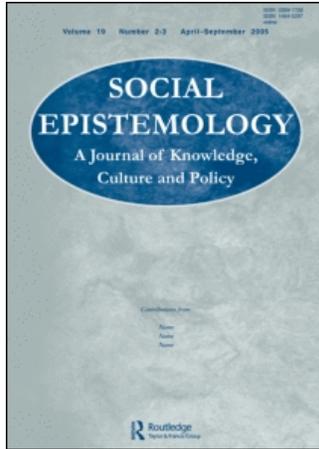


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Comments

Andrew Feenberg

The four papers included along with my own in this special section offer four different approaches to the critical theory of technology. Each paper makes an original contribution while also inviting me to respond to comments on my own version of critical theory. This gives me a welcome opportunity to clarify several aspects of my theory.

Bram Bos's paper introduces the concept of reflexive design. This is a new approach to design that works with all the actors implicated in the eventual use or consequences of a technology. In the case of chicken farming he presents, these actors to include farmers, hens, and consumers. The aim of the design work is to bring social dimensions of existing technology to the surface for critique in terms of the concerns of these actors. The new designs that emerge from this process are proposed to farmers not as final solutions, but rather to enlarge their sense of possibilities and their awareness of issues remote from their everyday concerns. The result, hopefully, is a system that satisfies everyone, including the hens.

Bos draws on my theories of instrumentalization, technical code and concretization to explain the workings of a reflexive design process. These theories are helpful for practical work since they not only address the socially constructed character of technology, but also introduce new ways of thinking about the politics of design.

Concretizations, for example, are cases in which multiple functions are served by a single structure. A concrete technology is characterized by an elegant and economical design and contrasts with a cruder design in which each function requires a separate structure to serve it. Gilbert Simondon, who introduced this concept of concretization, argued that it represented the immanent path of technical progress. In contrast with that rather deterministic notion, I suggest that we follow constructivism in relating functions to the actors whose interests they serve. Combining functions in concrete

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designs would thus reconcile actors with different interests. This would be the specific mode in which design achieves the technological equivalent of political alliance.

Where such alliances include subordinate actors in technical networks, I call the results “democratic rationalizations”, rationalizations from below. In this case, concretization enlarges the range of interests served by technology to embrace hitherto excluded members of the lay public. Bos contrasts my approach to democratic rationalization with Ulrich Beck’s reflexive modernization theory. Bos points out that Beck’s notion has a wider application than mine since it refers not just to rationalizations demanded by subordinate actors, but also to responses by institutional actors to the immanent tensions within modern systems of production. This accords with Bos’s experience in the field of agricultural technology. He notes the significance of epidemics among farm animals in stimulating an interest in improved design to which the Dutch state has responded by supporting reflexive design work.

I find Bos’s article extremely encouraging as an example of the applicability of critical theory in the real world of technology. But I do have one reservation. Bos notes that public concern with the safety of food supply and the condition of farm animals has played a role in motivating the search for new designs. But how big a role has it played? Since farmers are not the main advocates of reform, can we really believe that the pressure for reform is the result of Beckian reflexivity at the institutional level? Surely in that event, farmers would be the first to seek change. I wonder whether the interest of the state in reform is not a reflection of public concern that is itself the primary impetus to change, change that must now be given a technically rational form by Bos, his collaborators, and eventually the farmers themselves. That would be a case of democratic rationalization since consumers are subordinate actors in the food production network.

Hans Radder’s paper offers a rigorous dissection of the concept of technology, and on that basis an account of alternative technology. Radder proposes a definition of technology as “a (type of) artefactual, functional system with a certain degree of stability and reproducibility” and goes on from there to consider each aspect of his definition in detail. This account, significantly, restricts the term “technology” to material embodiments; in addition, Radder discounts the importance of aspects of technology that are not strictly functional on two grounds: first, that most technical artefacts have no symbolic significance, and second, that meaning is generally attributed to individual technologies, which tends to downplay the importance of systematic connections in the technical sphere. I will return to this later.

Radder goes on to discuss alternative technologies, which can appear through variation in each term of the definition. Whether to use a particular technology to accomplish a certain goal opens up a first choice. Next, functions may be varied, and, once a function has been chosen, choices appear between the various systems through which it can be served. Technologies have a context and thus further choices appear regarding the operating environment and durability of the design. The stability and reproducibility of technology pose yet further choices. However, in practice the range of choice is limited by all sorts of factors. These require empirical study that may belie the apparent freedom and contingency identified at the theoretical level.

Radder's paper moves from demonstrating the contingency of technology to normative considerations. Contingency without criteria for change is of no great interest. But which values should guide change? Radder asks us to consider not just the moral implications of technologies but the wider question of the way of life they support. An appropriate technology would be one that conforms to ethical values in supporting a desirable way of life. Democratic debate about technology should be directed toward the goal of realizing appropriate technology.

Having presented his own version of a critical theory, Radder turns to my contribution. His main criticism seems to be that the instrumentalization theory does not allow for choice at the level of the primary instrumentalization, which he identifies with the concept of function in his own definition of technology. I find this a surprising criticism. The fact that all technologies have a functional aspect does not commit any particular agent to any specific function. Nor does the fact that all technologies have a functional dimension commit one to technologizing everything. The instrumentalization theory is an analytic tool and so cannot do the work of a normative theory, but it is supposed to open up technology to normative evaluation in contrast to theories that treat technology as value-neutral. On the normative questions I think we are in complete agreement.

