SOCIAL CONSTRUCTIVISM FOR PHILOSOPHERS OF TECHNOLOGY: A SHOPPER'S GUIDE[1]

1. Philosophy of Technology Meets Social Constructivism

Social constructivist approaches in technology studies have recently gained the attention of philosophers of technology, as is shown by a number of publications (e.g., Mitcham, 1995; Feenberg and Hannay, 1995; Winner, 1991, 1994; Feenberg, 1992, 1995). Whereas the aim of some of these studies is to provide a philosophical critique of social constructivism (e.g., Winner 1991), others aim to incorporate notions and ideas of social constructivism into the philosophy of technology (e.g., Feenberg, 1992, 1995). The aim of this essay is not to (merely) critique social constructivism, nor is it to incorporate social constructivist notions into a philosophical analysis of technology. Its aim is, rather, to ask and (provisionally) answer two questions concerning the potential implications of social constructivism for philosophy of technology: (1) Could the philosophy of technology benefit from social constructivist approaches in technology studies through an incorporation of some of their analyses, concepts and theories? (2) If so, how would the philosophy of technology be transformed as a result?[2] These two questions cannot be answered properly without an evaluation of the weak and strong points of both current philosophy of technology and current social constructivist technology studies. A large part of this essay will be devoted to such an assessment.

In asking how the philosophy of technology may benefit from social constructivism, I am assuming that an agenda of relevant issues and research questions in the philosophy of technology already exists. The philosophy of technology was and is concerned with philosophical questions concerning the nature of technology, and the impact of technology on things of value: the human psyche, society, culture, and the environment. The expected role of social constructivist studies would therefore be to better help the philosophy of technology answer such questions. The possibility should not be excluded, however, that a consideration of these studies shows that certain traditional questions in the philosophy of technology are misconceived because based on false empirical

presuppositions and hence need to be discarded, that other questions need to be rephrased, and that novel philosophical questions present themselves.

In the next section, the case will be made that the philosophy of technology ought to pay more serious attention to empirical studies of technology, and that among such studies, social constructivist studies have special appeal for the philosophy of technology. In section 3, social constructivist approaches in technology studies will be characterized briefly, and three varieties of social constructivism, broadly defined, will be distinguished: Strong and mild social constructivism, and actor-network theory. Section 4 contains a critique of current social constructivist technology studies, taking as its point of departure an influential earlier critique of social constructivism by Langdon Winner (1991). Section 5 provides a critical discussion of both mild social constructivism and actor-network theory, their divergences from mainstream philosophy of technology, and their potential implications for the philosophy of technology. Section 6 does the same for strong social constructivism. The balance is drawn in section 7.

2. The Potential Relevance of Social Constructivist Studies to the Philosophy of Technology

One criticism sometimes levelled at the philosophy of technology is that its theories tend to be abstract, and say a lot about 'technology', 'society' and 'humanity', but often say little about particular technologies and their impacts, and particular social controversies in which technology plays a role. A second criticism that is sometimes voiced is that theories in the philosophy of technology often make or presuppose empirically testable claims, but that these claims are often not based on, or supported by, empirical evidence. Worse, some of its recurring empirical claims have been claimed to be false. In particular, technological determinist conceptions of technological change presupposed in many philosophical studies of technology (e.g., Ellul, 1954; Winner, 1977; Gehlen, 1980) have been claimed to be empirically inadequate (e.g., MacKenzie and Wajcman, 1985a; Pinch and Bijker, 1987; Noble, 1984). As Pinch and Bijker (1987) have claimed, the philosophy of technology is in need of 'more realistic models of both science and technology.' (p. 19).

Empirical studies of technologies and their impacts may be useful to the philosophy of technology, I claim, by aiding the philosophy of technology at arriving at analyses that are more concrete and detailed, and that are empirically more realistic. They can help the philosophy of technology to arrive at empirically more realistic theories by supporting or rejecting empirical claims made or presupposed by theories in the philosophy of

technology, such as claims about technological change and technological innovation, the way technology impacts society, and the characteristics of different types of technology, and by suggesting alternative empirical claims. These two functions of empirical studies of technology may be summed up by claiming that such studies are able to provide philosophical theories with *micro-elaborations* of their claims and concepts: insofar as philosophical claims and concepts have an empirical component, this empirical component may be corroborated, amended or replaced by the empirical concepts and claims of empirical studies of technology. Micro-elaborations are particularly important for studies in social and political philosophy of technology and technology ethics, because such studies typically presuppose some empirical model of technology dynamics. They can also prove relevant for other areas in the philosophy of technology.[3]

Philosophical studies of technology that presuppose some conception of technological change would consequently be improved, I claim, by incorporating empirically informed models of technological change. Because the currently most influential models of technological change in technology studies are arguably social constructivist models, these models are a prime candidate for incorporation into the philosophy of technology. Moreover, the potential relevance of social constructivist models of technological change for the philosophy of technology does not remain limited to their analysis of technological innovation. These models also contain (often implicit) accounts of the way in which technology impacts society. They show that technological innovation does not take a linear path from theory to application to introduction of the technology into society but is instead influenced by social choices at every point. Consequently, technologies bears the imprint of the social processes that have brought them forth.

