within the students’ brains than disgust towards transsexuality, i.e. seeing a photograph of a transsexual feels more disgusting than seeing a photograph of an overweight person. The most disgusting of all is to perceive general unattractiveness.

We can explore Krendl et al.’s study a bit further, with regard to the methodology and epistemology of social neuroscience. They assert that their study is, firstly, inspired by the awareness that social neuroscience studies on social categorization and stigmatization have predominantly dealt with race differences (see Phelps and Thomas, 2003 for a critical overview). Secondly, their study represents a critique of previous studies of social stigma which had resulted in the concept that theoretically controllable stigmas (such as obesity) lead to more negative feelings in the receiver than uncontrollable stigmas (e.g. blindness). Again, in philosophical terms Krendl et al. tried to reject the idea that *blame* and *guilt*, which have been lurking behind the concept of controllability, are involved in stigmatization. This complex field of guilt and visible stigma, which was analyzed in the laboratory, imported a specific Christian tradition into the scientific modeling. The differentiation between controllable stigma and that which is "given" has a long religious history, distinguishing a stigmatized person from others on the basis of a bodily wound. Having biblical origin, stigmata in the Catholic tradition refer to marks on the body which resemble the wounds of Jesus received while hanging on the cross – like wounds on feet and hands. In religious tradition, stigmata are not a sign of guilt but show a co-suffering with Jesus Christ and the capability of bearing the sins of others.

According to Krendl et al., they chose the attributes of obesity and transsexuality because these attributes are ambiguous, whereas piercings are clearly controllable, and unattractiveness is determined by genetics and is thus uncontrollable. The category of "control" is used variously in the social neurosciences: first, regarding personal and social behavior; second, regarding the control of emotions and emotional areas inside the brain by other, more "intelligent" areas (mainly the prefrontal cortex); and, third, regarding the present and future social response (of groups) and emotional response (of individuals) to the perceived behavior of others.

A scientific target of social neuroscience is the unveiling of political correctness rhetoric, or other forms of learned control, and to determine whether the evaluation given in the questionnaire (behavioral data) contradicts the neuroimages (fMRI data) or confirms them. These two different measurement methods are newly referred to as "explicit measures" (questionnaires) and "implicit measures" (neuroimages), thereby tacitly abolishing or at least reducing the implicit measurement methods referring to unintentional bias from psychology (see also Phelps and Thomas, 2003: 756). Unconsciousness wins over unintentionality. In the end, this issue is about the definition of truth and which science holds the greatest claim to defining it. And since emotions still seem to evidence the innocent nature of the uncivilized animal in us, which cannot lie, the neuroimages are thought to represent the "original" and true feeling of the reptile mind. It's a jungle out there, in the brain. Of course, the wildlife of the amygdala can be tamed by the civilized brain areas responsible for evaluation and emotional learning. As a consequence, *social norms* seem to be inscribed in the brain, somehow governing its cruel "nature". The dialogic nature of social norms which are practiced in social life is completely ignored. Above all, the *vision of a better future* in which today's stigmatized persons are no longer victims of social exclusion is dispensable.

Not surprisingly, in the discussion section of their paper Krendl et al. offer the opinion that, "Over the course of evolution, the avoidance of those possessing stigma may have been adaptive" (Krendl et al., 2006: 12). As neuroscience is rooted in biology, and biology in Darwinism, this phrase "Over the course of evolution x may have been adaptive" seems to be unavoidable. It is like the final scene in a Western movie regardless of the story; the cowboys are on their horses, riding into the sunset: their work is now done.

In the mentioned study, there are no visions assessed. Rather, the scientists' visions of a present society (including stigmatized people) and of a future society (with, according to biological determinisms, a smaller number of stigmatized people than today) are inscribed into the very heart of the experimental setup. As in the case of vision assessment of nanotechnology, exclusionary mechanisms regarding participatory elements manifest at the very beginning, i.e. already in the first hypothesis of the experiment. Could vision assessment, based on expert interviews and media analysis, detect these types of primary normative settings?

An ethicist might ask: For what purpose is this kind of research carried out and funded? Does it matter that the technology for neuroimaging already exists, and that financial investments have to pay off, i.e. that as many people as possible should be brainscanned, no matter what the reason? Or is the aim to control society for the sake of a better future for the "normal" majority of its members, reversely putting pressure on the present individual not to become a member of a (possibly) stigmatized group?

Ethicists' aim should be to reflect on a new area instead of labelling themselves as "neuroethicist" or "nanoethicists", thereby accepting the propria "neuro" and "nano" as essential. *The area encompassed could be described as the brain culture of individuals who rationalize their "self" while still believing in their unique personality*.

To sum up: In the mentioned experiment of social neuroscience, neither the individual nor the society is envisioned to have an open future. "Future" only means the future presence of the human species, organized in distinct populations. Social determinisms and biological determinisms are fused and thereby the human ability to make moral judgments is being abolished.

