Technoscience comes to Lund

ESS and the Enlightenment Vision

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CHAPTER 10

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The ESS and the Enlightenment vision

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In 2019, the first neutrons will be fired at the ESS facility on the outskirts of Lund, which if all goes according to plan will be the brightest neutron facility in the world. In the self-image of scientists, this kind of high technology and international collaboration is entitled Big Science or Global Science. The concept 'technoscience' is not used. This chapter will discuss whether the concept of technoscience reveals aspects of twenty-first-century knowledge production that the other labels exclude. My claim is that it does, and from two special vantage points: first, technoscience represents a new epistemological situation; and second, it represents a new attitude towards the social values expressed in the quest for innovation and improved human condition. These positions are associated with the new epoch of reflexive modernity, or second modernity, substituting the linear model of planning and institutional organization that has long been modernity's hallmark (Beck 1992; Lash 2003). However, one should discern this characterization of modernity from an important historical fact that science in practice has never been pure. In general, technology has been inseparable from science since at least the Scientific Revolution, with science dependent on technology and technology embedded in science. Hence the intertwining of theoretical science with technology cannot be a starting point to defend an argument of a new epoch of technoscience.

Technoscience evokes the question of whether science is taking on features we do not yet have an epistemic vocabulary to articulate, and hence have difficulty reflecting upon. The break with modernity consists in this non-determinate and open situation. Established binary categories such as natural–man-made and real–unreal have been in flux ever since technoscience remodelled the ontological situation, both from the perspective of science and everyday life. The aim of this chapter is to show that the concept of technoscience opens up for critical reflection on science and society veiled in concepts such as Global Science or Big Science (Carrier & Nordmann 2011). For some people, the term technoscience is provocative and associated with postmodernism and the deconstructivist ambition to dissolve the rational cornerstones of our modern age, and especially the Enlightenment heritage (Forman 2007; Bensaude-Vincent 2008). This ideological standpoint is redundant if one accepts that the new features of science are constitutive of knowledge-oriented society. Technoscience opens up to address the new situation of 'knowledge and objectivity, theory and evidence, explanation and validation, representation and experimentation' that affects society in the long term (Nordmann 2010, 286; Nordmann et al. 2011b).

Since antiquity, philosophy has been the reflective thinking tool for doing boundary work, separating nature from culture, artefact from reality, knowledge from mere beliefs, and science from religion. In a rough characterization, this philosophical reflection can be labelled purification work aimed at modelling the proper objects for solid knowledge. The story about purification was authored by philosophers who idealized science as a more or less pure activity and who strived to elaborate the relation between theory and reality, mind and model, nature and culture in an ongoing search for the ultimate truth (Bensaude-Vincent et al. 2011, 367). A quotation from Moritz Schlick, the founder of the Vienna circle, expresses this view on the scientific object and the asserted task for the philosophy of science.

> By its very nature knowledge demands that the one that seeks knowledge assumes a distance and elevation above the things from which one can survey their relations to all other things. Whoever gets closer to them and participates in their agency and efficacy, partakes in life and not in knowledge; face to face with the things one beholds their value and not their nature. (Bensaude-Vincent et al. 2011, 367)

The consequence of this philosophical conception of the scientific object was that the theoretical aspects of science were elevated compared to science in practice, which was classified as engineering. What mattered was theoretical progress, which was considered all that was needed to trigger scientific discoveries about Nature's architecture. Technology was needed for scientific achievement. As modernity ran its course, science in general held primacy over technology; with the dawning of the second modernity, this linear order has been questioned (Forman 2007).