Because it is during its development stage that many of the social and cultural effects of a new technology are determined, through various processes of social negotiation and interpretation, it becomes important for philosophical studies of the impact of technology on society and culture to take a closer look at this development stage. Only if technology evolved according to some internal logic, and had its social and cultural effects conditioned by this logic, or if technologies were strictly neutral, would it be justified to ignore this development stage, because it would then suffice to study this logic, or to study the choices that societies make after a technology has been developed. If their models of technological change are correct, however, social constructivist studies could be helpful in revealing how the social and cultural impacts of a technology

correspond to decisions made during its development stage. In this way, they could help the philosophy of technology to better understand these impacts.

3. A Brief Guide to Social Constructivist Technology Studies

Social constructivist approaches are currently influential in both science studies and technology studies. The label 'social constructivism' is used to refer to a variety of related, predominantly sociological approaches in science and technology studies. The roots of many, though not all, of these approaches lie in the sociology of knowledge (Bloor, 1976), and many social constructivists who now study technology have their roots in science studies, only to turn to technology later on (cf. Woolgar 1991). The starting point of social constructivist technology studies can be placed in the mid-eighties (cf. Bijker, Hughes and Pinch 1987). Since then, this paradigm has yielded dozens of books and hundreds of articles, most of them socio-historical case studies of technological innovation and technological change.

The term 'social constructivism' is sometimes used in a narrow sense, to refer to the influential Social Construction of Technology (SCOT) approach that was outlined originally in Pinch and Bijker (1987) and Bijker (1987), and a number of related approaches, such as those of Collins (1985) and Woolgar (1991). In a broader sense, which will be used throughout this essay, the term also includes what are called 'social shaping' approaches (e.g., MacKenzie and Wajcman, 1985a, b; MacKenzie, 1990), and the actor-network approach of Bruno Latour, Michel Callon, and John Law, and their followers (e.g., Callon, 1987; Latour, 1987).

There are different approaches in social constructivism, that have a family resemblance to one another. Although there are few features that they all have in common, it is nevertheless possible to mention some features that are fairly typical. First, social constructivism includes a conception of technological development as a contingent process, involving heterogeneous factors. Accordingly, technological change cannot be analyzed as following a fixed, unidirectional path, and cannot be explained by reference to economic laws or some inner technological 'logic'. Rather, technological change is best explained by reference to a number of technological controversies, disagreements and difficulties, that involve different *actors* (individuals or groups that are capable of acting) or *relevant social groups*, which are groups of actors that share a common conceptual framework and common interests. These actors or groups engage in strategies to win from the opposition and to shape technology according to their own plan.

Social constructivist approaches typically employ a principle of *methodological symmetry*, or *methodological relativism* (Pinch and Bijker, 1987; cf. Pels, 1996). This principle, in its most common form, implies that the analyst remains impartial as to the 'real' properties of her object of analysis, viz. technology. This implies, among other things, that the analyst does not evaluate any of the knowledge claims by different social groups about the 'real' properties of the technology in study. This principle was originally formulated in the sociology of knowledge (Bloor, 1976), where it was motivated by the idea that in a sociological explanation of claims to (scientific) knowledge, it is both possible and desirable to remain agnostic about any role of 'the world' in settling scientific controversies. Instead, the analyst should analyze putative 'true' and 'false' claims symmetrically, explaining them by reference to similar (sociological) factors. Such agnosticism is held to be *desirable* because the analyst is claimed to have no independent access to 'the world', and hence no independent way of evaluating knowledge claims of scientists and others. Such agnosticism is claimed to be *possible* because it is conjectured that 'the world' plays a small or even nonexistent world in settling controversies between different knowledge claims, and that social factors are much more important.

As a consequence of this principle, when applied to technology, the analyst will generally avoid making claims about the 'true' nature of technology, including claims about the (in)operativity of artifacts, technological (in)efficiency, success or failure in technical change, the (ir)rationality of technological choices and procedures, technological progress, the 'real' function or purpose of an artifact, and 'intrinsic' effects of technology. Because the analyst avoids reference to 'real' properties of a technology, moreover, such properties cannot be invoked to explain technological change. For example, no reference should be made to the 'actual' properties of an artifact in explaining its commercial success, or its selection out of a pool of several other designs (cf. Staudenmaier, 1995).