8.6 Outlook: The Future of Vision Assessment

The main argument of this essay was that envisioning one's own future is based on the belief in individual potentials and sharply contrasts the idea of artificially designing "the" future of "the" society. As up to now there is no definite methodology for vision assessment, it allows for thinking of methodological instruments ranging from *discourse analysis* (a concept widely used in the humanities) to *simulation* (a concept widely used in engineering) to politically initiated, *public discourses* which follow defined and institutionalized discourse rules. Admittedly, none of these instruments can empirically certify full inclusion and equality, but regarding both they offer different shades of grey between the black pole of expert-elitism and the white pole of politically engaging the whole society. Naturally, the sources and media that are being used in these approaches substantially differ, as do the chances for addressing pluralism. At present, vision assessment-techniques combine media analysis (of daily newspapers, cinema productions and TV programs), pop science writings, and expert interviews. From a systematic point of view, each of these sources is already a meta-source and has to be evaluated with regard to its unique normative settings and implications. From a sociological point of view, each of them has to be analyzed as to which social groups (or even strata) are included and excluded (or purposely exclude themselves) from the media, thereby also taking gender and race aspects into account. From a historical point of view, vision assessment is unlikely to serve as a prognostic method. As historians of science (e.g., Hård and Jamison, 2005) point out, technological innovations of the past were rather supported by "small narrations" than by big visions or projected futures.

When vision assessment is used as a tool for TA, the question as to whether the "imagined" technology to be assessed should fall into the TA-category of "technology-induced" or "problem-solving" is likely to be ignored. This omission imposes ethical problems and normative short-sights. In the particular case of nanotechnology, the question *which* problems should be solved with the help of nanotechnological means is not even asked. As a theoretical consequence, the question of present and future needs, and the turn to possible alternatives, is also neglected in this approach. Instead of correlating the envisioned means with preferable ends in the ethical sense (e.g., taking arguments of justice and participation into account), vision assessment paves the way for science actors that search for accepted ends even before the means (i.e. the technical prototypes) allow them to deliver reliable data if they in fact *are* reliable, i.e. if they in fact *are* means. By vision assessment, public acceptance is empirically tested even before a normative judgment on the acceptability of a technology could have taken place. Therefore, it remains unclear if the concept of vision assessment is part of a science *of* (mentally) designed futures or *for* (really) designing *a* future that is envisioned to be "better" for all.

This methodological weakness might turn out as strategic back-up for a science policy that forces scientists who are engaged in basic research into early visions of application and marketing. At the same time, such a science policy would weaken the position of ethicists and TA-researchers. It does not lack irony that ethicists are weakened by the encouragement to assess and evaluate something which is still a vision. In fact, by helplessly claiming (in printed form) that they cannot assess or even evaluate nanotechnology, ethicists open a fake-discourse which gives the public the impression that ethicists *can* be whistle-blowers in the nano-field already. In the long run, ethicists and TA-researchers can thus only disappoint the public – and thereby reduce the general trust in ethics and TA. On the contrary, ethicists can also say "No" to science funding and resist the lure of assessing and evaluating pure visions of powerful science actors. As a positive side effect, risk research would still be kept in the stronghold of the engaged scientists itself (who are best informed about the "facts", i.e. the malleability of the generated epistemic objects) rather than being delegated to TA-researchers who deal with categories of imagination all too soon.

Regarding the innovative process of how scientists and engineers actually create and design technologies, there is more theoretical work to be done, combined with laboratory studies (see, e.g., Banse et al., 2006; Karafyllis, 2004, 2006; Stiftung Brandenburger Tor, 2007; Poser, 2008). Basic research does not primarily seek for inventions; they more or less crop up by creative acts of tinkering. However, nowadays possible applications are also imagined "technically" (by means of simulation), thus partly reducing the imaginary element of a scientist's mind. In the 1990s, the terms "imagination" and "engineering" were coined to form the neologism "imagineering". The latter addresses artificial worlds of imagination, in which new products and production processes should be visualized (Bürdek, 2007: 348). There, ad hoc-premises are encrypted in programs which contain data for future supplies and demands. In all kind of simulation techniques, including vision assessment, the anthropological self-image is handled as astonishingly inert. Thinking of the growing anthropological need for understanding oneself as part of nature (Karafyllis, 2008), one can doubt if a technologically upgraded individual of the future is the best guess. In general, anthropologies have a dialectic structure (Latour, 1995), i.e. one cannot proclaim a "technological future" without referring to a "natural future". In addition, psychological boundaries for imagining and enduring possible futures have not yet hit the radar of the proponents of vision assessment.

Vision assessment as a concept for TA might be useful in combination with media ethics (Funiok, 2007), science ethics (Düwell, 2004) and business ethics. Then, for instance, the normative questions would arise as to *who* is setting the agenda and *who* is funding agenda-setting for what purpose. Moreover, one might ask *who* develops persuasive images and narratives for future technologies for what purpose. Only insofar as this information is provided is a public debate about futures possible that would deserve the name "discourse". Moreover, only then can individuals differentiate between facts and fiction and are able to reflect on their own values that are basic for a better future. Therefore, vision assessment could help to deconstruct ideologies.

Obviously, nanotechnology is triggered by basic research. This insight would provide a chance for classic TA in the problem-oriented mode: asking about people's present needs and wants and how technologies are able to support and stabilize them in order to generate a better future for (ideally) everyone. Idealizing the possible extent of participation on a theoretical level, as Habermas did, has an *operative* outcome for the actual discourse; as the process of decision-making is only publicly accepted as reasonable if it is based on the avoidance of deception and exclusion. However, this insight also allows for imagining that (not only) nanotechnology might be dispensable for a better future – depending, of course, on who you ask.

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