[Paper delivered at the Copenhagen Meeting of the Society for the Social Study of Science, 2012]

Palimpsestology: The Many Layers of Technoscience

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In this talk I'm going to address some issues in our understanding of techno-science. I hope this will make it possible to shed new light on questions of method in technology studies. I should say at the outset that I refuse all methodological dogmatism. There is no one "correct" method for studying science and technology. Methods are not true or false, they are more or less fruitful. Methods are perspectives and there is no absolute standpoint. This pragmatic criterion implies methodological pluralism. As Horkheimer and Adorno write, "The proposition that truth is the whole turns out to be identical with its contrary, namely, that in each case it exists only as a part."[1] With this in mind, let me turn now to my subject.

Physicists like to say that they're happy they've chosen a field in which the problems are relatively easy to define and solve.[2] The implied contrast is with the study of society which is in fact a lot messier than the world of physics. The difference shows up in the lack of consensus in social science as contrasted with the relative ease with which natural scientists reach agreement.

Technology lies somewhere along a continuum running from the simplicity of nature to the complexity of society. It thus exhibits features of both extremes. Noticing its similarity to science, Pinch and Bijker applied the methods of science studies to technology. Constructivist technology studies is based on the analogy of "true and false" to "working and not working." The symmetrical treatment of each pair opens the possibility of a general sociology without a remainder exempted from social explanation because of its presumed rational character. They compared the process leading to a single technological design prevailing against a field of alternatives to the similar triumph of a single result in scientific controversy. If closure around a victorious design could be understood in terms of concepts developed for the study of scientific controversy, such as interpretive flexibility and symmetry, then a whole new field of technology studies could be born from within science studies.

But certain aspects of technology studies differ from the study of science. As technoscience spreads in more and more fields of research these differences inevitably come back to haunt science studies itself. Then many of its methodological choices get tweaked. The symmetry principle proved flawed in the study of scientific-technical controversies in which a far wider variety of actors intervene with a wide variety of tests and criteria. For example, money and power play a far greater role than in pure science. What to do about well financed tobacco "science" and climate denial?

The hermeneutics of true and false has to do with the meaning of given

[1] Adorno, Theodor and Horkheimer, Max (1972). *Dialectic of Enlightenment*. J. Cummings, trans. New York: Herder and Herder, 224.
[2] Wigner, Eugene, "The Unreasonable Effectiveness of Mathematics in the Natural Sciences," http://www.dartmouth.edu/~matc/MathDrama/reading/Wigner.html.

results, used to ground an argument. The interpretation of data depends on theory and the understanding of instrumentation. Whether an artifact or technical system works or not depends in part on what it is for and this in turn depends on the meaning attributed to it, the program to which it belongs. This establishes a criterion which can be used to judge between alternative designs and which may also be used to guide redesign. The inputs in the design of technology are far more heterogeneous than in most scientific cases. Many different types of actors intervene, each with its own independent notion of what constitutes a criterion of success and a satisfactory demonstration.

In this context it is quite difficult to imagine anything like the role of epistemic criteria in natural science. The resolution of the contest over meaning must determine closure rather than compelling logical or experimental criteria. Technological controversies cannot be narrowed down to precise measurements as scientific controversies often can. There is an ambiguity or vagueness about them that is distinctive. It seems to me that these hermeneutic approaches are rather different since science aims at and usually achieves precision, while the fit between meaning and artifacts is singularly loose. And yet closure is possible in technology too. The actors often reach agreement of some sort and each in its own way finds satisfaction in the artifact.

However, often no closure occurs at all; different versions of an artifact co-exist peacefully without standardization. And why not? Technology need not be consistent and unified, unlike science. The difference was unwittingly illustrated in Pinch and Bijker's famous article on the social construction of technology. The bicycle was interpreted on the one hand as a racing vehicles and on the other hand as a transportation vehicle. Different designs served these different functions for decades, but either could qualify as a bicycle, just one that worked better for one or the other function. There was no need to decide between them, as there is in the case of competing scientific theories, simply more or less congruence between expectations and performance. That a decision was finally made is owing to a special type of innovation I will discuss later.