The outcome of the process of controversy and strategy mapping that surrounds technical change is the *stabilization* of a technology, together with concomitant ('co-produced') social relations. Stabilization of a technology implies that its contents are 'black-boxed', and are no longer a site for controversy. Its stabilized properties come to determine the way that the technology functions in society. Most social constructivists, including SCOT scholars, attribute the stabilization of an artifact to an agreement or settlement between different social groups, that arrive at a similar interpretation of a technology, as the result of a series of controversies and negotiations. Technology is claimed by these social constructivists to have *interpretive flexibility:* it has no objective,

fixed properties, but allows for different interpretations of its properties, not only of its functional and social-cultural properties but also of its technical content, that is, the way it works. Facts about a technology are hence not objectively given by the technology itself, but determined by the interpretations of relevant social groups. The rhetorical process of agreement on the 'true' nature of a technology as the outcome of negotiation and social action is called *closure*. Technology is hence socially shaped or socially constructed: its properties are largely if not exclusively determined by the interpretive frameworks and negotiations of relevant social groups.

The above broad characterization of social constructivist technology studies obscures the fact that a variety of approaches exist, between which there are important differences. There have been various attempts at classifying different approaches within social constructivism (e.g., Bijker and Law, 1992a; Sismondo, 1993; Collins and Yearley, 1992; Woolgar, 1991; Grint and Woolgar, 1995). The following taxonomy of three (broad) approaches is loosely based on these attempts.[4]

The most characteristic variety of social constructivism in technology studies may be called *strong social constructivism*. This approach is the one aligned most closely to the sociology of scientific knowledge, and includes the SCOT-approach, as well as the work of such scholars as H. M. Collins and Steve Woolgar. It vigorously upholds the principle of symmetry, and hence avoid all reference to the 'actual' character of technology in its analyses. Technological change is to be explained by reference to social practices, particularly by reference to processes of interpretation, negotiation and closure by different actors and social groups. Technology is a genuine social construction, that is, a stabilized technology can only be explained by reference to the social elements (including other socially constructed entities) that have produced its stabilization. No 'properties', 'powers' or 'effects' can be attributed to technologies themselves.

Mild social constructivism is the label that will be used to characterize more moderate approaches, that sometimes go under the name of 'social shaping' approaches (e.g., MacKenzie and Wajcman, 1985a, b; MacKenzie, 1990).[5] Social shaping approaches retain conventional distinctions, between the social and the natural, and between the social and the technical, and study the way in which social factors shape technology. They do not reject a role for nonsocial factors in technological change, and are also willing to attribute 'properties' and 'effects' to technology, although these properties and effects are usually claimed to be defined relative to a particular social context. Because technologies are 'socially shaped', these properties and effects are in large part social properties and social

effects, that can be attributed to social biases or politics 'built into' or 'embodied by' these technologies.

Actor-network theory, sometimes called 'constructivism' (without the 'social'), is a third influential approach. It studies stabilization processes of technical and scientific objects as these result from the building of actor networks, which are networks of human actors and natural and technical phenomena. Actor-network theorists employ a principle of generalized symmetry, according to which any element ('social', 'natural', or 'technical') in a heterogeneous network of entities that participate in the stabilization of a technology has a similar explanatory role (Callon, 1987; Latour, 1987; Callon and Latour, 1992). Strong social constructivism is criticized for giving special preference to social elements, such as social groups and interpretation processes, on which its explanations are based, whereas 'natural' or 'technical' elements, such as natural forces and technical devices are prohibited from being explanatory elements in explanations. Actor-network theory also allows for technical devices and natural forces to be actors (or 'actants') in networks through which technical or scientific objects are stabilized. By an analysis of actor networks, any entity can be shown to be a post hoc construction, but entities are not normally socially constructed, because stabilization is not only the result of social factors.

4.   Upon Opening the Black Box Six Years Later and Finding it Filling Up: Contemporary Social Constructivism and the Philosophy of Technology

Social constructivist technology studies have been under attack from different quarters for being an inadequate approach to technology studies. Before applying such studies to their own work, therefore, philosophers of technology should carefully consider arguments about their flaws and limitations. Some of the main criticisms against social constructivist technology studies were voiced six years ago, in an influential article by Langdon Winner called 'Upon opening the black box and finding it empty: social constructivism and the philosophy of technology' (Winner, 1991). Winners criticisms, in summary, are as follows:

(1) By focussing on processes of technological innovation, social constructivist studies tend to disregard the social consequences of technical choice.

(2) Social constructivism tends to only recognize social groups that have a role in 'constructing' technology, and not social groups that are impacted by technology, but that have been suppressed or even excluded during its construction; it hence ignores

deep-seated political biases in technological   choice, and power struggles by which the initial agenda of technological   development was set.