In its information material, the ESS is portrayed as an exemplary realization of science and applied research fusion in a complex technological constellation. The combined science and technology practices house both the "life of science" and "innovative research". However, the ESS also exemplifies the new scientific conditions that challenge the available epistemic resources offered by the philosophy of science. In technoscience, artificial objects are created that far exceed evolution's capacity in both speed and buildability. I will start by giving an account of the concept of 'technoscience' as a framework for discussing first, the concept of 'ontological indifference' and, second my own suggestion: 'ontological inclusion'. The article ends with a discussion about three themes that might seem incoherent, namely the prospected ESS facility in Lund, the humanities, and the future of the Enlightenment vision.

Technoscience

In the 1990s, 'technoscience' started to circulate as the term for an assumed epochal break with former modes of scientific knowledge production in late modern Western societies (Gibbons et al. 1994; Hottois 1984; Latour 1987; Nowotny et al. 2001).[1] Technoscience supposedly represented a new knowledge hybrid, which fused theoretical representation with technical intervention. Certainly, the new mode for knowledge production also represented a new disciplinary heterogeneity; new transcending combinations emerged such as innovation science. (Fagerberg et al. 2009). Another sign of the new epoch was an increasing number of new knowledge actors outside the traditional knowledge sites (Etzkowitz & Leydesdorff

1998; Gibbons et al. 1994, 8–9). Technology centres inspired by Silicon Valley sprang up across the world.

In the discussion, three main perspectives on technoscience can be discerned. First, there is the approach that examines technoscience as a social arena, constructed by negotiated interests. In science studies this approach dominates and illustrates the allover accepted position of post-Kuhnian science studies, namely that progressive development in the sciences are dependent on external actors and conditions (Biagioli 1999; Elzinga 1982; Knorr-Cetina 1999; Latour 1987; Shapin & Schaffer 1985; Woolgar 1988). This is a well-known fact, forcefully experienced by the existing science communities hit by the present economic recession in Europe. Science is conceived as a social process, which is reflected in the replacement of the term industrial society by knowledge society (Gibbons et al. 1994; Nowotny et al. 2001).

Second, there are the cultural studies of technoscience. One of the central foci is how the practices of technoscience reshape the dimensions of everyday life. In robotics, the shift is from 'manipulating things and moving materials to providing service gadgets for the well-being of humans ... a move from infrastructural technologies toward the production of consumer technologies' (Weber 2011, 165). During recent years, cultural studies of technoscience have widened its disciplinary basis from its feminist and media studies' origins to back up 'a cultural turn of technoscience studies', stimulated by the emergence of new consumer-oriented technologies (Haraway 1991 & 1997).

Third, technoscience means altered knowledge production, following on from the transformed relations between natural and artificial nature that affect traditional epistemology and ontology alike. Nano- and biotechnology, as well as information technology, do not aim to model the world and make proper representations of it, but rather aim to build 'flexible, robust, situated and embodied systems' (Weber 2010, 24). This last approach is not intended to be classificatory, but rather to lay bare the 'guiding ideals or research orientations that shape practice in the different ways even within the same fields of research' (Bensaude-Vincent et al. 2011, 367). A meaningful distinction between science and technoscience can be made by considering the objects of research. This focus admits that a certain practice can be considered both scientific in the traditional way and technoscientific from another position, namely the purification perspective. When making objects using scanning tunnelling microscopy or nanomaterials made with Aerosil® powder, it is unnecessary to distinguish between the scientists' contribution and the mind-independent world. It doesn't make sense. In this perspective, technoscience is defined by its neglect of purification work.

Technoscience aims at creating robust systems and user-friendly technologies that work outside the laboratory rather than establishing justified representations of reality. The reliability of the observation has another footing. It depends on the performance of the system, not the representational features as stated in traditional philosophy of science. At the centre is the production of objects making up the technical infrastructure that embeds human action, from research settings to everyday life. Home electronics, computers, and smartphones are all cases in point. This technoscientific task is accompanied by an entrepreneurial agenda to develop innovative solutions that improve human performance (Roco & Bainbridge 2003; Bensaude-Vincent 2008; Nordmann 2004). In this high-tech setting, values are a central guiding interest for the research agenda— which is a striking difference to traditional science production, where elimination or suppression of values was considered necessary to obtain objective results (Daston & Galison 2007). If increasing parts of reality are created with specific human enhancements as the prime objective, values will be a necessary means to achieve the desired end.