The greater messiness of society clearly requires a different method and metaphor. Actor Network Theory supplied the new method. Not controversy but “association,” the joining together of people in social networks, became the metaphor for scientific and technological development. They were to be studied as mundane processes of establishing social relations between people and — symmetrically — between people and things. The metaphor now compared both science and technology to society in opposition to the physicists’ dictum. It was thus able to recognize the significance of the heterogeneity of actors, but at a price.

The flattening of distinctions between scientific-technical practices and other everyday practices, and between people and things has advantages and disadvantages. The main disadvantages are twofold: the loss of an intuitive way of talking about social conflict within networks, and minimizing the differences and the specificity of science and technology.

Politics is about human agency. The political interventions of things described by Actor Network theorists are little more than rhetorical flourishes.

Conflicts over technology are often initiated by reference to a transcendent nature or transcendent values and rights, yet the whole thrust of Actor Network Theory is to deny the existence of transcendent entities. The translation of actors' self-understanding into the new vocabulary of the theory is far from convincing. Furthermore, the rejection of the usual distinction between science and technology is troublesome. Everyone agrees that there must be differences between the role of politics in scientific and technological controversy, but how to define and defend that difference once the distinction is blurred? Finally, the flattening of the distinction between scientific-technical rationality and everyday rationality is unconvincing. Of course there are significant continuities, but quantity changes into quality when precision of measurement and rigor of argument become professional values of specialized technical strata.

In this talk I will suggest another way of thinking about technology based on a different analogy; the analogy I have in mind is the palimpsest. A palimpsest is something having unusually diverse layers or aspects apparent beneath the surface. Technological design resembles a palimpsest in this sense. It multiplies layers of influence on a shared object coming from very different regions of society and responding to different, even opposed, logics. This metaphor allows for more eclectic methods than either constructivist alternative.

In what follows I will apply this approach to technological closure. Design is the terrain on which social groups advance their interests. Sometimes the losers are simply losers and their interests are sacrificed. But more often apparently conflicting interests are reconciled in the final design. It is in these interesting cases that the metaphor of the palimpsest is illuminating for each relevant social group contributes a layer to the final result. Layering is a useful concept for understanding the design process and competition between designs. Design proceeds through bringing together layers of function corresponding to the various meanings actors attribute to the artifact. The study of technology must identify the layers and explain their relations.

Adding layers corresponds to accepting more social inputs to the design. This takes several different forms. Technological closure may involve trade-offs, compromises resulting in a less than perfect design for all parties to the controversy. More interesting are those cases in which elegant innovations make it possible to satisfy all the different demands without loss in efficiency. Such innovations are called concretizations by Gilbert Simondon.[3] He defines concretization as the merging of several functions in a single structure. This can be seen in the bicycle case where inflatable tires satisfied both the racers' desire for speed and the ordinary users' transportation needs. This concretizing innovation reconciled all the relevant actors in a single perfected design.

Layers can be conceptualized in many different ways. In the remainder of this paper I will discuss examples of the relation between several types of inputs, public, commercial, technical, and scientific. The first three characterize most of the things we ordinarily call technology. In this usual case public concerns must be reconciled with the commercial-technical aspects of design and production managed by corporations. Much advanced technology involves all four layers

[3] Simondon, Gilbert (1958). *Du Mode d'Existence des Objets Techniques*. Paris: Aubier.

which must therefore be aligned to achieve success.

I would like to reserve the term technoscience for cases in which the scientific layer is decisive. I want to give some examples now of various ways in which this process plays out. My examples represent three types of alignments: independent tests according to both scientific and commercial-technical criteria, compromise and concretization.

My first example is cold fusion. When Martin Fleischman and Stanley Pons appeared at a press conference at the University of Utah to announce the discovery of cold fusion, the President of the university was also present and spoke to the press. He promised that cold fusion would revolutionize electricity production and transform the world economy. Soon the University announced the formation of a research institute with funding from the state. Its goal was not only to produce knowledge of the phenomenon but also to prepare large scale commercial applications.

We know the end of the story. Within a short time cold fusion was discredited and most researchers lost interest in it. The institute at the University of Utah closed in 1991 and support for further work in this field quickly evaporated.[4] These events provide a particularly clear illustration of the complexity of technoscience.

Fleischman and Pons did not apply any existing science in their work but made an empirical discovery of the sort that we associate with invention. Their discovery employed a technical device that was both an experimental apparatus and a commercial prototype. Accordingly, the two pronged launch of their discovery at a news conference aimed at both the scientific and the business communities.