(3) Social constructivism disregards that technological change involves   dynamics beyond those revealed by studying the characteristics and actions of   relevant social groups, such as deeper cultural, intellectual, or social origins of   social choices about technology, and autonomous properties of technology.

(4) Social constructivism does not take evaluative stances or invoke moral or   political principles, and apparently disdains evaluative stances.

Winner's criticism took as its main target what I have identified as strong social constructivism, particularly the SCOT approach. Most of these criticisms, however, also apply to actor-network and mild constructivist approaches.

At the time that Winner's article was published, these four statements about (strong) social constructivism were for the most part accurate. Since then, however, there have been some significant changes in social constructivist practice. Before discussing these changes, I will first consider the extent to which Winner's criticisms do indeed reveal fundamental flaws in the social constructivist approach to technology studies. Most of Winner's criticisms, I claim, do not point to internal methodological flaws in social constructivism, but criticize its narrowness in scope, and the consequently limited social and political relevance of its studies. Apparently, social constructivists have chosen to draw the scope of their field so as to exclude analyses of consequences, analyses of impacted social groups and initial settings of the agenda, and evaluative and normative analysis. They would argue that their principal aim, to explain technical change, turns out to be possible without such analyses. These delimitations, then, may not point to inherent flaws in their methodology, but only to a narrowness in their methodology and in their aims.

Only Winner's third criticism questions the adequacy of the explanatory framework of constructivist technology studies on strictly methodological grounds. This criticism is important, however, as it questions the power of social constructivist micro-level sociological analyses to explain the dynamics of technological choice, and suggests that these need to be supplemented with macro-level analyses or analyses that involve reference to nonsocial factors. Whether this criticism by Winner is justified will be discussed in sections 5 and 6.

Although the narrowness of the scope of social constructivism is for the most part defensible on methodological grounds, its result is that the use of social constructivist studies for addressing issues in the philosophy of technology is more limited than it could conceivably have been. The greatest worth of social constructivist technology studies for the philosophy of technology lies in their detailed empirical analyses of the way in which technological development is a contingent, heterogeneous process involving interpretation and social negotiation, and the way in which the resulting technology is socially shaped. As indicated in section 3, such studies are relevant for studies in philosophy of technology in as far as these depend on some conception of technological development and the character of technology. They imply a corrective to technological determinist theories of development, and indicate how during the development stage of technology, many of its social and cultural effects are already built in. In this way, they also indicate the possibilities for alternative technologies (which has been a theme in the philosophy of technology), as well as possible points of intervention in the process of technological development.

Because of the narrowness in scope of constructivist technology studies, however, philosophers of technology will often have to look elsewhere if they are looking for empirical studies of impacts of technology and of initial settings of the agenda and the exclusion of social groups in technological innovation, or for 'deeper' social and cultural factors that play a role in technological development. Their own (macro-level) evaluative or political analyses, moreover, will not be able to take a leaf from any (micro-level) evaluative analyses performed by social constructivists.

It should be noted, though, that in the past six years, some significant changes have taken place in the content of social constructivism. It looks as if some social constructivists have taken Winner's critique seriously. First, there are now more studies in which the social consequences of technical choice are considered. Social (and environmental) impacts are still not a main concern of social constructivist studies, however, and their analyses of social consequences tend to be unconventional. Some studies, mainly occurring within a social shaping or actor-network approach, analyze the way in which social consequences are 'built into' technologies (e.g., Akrich, 1992; Latour, 1992; MacKenzie and Wajcman, 1985a). Others study the way in which 'truths' about the consequences of a technology are socially negotiated and constructed (e.g., Bruhèze, 1992; Bijker, 1992, 1995). What both approaches have in common is that they reject a conventional, technological determinist conception of technological impacts according to

which technologies 'impinge on' societies and bring about changes. Instead, they adopt a conception of consequences as resulting in part or wholly from social interpretation and negotiation, rather than (just) from intrinsic features of the technology in question.

Second, more attention has been paid by social constructivists to excluded social groups in technical choice and initial settings of technological agendas. As argued by Aibar (1995, 1996) in a defense of the SCOT approach, excluded social groups can be accounted by analyzing the statics and dynamics of their *technological frame*. A technological frame is the repository of knowledge, cultural values, goals, practices, and exemplary artifacts shared by a social group, and structures their attributions of meaning to objects and processes in technical innovation, and their subsequent actions.[6] In analyzing a particular process of technological innovation, the analyst can choose to include not only the technological frame of social groups that have been influential in determining the outcome of this process, but also the technological frame, and changes therein, of groups that have failed to have their voice heard.