The historical argument against technoscience

These three characterizations of technoscience claim that profound changes have occurred, generally described as an 'increasing hybridization of science, technology, industry and society' (Weber 2011, 160). No one doubts that science and technology are intertwined, but the doubt is whether this intertwining represents a historically new constellation. Much of the discussion has been centred on this historical argument as the pros or cons for the thesis of an epochal break. The most common position is that the intertwining has always existed, but it was overlooked until the 1990s (Weber 2010, 29).

Nordmann points out that looking

> at the particulars of research practice teaches us that there is neither 'science' nor 'technoscience' but a multitude of ever-shifting disciplinary formations that are guided by specific epistemic values, experimental, observational, and representational practices, patterns of explanation and intervention. From this perspective, nothing could be more misleading than to speak of a transition from 'science' to 'technoscience.' It is wrong to even to posit a monolithic and idealized notion of 'science' in the first place. Instead, there was and is a multiplicity of sciences. (Nordmann et al. 2011b, 21)

In the discussion of whether technoscience is a new type of relation between science and technology, a historical argument has been invoked, summarized in the motto 'Back to Bacon'(Hacking 1983; Schmidt 2011). Francis Bacon is usually named as the founding father of the modern contract between science and society. In the Baconian contract, basic science work was done autonomously, free from intervening societal interests. If society provided the necessary experimental and institutional setting, science would deliver results for the benefit of mankind. In Bacon's *The New Atlantis* (1627/1991), artificial laboratory experiments were the means to gain knowledge about nature. In the laboratory, the scientist had a protected space free from societal control to investigate nature. In his *Novum organum* (1620/1994), Bacon stressed that society had to take the risk and trust that science would fulfil its promised goods (Schwarz & Krohn 2011, 124). From today's perspective, Bacon's trust in science's self-regulating capacity seems an idealized vision in the absence of an institutional infrastructure that guarded the public interest. The usual interpretation is that Bacon's vision expressed the self-consciousness of the new emerging sciences during the seventeenth century. In a famous passage, he insisted on the primacy of observation as the way to uncover the hidden essentials of nature.

> Man, the servant and interpreter of nature, does and understands only as much as he has observed, by fact or mental activity, concerning

the order of nature; beyond that he has neither knowledge nor power. (Bacon 1620/1994, aph. 1)

The metaphysical philosopher who had dwelled on scholastic subtleties had to make way for the inquisitive, empirically minded researchers who seek to understand nature in order to master it.

Francis Bacon has been recalled in the attempts to clarify whether technoscience represents an epochal break, or is basically continuous with the Baconian programmatic position. No doubt, Bacon himself occupied a position he named 'experimental philosophy', 'scientia operativa' and 'inquisition of nature' (Schwarz & Krohn 2011, 124). It is easy to accept that Bacon's world-view and programme are continuous with technoscience, and hence the obvious conclusion: technoscience is a part of modernity, and no epochal break is at hand. That is an acceptable standpoint if one confines Bacon's task to the programmatic level. It becomes a baffling assumption if the horizon is widened to include a comparison of seventeenth-century research practices and objects, and those of current science.

In this 'historical argument discussion' against technoscience, the philosopher Ian Hacking is often invoked to strengthen the arguments. In 1983 he wrote *Representing and Intervening*, now a modern classic in philosophy of science (Hacking 1983). One of Hacking's themes was to recall Francis Bacon in order to view the present state in philosophy of science. What Hacking found in contemporary philosophy of science was a strong bias towards discussing representation but neglecting experiments and technology. 'Philosophers of science constantly discuss theories and representation of reality, but say almost nothing about experiment, technology, or the use of knowledge to alter the world.' Francis Bacon represented a view of science that was more apt than many of the current philosophical views on science. Bacon, he wrote: 'taught that not only must we observe nature in the raw, but that we must also 'twist the lion's tail', that is, manipulate our world in order to learn its secrets' (Hacking 1983, 149).