In the cold fusion affair science and technology are practiced simultaneously in relation to the same object, hence the applicability of the term technoscience. The very same effect which the Institute was created to exploit was also exposed to scientific evaluation. There the potential profits to be made on commercial electricity production were attention-getting but less significant. Scientific criteria were brought to bear on the effect and it was rapidly discredited. The failure of alignment meant the failure of the whole project.

Next I want to present two example that illustrate the operation of public acceptance in the design of technoscientific objects. Since the protests over AIDS in the 1980s, medicine has become particularly rich in such cases.

In a recent article, Taigo Moreira poses the problem of the relation between universal "rational" standards and personal experience through the example of the denial of a medicine for treatment of Alzheimer's disease by the British National Health Service. The NHS evaluates medicines and decides on their cost/benefit ratio in terms of quasi-scientific measures. In the case of Alzheimer's the measures did not include issues of quality of life but were based on cognition and hospitalization. When the existing treatment was found not to be cost-effective on this basis, it was withdrawn. This represents a socially rational basis for community action to create, in this instance, a medical treatment

[4] Simon, Bart (2002). *Undead Science: Science Studies and the Afterlife of Cold Fusion.* New Brunswick: Rutgers University Press.

system, aligning scientific and economic regimes.

But patients and carers were upset because even though the medicine in question did not slow cognitive decline much or prevent many hospitalizations, it did have a big impact on quality of life. The article concerns how the victims of the decision made their point and forced a modification of the decision. They did so through telling stories about how the medicine had changed and improved the patients' quality of life, and their own experience of caring. These stories evoked affect—anger, disappointment, depression. They operated as allegories, much like human interest stories in newspapers. Everyone can identify with the subject of a human interest story through sharing imaginatively the affect it evokes. Similarly the stories told by the patients' carers solicited identification and formed community on a different basis from the quasi-scientific "rational" standards applied by the NHS, with different results for the definition of the medical system.[5] Eventually the NHS agreed to supply the medication to some patients at a certain stage in the progress of the disease. Only partial alignment between the layers was achieved by this clumsy compromise.

The case of AIDS illustrates a concretizing advance. AIDS activists initiated a movement for more research on AIDS in the 1980s. This movement started out with considerable conflict and distrust between patients and the scientific-medical community. Patients objected to restrictions on the distribution of experimental medicines and the design of clinical trials. They engaged in protests that upset the medical and scientific community. This was a literal trial of strength. Compliance with experimental regimens broke down as patients rejected or undermined the use of controls. Reforms were finally introduced. Patient advocates were enlisted by scientific committees, protocols modified, and opportunities to participate expanded. A more humane organization of research was introduced.[6]

The struggle eventually died down and was replaced by cooperation. The lay intervention added a new ethical dimension to scientific practices without harming the research process. The changes were cognitively significant since they made it easier to recruit human subjects and to insure that they supplied reliable information. In this case the layers of science and public acceptance eventually coincided, with beneficial results on both sides, but only after a political intervention from below.

This paper has attempted to supplement the models of controversy and association with the model of design in the interpretation of technoscience. The design metaphor suggests a way of conceiving the variety of inputs and methods of closure observed in technology in terms of the alignment of layers. Layering of design brings together a wide variety of social inputs, each of which applies meanings and tests to technological artifacts. Where science is essentially involved, some of those tests take the form of scientific knowledge. In such cases, the model of controversy applies quite literally, but as a layer in the design

[5] Moreira, Taigo "Health Care Standards and the Politics of Singularities: Shifting in and out of Context," *Science, Technology and Human Values*, 37(4) 307-331.

[6] Epstein, Steven (1996). *Impure Science*. Berkeley, University of California Press. Feenberg, Andrew, *Alternative Modernity.* Berkeley: University of California Press, 1995, chap. 5.

process.

In conclusion, I would like to summarize the discussion briefly. I have proposed that the metaphors and associated methods based on the concepts of controversy and association be supplemented by the metaphor of the palimpsest. Layering is a fruitful model of the technological design process. In this context I have shown that scientific controversy is incorporated into technoscientific design as one of several layers. Association remains important in my approach, but I emphasize the association of technical and non-technical knowledges and actors. This association has implications for the democratization of technology.