A related way in which excluded social groups and choices in the setting of the technological agenda can be included in social constructivist analysis is by the notion of the *script* of technical artifacts, a notion that has been introduced into the actor-network approach by Madeleine Akrich (1992) and Bruno Latour (1992). In technological design, design constituencies inscribe a vision of the world into their designs. Designs consequently embody a script: they harbor expectations about the characteristics of users, social relations, the use environment, and so forth, and stimulate or even demand conformity to this vision. Studying the process of inscription and the resulting script of an artifact enables the analyst to reveal how designs exclude certain social groups, or work against their interests in other ways.[7]

Third, influential proponents of social constructivist technology studies have recognized early on that its micro-level analyses, in which the technical content of design is explained by reference to the characteristics and actions of relevant social groups, need to be placed in a broader, macro-level context, in which technical content and the characteristics and actions of social groups are related to the wider social, political, and cultural milieu in which they are found (e.g., Pinch and Bijker, 1987, p. 46). Initially, however, little attention was given to this item on the agenda of constructivist technology studies. Recently, though, such studies have started to appear (e.g., Rosen, 1993; Carlson, 1992; Bijker, 1992, 1995 ch. 4, 5; Pfaffenberger, 1992). Typically, these studies translate macro-level variables, such as power relations or characteristics of the culture, to cultural

values and goals in the technical frames of relevant social groups. What still remains more difficult for most social constructivist approaches is to account for any 'autonomous' features of technology: ways in which the use of technology can have consequences that are neither intended nor anticipated by any social group. This issue will be discussed at length in the coming sections.

Fourth, there has been an increasing interest by social constructivists in normative and political issues concerning the role of technology in society (e.g., Bijker 1993, 1995; Aibar, 1995, 1996), and in the actualities and potentialities of normative and political analysis within a social constructivist framework (e.g., Radder, 1992; Grint and Woolgar, 1995, 1996; Bijker, 1993, 1995; Aibar, 1996; Jasanoff, 1996). It must be observed, however, that many of these studies reject conventional normative and political analyses of the sort often found in mainstream philosophy of technology. The principle of symmetry obeyed in most of these studies prevents the analyst to 'take a stand' and prescribes methodological neutrality. Many social constructivists have argued that in spite of the principle of symmetry, or perhaps because of it, their analyses have political consequences, and argue for the possibility of a social constructivist politics. The very possibility of such a politics will be discussed in section 6.

All in al, it appears that the scope of constructivist technology studies is widening in a way that is interesting to philosophers of technology wishing to apply constructivist studies to their own research. However, there appear to be important tensions between some of the key assumptions of social constructivist technology studies and those of mainstream philosophy of technology. These differences must be overcome before such applications are unproblematic. Three such tensions have been indicated so far. First, social constructivist studies appear to have an unconventional conception of technological 'effects'. Second, social constructivist studies often seem to deny the possibility of unintended and unanticipated consequences of technical choice, whereas philosophers of technology tend to affirm the existence of such consequences. Third, social constructivists tend to have a different conception of political and normative analysis than do philosophers of technology, and often seem to reject conventional normative analyses as incompatible with a social constructivist approach.

Philosophers of technology may reject social constructivist models because of these deviances, but may also see such models as posing a challenge to conventional assumptions in the philosophy of technology. In the remainder of this essay, I choose to meet this challenge by analyzing social constructivist conceptions of technological effects,

unintended consequences of technical choice, and politics. I will also try to point out how the corresponding social constructivist models can be employed by philosophers of technology to arrive at novel analyses of the (intended and unintended) impacts of technology, and at novel kinds of evaluative and political studies of technology. This analysis needs to take place for each of the three varieties of social constructivism that has been distinguished in section 3. Mild social constructivist and actor-network approaches will be discussed in section 5, and strong social constructivist approaches will be treated in section 6.

5. Mild Social Constructivism, Actor-Network Theory, and the Philosophy of Technology

Mild social constructivism acknowledges that technologies are capable of having 'effects', although such effects are strongly dependent on the social context in which the technology is used. It tends to avoid reference to effects, though, because its focus tends to be on technological innovation, and not on the impacts of technology. It is normally concerned deconstructing the way in which new technologies are 'stabilized' as the result of heterogeneous action of different actors. Mild social constructivism also appears compatible with there being unintended consequences of technical choice. Because it does not adopt the view that technologies are wholly socially constructed, it is not committed to the view that any 'effect' must be explained by reference to (conscious) social choices.