Hacking's point was that the materialistic, engineering and technological aspects of science had in general been neglected. Put more bluntly, twentieth-century philosophy of science has with few exceptions kept away from tackling experiences concerning scientific practice. Francis Bacon, the founding father of the visionary scientific world-view, articulated a concept of science that involved both representation and intervention. In that sense, the slogan 'Back to Bacon' makes sense. Philosophers in general have neglected the practical aspects of science. But Bacon is not much of a help beyond the programmatic level.

A rebuttal of technoscience as an epochal change on the basis of historical arguments centred on programmatic similarities is not persuasive. Behind this position one can discern the contours of the well-known 'linear model', which sees the relations between scientific innovations, industrial applications, and societal economic development as automatic processes. With increasing expenditure on research, European welfare societies will sustain and develop as has been the case since the Scientific Revolution. A search for epochal differences gives other results.

Crucial arguments for identifying a specific new technoscientific epoch can be found in epistemology and ontology. One major point is that technoscience does not have the same reason to uphold the traditional epistemic ideal of objectivity that is accomplished by philosophical purification work. The researcher's intervention does not need to be separated from what arises from her perspective, in contrast to a mind-independent world (Bensaude-Vincent et al. 2011, 368).

New epistemic conditions

In the Baconian age, science aimed at exploring and understanding the fundamental laws and forces of nature with the explicit goal of improving the human condition. Technology was a means to master and alter the discovered material dimensions of nature. This description was valid far into the twentieth century. It was clearly stated in the motto of the Chicago World's Fair in 1933, 'Science finds, industry applies, man conforms', which expressed this programmatic, linear ideal that still has its firm proponents in European science policy (Felt 2007, 22–9 ff; Rydell 1993, 98–9). However, in the technoscientific era this 'Baconian contract' has insufficient interpretative force, despite substantial attempts to defend its validity

(Nordmann et al. 2011b). The difference is dramatically described by the German philosopher Alfred Nordmann. Technoscience represents genuinely new epistemic conditions:

> In technoscientific research, the business of theoretical representation cannot be dissociated, even in principle, from the material conditions of knowledge production and thus from the interventions that are required to make and stabilize the phenomena. In other words, technoscience knows only one way of gaining knowledge and that is by first making a new world. (Nordmann 2006, 8)

The oncomouse, a genetically modified mouse, is commonly used to illustrate what technoscience can be about—a hybrid that transgresses the traditional boundaries between Nature and artefact (Haraway 1997). The hybrid argument recognizes that the mouse is both a living organism and an artificial construction. The mouse has an oncogene sequence implanted and then spontaneously develops cancer tumours. Patented in the US in 1985 and in Europe in 1992, it has been widely used in cancer research, because the engineered tumours correspond to human cancer. However, even if it is in the nature of the mouse to develop cancer, it is still a part of the present perceived reality, despite being used for biomedical modelling. The effect—the delivered cancer—does not mean the mouse is deported to an alien metaphysical universe. It is still available for conscious inclusion in our present thought. Donna Haraway has suggested another perspective that is more intuitively appealing, namely that the oncomouse is 'subjectified' since it acts and dies on our behalf (Haraway 1997). It is invested with human values from the very moment of its creation, and does not represent the notion of objectivity as a virtue of detachment from the object.