Moreover, mild social constructivist analyses can take a normative or political slant by analyzing the way in which particular technologies, designed for use within a particular use environment, come to 'embody' a particular politics or particular social effects. The political significance of such studies can be exploited by breaking with the symmetry principle, and by using them to make explicitly political and normative statements, such as statements about the 'success' of certain social groups in promoting their interests through a particular technology, or the 'suppression' of other social groups through a technological innovation. Winner's (1980) famous article on political artifacts, for example, is presented in MacKenzie and Wajcman (1985a) as an example of a 'social shaping' approach in technology studies. However, Winner's analysis breaks with the principle of methodological symmetry upheld in in many studies in the 'social shaping' approach, by privileging some of the many 'effects' of technologies over others because of their claimed political relevance, by relating these 'effects' to a definite 'cause' that is found in the design history of the technology, and by making evaluative statements about the political significance of these effects.

In his recent philosophical work, Andrew Feenberg (1992, 1995) also adopts a social constructivism, that is probably best classified as 'mild'.[8] In Feenberg (1992), for example, he uses social constructivist doctrines to 'update' the Frankfurt School approach, and to argue that technology is subject to conscious social control. He argues that modern technology embodies political values that promote hierarchy and domination, but that social constructivist studies show that a radically different, democratized technology is possible. Such an alternative technology is possible if more social groups participate in technical choice, and if technological development is consequently brought under democratic control. Feenberg concludes by arguing for the need of such democratic control, and for challenges to prevailing conceptions of technological rationality. Like Winner, Feenberg hence adopts a mild social constructivism, but transcends the methodological symmetry in social constructvist studies by making evaluative and evaluative claims. It hence appears that by selectively breaking with the symmetry principle, philosophers can use mild social constructivist studies as a starting point for evaluative and political analyses.

In spite of its pretenses to radicalness (e.g., Callon and Latour, 1992), actor-network theory often treats technology in a way that superficially resembles the analyses of 'social shaping' approaches, by liberally assigning 'properties', 'powers' and 'effects' to technologies. Artifacts can have 'effects' because they can 'act', just like human beings. Consequently, they can also have unintended effects, just like an individual can perform actions that were neither intended nor anticipated by others.

Although studies in actor-network theory do not normally contain political or evaluative claims about technologies and their impacts, these studies can provide an empirical basis for such claims by philosophers of technology, in much the same way as do studies within a 'social shaping' approach. For example, its notion of the 'script' of an artifact, that was discussed in section 4, appears to be actor-network idiom for referring to the 'politics' of artifacts. As Latour (1992) claims, artifacts harbor a large part of the morality of a society in their scripts, or 'programs' (Latour, 1995). They issue prescriptions for the behavior of their users, and help to impose a moral structure on society. If Latour's analysis is correct, then actor-network studies of scripts provide a starting point for normative and political analyses of the scripts of artifacts and their inscription into artifacts by design constituencies.

6. Strong Social Constructivism and the Philosophy of Technology

Reference to technologies having 'effects' or 'politics' or indeed to them having any fixed property is difficult within strong social constructivism, because of its strict adherence to the symmetry principle. References to unintended effects are even more problematic, because to the extent that technologies can even be claimed to have effects, these effects are claimed to result from social choices, and are therefore, it would seem, not wholly unintended; strong social constructivism seems to imply that every event is socially determined, and therefore within social control. Reference to 'properties' or 'effects' of technology is not only problematic in strong social constructivism, it is often also not seen as part of the task of the analyst. The task of the analyst is to deconstruct technologies, by analyzing the processes by which technologies are stabilized, and by which 'closure' is reached on their properties. Technology is sometimes metaphorically described as a 'text' that is 'read' by different actors in different ways, and the task of the analyst is to analyze how the text of technology is 'written' by different actors, and how particular 'readings' of it come to prevail (Woolgar, 1991; Grint and Woolgar, 1995); the task of the analyst is not to select a particular 'reading' of a technology, i.e., her own reading, and present it as a 'correct' reading.

Still, as Bijker (1995) has argued, a strong social constructivism does not require a complete abandonment of the notion that technologies have effects. In the SCOT-approach, a 'social impact' of a technology is defined as a modification of the technological frame of a social group (cf. section 2), as a consequence of the 'stabilization' of a particular technology within this technological frame. As an example, Bijker analyzes the development of fluorescent lighting. Different interpretations of fluorescent lighting existed, but the particular social construction that was settled on was a 'high-intensity daylight fluorescent lamp'. This social construction required changes in the technological frames of various relevant social groups, such as the adoption of new scientific theories, goals, and practices. These changes, then, are 'social impacts' of the introduction of fluorescent lighting. Notice, however, that according to Bijker's analysis these impacts were not generated by any intrinsic properties of fluorescent lamps, but instead derive from the particular way in which fluorescent lighting was socially constructed.

The notion of artifacts having 'politics', which is rejected by strong social constuctivists, can also be seen to survive in a different form. Pfaffenberger (1992) adopts the 'technology-as-text' metaphor, and argues against Winner that artifacts do not have politics, not even relative to a particular social context. Instead, Pfaffenberger argues, if an artifact is to have political effects it 'must be *discursively regulated* by surrounding it with

symbolic media that mystify and therefore constitute the political aims' (p. 294). In other words, a technology, as a mere text, does not force a particular reading. Readings are determined, instead, by dominant discourses surrounding a technology, that prescribe how the technology should be 'read'. The political impact of a new technology therefore cannot be attributed to this technology itself, but must be attributed instead to the 'symbolic discourses' that compel a particular interpretation and usage of it. An attempt to change the 'politics' of a technology therefore does not require its substitution by a different technology (a 'rewriting' of the text) but can also be achieved by challenging the 'symbolic discourses' surrounding the technology and by introducing alternative readings.[9]

The notion of 'unintended effects', finally, may also be argued to survive in some form in a strong social constructivist approach. As Bijker (1995) has argued, actors are not always fully in control of their technological frame, and cannot change it at will. Consequently, 'stabilized' technologies may transform technological frames, in ways that no actor fully controls:

> An artifact in the role of exemplar (that is, after closure, when it is part of a technological frame) has become obdurate. The relevant social groups have, in building up the technological frame, invested so much in the artifact that its meaning has become quite fixed - it cannot be changed easily, and it forms part of a hardened network of practices, theories, and social institutions. From this time on it may indeed happen that, naively spoken, an artifact 'determines' social development. (p. 282).

Notice, however, that what is having an impact on society is again not an independently existing artifact, but instead a socially constructed artifact that affects other social constructions in the technological frames of social groups, in a way not fully controlled by these social groups.[10]

Although the symmetry principle seems to rule out evaluative and political analyses, many of those who adopt a strong social constructivism nevertheless argue that its analyses embody, or are able to result in, a politics. Bijker (1995), for example, argues that social constructivist studies are able to support a social constructivist 'politics of technology' even when they obey the principle of symmetry and merely deconstruct particular social constructions.[11] Such a politics does not require that the analyst makes evaluative statements or prescribes courses of action. Rather, the political agenda of social constructivist studies should be to show 'the malleability of technology, the possibility for

choice, the basic insight that *things could have been otherwise*.' (p. 280), and also to point to the obduracy of stabilized technologies and other stabilized objects, and the limitations these impose on attempts to change technology and its social impacts. Strong social constructivist studies are hence political by revealing the contingency and politics contained in technological choice. This information can subsequently be used by actors with a political agenda to influence technical change and the 'social impacts' of technologies.

Bijker admits that there is no guarantee that social constructivist studies will have political impacts that are desirable. Ideally, social constructivist studies would aid less privileged social groups by showing them how stronger parties impose a particular political hegemony, and they could resist this hegemony and exert more influence over technology. However, as Bijker points out, these studies may also work against less privileged groups, by undermining their own attempts at stabilizing certain social constructions, and by handing tools to stronger parties to impose to exert still more influence over technology. Bijker's hope, however, is that social constructivist studies have a political bias towards stimulating democratic control of technology, because they show to citizens that influence on technology's course is possible, even in the 'diffusion stage' of a technology (cf. Bijker, 1993, p. 131).

There is no convincing evidence, however, that social constructivist analyses systematically favor less privileged groups. Instead, Jasanoff (1996) presents examples of the use of social constructivist studies by powerful actors to promote their interests that confirm Bijker's worry that social constructivist analyses do not necessarily favor less privileged groups. Moreover, Martin (1993) has argued that there is little evidence that social constructivist studies work to aid less privileged groups. Perhaps social constructivist politics is a good idea in theory, but there is no convincing evidence that it works to stimulate positive political change in practice.

I tentatively conclude that social constructivist politics, in its current form, is unsatisfactory. If political analysis is desired, it seems more attractive for social constructivist studies to study powerful and less privileged groups asymmetrically, by siding with the less privileged group in one's analysis (Martin, 1993; Scott, Richards and Martin, 1990). More specifically, the analyst may attempt to adopt the technological frame of less privileged groups, and present analyses from this perspective that are claimed to represent the 'actual character' of a technology and its 'real impacts', even though the analyst may be aware that her own analysis is also a 'mere' social construction. Such a

'realist' analysis may suggest specific courses of action to these groups, and be more directly helpful in this way than analysis that are merely deconstructive (Soper, 1995; Kling, 1992; Gill, 1996).[12]

7. Conclusion

Social constructivist studies pose interesting challenges to the philosophy of technology, by presenting nondeterministic models of technological change, and by arguing that the choices made in technical innovation in large part determine the social impacts of technologies. This emphasis on the development stage of technology has been shown to result in interesting analyses of technologies as being 'socially shaped' or having a 'script', that provide a potentially fruitful basis for normative and evaluative philosophical analyses of technology and its impacts. Even the strong variety of social constructivism was seen to allow for evaluative and political analysis, by studying the ways in which technologies are 'socially constructed' by different parties and by exploring the possibilities for alternative social constructions by 'reading' technologies differently, thus subverting dominant technological frames. In all cases, normative and evaluative philosophical analysis required that the symmetry principle upheld by social constructivists was disobeyed. Although a full investigation of the methodological and empirical adequacy of social constructivist approaches is beyond the scope of this essay, these approaches, if valid, do suggest new directions for the philosophy of technology.