The oncomouse has acquired the status of technoscientific icon, which is not the case for carbon and its new forms in nanotubes and graphene. Neither is this the case for the rapidly growing technoscientific application field related to structural molecular biology that develops alterations in molecular structures that affect the molecule's function—research that has resulted in a wide range of new products from drugs to washing powder. The shift from research object as an entity existing in nature and discovered by the researchers, to research object as man-made artefact, is one of the most significant features of technoscience. Nanotubes, ferromagnetic materials, laser processes, and graphene are all inventions and non-existent in nature: they are technologically produced objects. From this standpoint, nature is now created by the scientist and far exceeds what is naturally out there. In a drastic reformulation, nature is produced by applied technology (Carrier & Nordmann 2011; Daston & Galison 2007; Nordmann et al. 2011b).

Nature in technoscience differs quite radically from what we have as our model of science, namely twentieth-century physics (Nordmann 2010, 289 ff). One interesting suggestion is that technoscience encourages an anthropomorphic view of nature. Instead of viewing nature as a system of laws and essences, it is presented as plastic: a 'toolkit or warehouse of functional devices.' The molecules are building-blocks that possess indefinite opportunities to reconstruct materials and bodies. The ultimate designer has disappeared and the field is open for unbounded creative play with nature (Bensaude-Vincent 2008, 7).

Certainly, none of the traditional aspects of science have ceased to exist, but the point being made here is different—namely that the separation between nature and artefact is not necessary in the technosciences. Science and technology have been two mingling companions since the birth of modern science, but accompanied by a philosophical work of purification that has strived to sustain the border between them. From a Baconian perspective, this purification work has been a Sisyphean labour that has disguised the real essence of science, namely to be applied and to benefit mankind. The technoscientific research process operates under altered conditions. The relation to reality has ceased to be an anxious companion, as in traditional physics in accordance with the Enlightenment and traditional philosophy. This profound change, from nature as a given entity, often reluctant and hard to understand, requiring interventions, negotiations, and simplifications, to an object for the application and implementation of robust systems, has several implications. A drastic characterization comes from robotics, which assumes that the researcher is involved with her research objects in new ways:

> This development is accompanied by a shift in the human–machine relations from the traditional master/slave representation to one of partnership or of a caregiver and infant—not only between the user and the machine, but also—at least partially—between the engineer and the artifact. … Imitation, adaption, learning, gesture, mimicking and the expressions of emotions become important features of so-called socio-emotional machines. The dream of an autonomous machine relies now on the idea of the engineer and the machine co-producing the artifact … the empathy of the engineer who is supposed to anticipate the 'standpoint' of the machine and understand its problems. Empathy and mimesis become proper epistemological strategies … that rest on testing/changing the boundary conditions of a system rather than optimizing a top-down working control. (Weber 2010, 25)

Central here is the interaction between researcher and the object. In the shift from industrial technologies to consumer technologies, the construction work benefits from a tight relation between actor and network, or what Bruno Latour terms 'actant', which results in a hybrid entity between man and machine (Latour 2005). In a society which celebrates a regime of constant innovative change, this hybrid actant becomes a naturalized part of present circumstances, and envisions further promises of a technological future. In the end there is nothing to separate, and science and technology merely live on in a given universe.

Ontological indifference and inclusion

One term for this changed interaction between the scientist and her object, 'ontological indifference', is credited to Peter Galison, although he has not yet developed it in the public beyond a brief mention (Daston & Galison 2007, 393). The concept has nevertheless circulated quite extensively in discussions about technoscience as a characterization of the view that 'it makes no sense to artificially separate out theory and reality, mind and world' (Bensaude-Vincent et al. 2011, 369). From a philosophical perspective, the term ontological indifference is a precise designator. The term is helpful and makes sense from a philosophically normative position. Most traditional philosophical work can be characterized in terms of purification work, which aims to draw distinctions. In Western culture, conscious reflection has been a part of the educated elite's cultural capital—the tool to disclose different dimensions of reality.