NOTES

1. I would like to thank Annemieke Nelis, Martijntje Smits, Tjalling Swierstra, and Peter Paul Verbeek for their comments on an earlier draft.

2. The converse question, of how social constructivist analyses could benefit from work in the philosophy of technology, will hence not be addressed.

3. Empirical technology studies is not the only empirical discipline helpful for the philosophy of technology. For philosophical analyses of the social and cultural implications of technology, a good knowledge of general sociology, anthropology and cultural studies could also prove beneficial.

4. To be precise, my analysis adopts Sismondo's distinction between mild and strong social constructivism, but holds, unlike Sismondo's typology, that the SCOT-approach (Pinch and Bijker, 1987) is best understood as a form of strong social constructivism. It also adopts the common distinction between social consctructivism as exemplified by the SCOT-approach, and actor-network theory. Moreover, strong

social constructivism, in my analysis, corresponds with what Grint and Woolgar (1995) call 'post-essentialism' and 'the constitutive variant of anti-essentialism'. Mild social constructivism corresponds with the remaining forms of anti-essentialism. My typology should be understood as describing 'ideal types', and approaches exist that fall in between these 'ideal types'.

5. Included in social shaping approaches may be the 'systems approach' that has been developed by Hughes (1987).

6. The notion of technological frame has been introduced by Bijker (1987, 1993, 1995).

7. A third, promising, notion within (strong) social constructivist technology studies was recently presented by Pfaffenberger (1992). Pfaffenberg argues that the introduction of new technologies is normally accompanied by a series of 'moves' and 'countermoves' by relevant social groups, a series of events that he calls a *technological drama*. The analysis of technological dramas does not just reveal the role of social groups that are successful in shaping the technology according to their interests, but also the role of impacted groups that are unsuccessful in doing so.

8. Although Feenberg (1992) mostly draws from the SCOT-approach, which is here classified as a type of strong social constructivism, Feenberg only adopts the assumptions made in SCOT that there is room for social choice in technological innovation, and that technologies have interpretive flexibility. Both these claims do not go beyond those of mild social constructivism (cf. Sismondo, 1993). Some of the analyses in Feenberg (1995), however, seem to come close to embracing the strong social constructivism discussed in section 6.

9. A similar analysis is presented bij Bijker (1995, p. 262-4), who argues for a semiotic conception of power, according to which power is 'the apparent order of taken-for-granted categories of existence, as they are fixed and represented in technological frames' (p. 263). Artifacts hence are not political in themselves, but derive their political power from the semiotic structure in which they are embedded.

10. The acknowledgement that technological change and the 'social impacts' of technology are not just the outcome of 'explicitly planned, rationally decided, conscious action' has a price, as Bijker is aware. Social constructivist studies cannot fully account for technical change by reference to the actions of different social groups. They also need to recognize structural constraints on technical change. According to Bijker, these structural constraints are found in the semiotic structures, or categories, that stabilize elements in technological frames. Notice, however, that this reference to 'semiotic structure' seems to open the door to functionalist and structuralist accounts of technical change (cf. Elster, 1983), which is probably not wat Bijker has in mind.

11. See Grint and Woolgar (1995, 1996) for a related proposal for a social constructivist politics, which they call 'post-essentialist' politics. See also Mol and Mesman (1996).

12. Some social constructivists have criticized politically motivated 'realist' analyses, because they argue that realist analyses are politically dangerous. Thus, Elam (1994), in a critique of Winner (1991), argues that adherence to 'truth', even in in the name of a 'politically correct' analysis, goes against the very foundations of a liberal politics. According to Elam, liberal politics requires one to refrain from enforcing

one's views on others, and hence from presenting any of one's views as 'true'. Similarly, Woolgar (1993) claims: 'Definitive versions of the "actual political" character of, say, Moses' bridges must be resisted, because there is a very real danger of accepting any political interpretation in the guise of its being true.' (p. 527). Woolgar holds that the very denial that any view qualifies as 'true' or as superior to other views is in the interest of protecting fundamental liberties. Neither party, however, acknowledges a difference between claiming that a statement is true, and dogmatic adherence to the truth of a statement, and neither party presents an argument that presenting statements as true works to undermine fundamental liberties.

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