In the twentieth century, few philosophers recognized a problem of ontological indifference, with two notable exceptions: Martin Heidegger and Willard V. O. Quine (Heidegger 1927/2010; Quine 1969). Both used it as a philosophical diagnosis: Heidegger for modernity; Quine for the epistemological post-positivistic conditions for science. In general, notions of indifference conflict dramatically with how the philosophers in general perceive their task, as consciously performed by philosophical purification work to secure the border between different subjects such as science and non-science, metaphysics and physics, theory and mind-independent reality.

In technoscience, the transfer between different universes is made seamless by technological software, and the critical distance is less easy to achieve. The transfer from the invisible, subatomic data to visible representations of research findings is technologically opaque. I would suggest that an accurate term for this conjunction of being and knowing is ontological inclusion. The purification work between different aspects of reality is superfluous for the assigned task of producing new products. The working material—the graphene or moved molecules—is an immediate and immersive part of the researcher's experience. The perspectives of realism and constructivism have no predefined vantage points. The scanning tunnelling microscope refigures the surface of any natural object as something else. The molecules can have their structure changed by intervention and result in an artefact that does not exist in nature. The ready applications span a wide area, from pharmaceuticals to new materials such as graphene.

One advantage with the concept of ontological inclusion is that it can be used as a general characterization for both technoscientific research work and everyday imagination. Today many of us are fusing, mingling, blending, combining, and spending our time in different spheres, but experience that we are in a coherent universe. Ontological inclusion is a presupposition for everyday life and present in both scientific and cultural practices. This is an argument for the concept's interpretative power: it captures several perspectives and is valid from the internal point of view of the technoscientist; she moves between different levels of reality in the research situation, but the activities are perceived as one holistic activity. It is valid from the perspective of the layperson who, armed with high-tech objects, is able to visit and move between different worlds. It also works as a general characterization of the natural blurring of fact and fiction by the visualized media in the technoscientific epoch. This is not to say that the formal features of ontological inclusion are historically unique—Isaac Newton's moves between prolific cosmic philosophical universe, logic, religion, and magic were intertwined intellectual companions (Westfall 1980) — but the current shifts are more abundant and more smoothly done, because of the ubiquitous technologies.

Both terms point to a lack of reflection. In the case of ontological indifference, the disinterest in drawing distinctions between different spheres of reality is striking. In the case of ontological inclusion, the undistinguished immersion in qualitatively different universes is significant. Yet, we have no problem moving between real and fictional worlds. The moves are done smoothly, and enliven the mind and enlarge our field of experience. Societal and ethical challenges might be located in these easy moves, one being equal with the next. The visual similarities in digital communication technologies produce a familiarity that makes it hard to differentiate between entertainment and serious events. One telling example is how digital games are used to train soldiers, moving them to future fields of battle. The soldier is accustomed in advance to an imagined yet approaching universe.

Nordmann has argued that the concept of technoscience requires a special historical vantage point, for it lacks the self-understanding that has distinguished modernity from previous epochs: it 'regards all research at all times as knowing by doing … and thus to construct the world we live in' (Nordmann 2011a, 29). Modernity was the offspring of the Enlightenment, which first sealed the alliance between science and human improvement. A constant companion in the Enlightenment's enhancement of science was critical scepticism, a quest for the reasons for the proclaimed scientific beliefs that underpinned David Hume's and Immanuel Kant's philosophies. This philosophical scepticism had several analogues in the spirit of the time. Religion, politics, and oppressive autocracy were scrutinized and questioned by Voltaire, Montesquieu, d'Alembert, and Condillac. Belief in constant, linear progress had its moderating voices in philosophers such as Rousseau and the strands of cultural criticism that ran parallel with the Enlightenment (Höög 1999).

Hence our concerns should not be limited to technoscience's lack of reflection—Nordmann's focus—but should include the disappearance from society of the sceptical and radical values of the Enlightenment. The effects have been much more dramatic than those of the lost relevance of philosophical purification work. The epochal break thesis is as much a break with modernity's scepticism that framed the democratic quest for political participation.

For this process, I claim that the concept of 'ontological inclusion' is illuminative. In constructing a broad understanding of the epoch of technoscience, the concept is a more apt characterization than 'ontological indifference', which catches out the critic from a modernist philosophical Enlightenment horizon. Left out are the changed everyday practices that easily and constantly supply us with new experiences, but without the necessary tools for reflection.

Technoscience, the humanities, and the Enlightenment vision

Given the abundance of technoscientific objects in our lives, it is urgent to discuss the relationship between scientific and cultural values. In the present discussion in philosophy of science, Philip Kitcher and Noretta Koertge claim the positive civic impact of internal scientific values, a supposition that is not supported by any empirical evidence (Kitcher 2001; Koertge 2005). The purification work to distinguish science is made into an internal question about conflicting theories, problem solving, quality assessment, and cognitive resources. When dehumanizing practices appear in the sciences, the suggested solution is to enlarge on the formal instructions on research ethics for scientists. It is simply taken for granted that valuable, rational scientific practices will influence and benefit society as a whole if only the scientists make the proper ethical efforts. This attitude is well known in the history of science. The established concept for it is 'scientism', designating a belief that (natural) sciences have few if any boundaries in understanding the world. In its strongest form, scientific understanding is appointed the prime way to solve the sorrows and shortcomings of humanity. The humanities have no articulated role to play in the visions of scientism. This science optimism also permeates the public information about the ESS project.

Today, fifty years after C. P. Snow delivered his famous lecture on the 'Two Cultures', the gap between the sciences and the humanities is still wide (Snow 1959). C. P. Snow's target was the humanists, which he characterized as a nostalgic, outdated community who were deeply ignorant of the actual content and implications of modern science. He himself belonged to the modern Enlightenment project, asking for acknowledgement of the values of science that had contributed to the improvement of human life on the linear model—from basic science to industry to societal benefits—dominating his world of ideas. Today, science permeates society in a way only foreseen in science fiction. Ontological inclusion signals a profound shift in attitudes to reality, not only to nature. It represents a break with a mode of critical reflection that has accompanied modernity and the Enlightenment project.

Where do we find an accurate analysis of the technoscientific predicament that takes the vision of the Enlightenment seriously, that the promises of science should be balanced by reflections that critically conceptualize and reveal the unquestioned values set by technoscience that encompass and transform ubiquitous aspects of our twenty-first century? Currently, it is hard to see where a new awareness could arise that might challenge this hyped vision of science and technology. Democratic examination is needed to critically reconsider the scientific and technological futures envisioned by experts and politicians.

In the information material about the ESS, the facility is presented as a grand vision that incorporates conscious manoeuvres between basic science research and applied, market-driven science innovation in order to secure an innovative future for Europe. No doubt the ESS will expose and merge both basic science and application-driven science. The Enlightenment vision is still represented in the ESS plans as presented: the linear model that views science as the unique key to welfare and a prosperous society. What is lacking is another inseparable part: the critical and reflective perspective that has balanced the Enlightenment vision throughout modernity. If the ESS could reclaim that lost part, reform its policy institutions, and replace the technocratic expert images that presently dominate the agenda with new cultural practices, then renewed civic confidence in science would have reason to prosper. Until then, at least one human condition will be fulfilled when the ESS comes to Lund: science and technoscience will produce new materials for making ubiquitous ontological universes available.

Notes

1 Gilbert Hottois coined the term in 1984 and Bruno Latour used it to argue that basic science and applied research have never been separated in practice (Hottois, 1984; Latour, 1987, 1993). In a historical perspective, the borders have always been in flux and there have always been hybrids, hence the Latourian conclusion that we have never been modern. Different labels have been used for the proposed new mode. In Europe 'Mode 2' research is the accepted term, while in the US the most popular are 'entrepreneurial science', 'triple helix', 'post-normal science', and technoscience, the latter term being in the ascendancy (see Carrier & Nordmann 2011, 2).

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