Radder also believes that the concept of systematization I introduce ought to be a primary instrumentalization rather than a secondary instrumentalization. He argues that functions cannot exist without contexts and so the system within which a function is identified is intrinsic to it. Yes and no. I do not identify the primary instrumentalization with the functionality of devices as does Radder. I think that many ideas about function arise independent of context, almost as aesthetic concepts. Many functions are also in inception multi-functions; that is to say, they can be systematized in various ways with different consequences. The slippage between abstract functions and concrete devices plugged into a whole system of social and technical environments seems to me essential to the possibility of modern technical disciplines. For this reason I see systematization as a secondary effect that overlays some original insight into function and makes it operative in the real world.

On the question of the relation of function and meaning, we have a more significant disagreement. I believe a functional perspective on technologies is perfectly legitimate, but I also believe it to be an abstraction from the social complex within which technologies support a way of life. In this latter capacity the meanings technologies bear encompass the lived experience of function as well as many other symbolic aspects and social effects. To reduce an automobile to its function as a means of transportation is reasonable from the standpoint of an automotive or highway engineer but is not true to life as it is lived by drivers and passengers. Thus, I grant meaning a central role in our understanding of technology.

Philip Brey's paper undertakes to explain the implications of technology for power. This is a complicated subject and Brey addresses it through breaking power down analytically into its different types and then considering the various ways in which technology serves in the corresponding strategies. Brey draws on Bruno Latour's notion of delegation to explain how power is exercised through technology,

and on Brian Pfaffenberger's theory of technological dramas to explain resistance to technologically embedded power relations. The argument is convincing to me on its own terms and provides a good basis for discussing the democratization of technology. As Brey argues, democratization is an inherent potential of technological systems and embraces not merely questions of design but also of social context and meaning.

I can only add that there is an aspect of my interpretation of the problem of technological power that Brey might want to articulate more fully in his own account. This concerns what I call "formal bias" and its relation to the concept of "operational autonomy" I introduce in my analysis of management in industrial societies. Formal bias refers to the way in which a relatively neutral system, such as a technological device, a bureaucratic procedure, or a market, produces effects of inequality through its relation to its context. In the case of technology, the concept of formal bias is useful for understanding the asymmetrical effects on the distribution of power of designs that centralize control over technically mediated activities and disempower subordinates relative to those at the top of organizational hierarchies. Operational autonomy refers to the independence leaders win from subordinates through such formally biased arrangements. This structure empowers those in command to reproduce their own operational autonomy through the organizational and technological choices they control.

Why is this analysis relevant to Brey's argument? Because it is essential to distinguish modern forms of power based on socially rational systems and artefacts from premodern forms based on narrative myths. The concepts of formal bias and operational autonomy distinguish between modern forms of disempowerment through systems that are coherent and rational, if not necessary and just, and older forms of discrimination that respond to personal preferences and prejudices without regard for the principles of rational management. Brey presupposes this distinction without addressing the conceptual problems it raises. It is not obvious that power is involved in motivating the uses of technology he describes. It could be argued that power effects are simply accidents of choices made on grounds of efficiency. Furthermore, if power does indeed motivate technological choices, it is unclear whether this detracts from the pursuit of efficiency and so could be criticized from a traditional progressive standpoint, or if efficiency is conserved across technological choices with different implications for control.

Without the conceptual framework of critical theory of technology it is difficult to criticize the highly centralized systems of command and control that characterize modern societies. These systems do deliver the goods, so we can no longer claim, as Marxists used to, that capitalist administration of industrial technology impoverishes society. Criticism of hierarchical forms of social organization and their supporting technological designs is far more challenging because it must rest on exclusively normative grounds.

Yet democratization of technology cannot go far without challenging these systems. Unless we can show them to be biased and contingent, the demand for democracy will imply voluntary poverty, and that will condemn it to irrelevance. Accordingly, critical

theory of technology treats the modern exercise of power as largely structural. Centralized organization generates the rationale for its own perpetuation since, beyond a certain point, loss of control in this context is associated with lower productivity. The notion of a different structure with a different and more democratic type of leadership inspiring different motivations is the excluded alternative against which the established structure must be measured.

This leads me to Han van Diest's account of democratic management. van Diest argues that under the influence of Habermas, critical management studies have failed to appreciate the role of technology in organization. For Habermas, technology is neutral in its own sphere – but van Diest points out that technological designs are underdetermined by purely technical reasons and respond to the interests of powerful actors. This constructivist point is compatible with Marcuse's perspective on technology, if not that of Adorno and Horkheimer in many of their formulations. van Diest then extends the argument to organizations, which are also designed in response to both technical and social considerations. Rigid hierarchical structures are not the only rational solution to organizational problems, but one of several competing solutions, including some that are more democratic.

van Diest argues that, in addition to social underdetermination, there is also something he calls ontological underdetermination, by which he means that neither technologies nor organizations work exactly according to plan. The individuality of the concrete and real will always exceed the reach of conceptual designs. He claims I do not recognize this form of underdetermination but then concedes that my concept of "margin of maneuver" is similar. I introduced this concept to refer to the ineradicable contingency of situated action even in tightly controlled production processes.

In fact, I think we are in complete agreement on this point, but I simply do not use the word "underdetermination" in an ontological context. I agree that the behavior of humans and the properties of things are everywhere unpredictable to some extent, but this only becomes relevant to the question of social rationality in a modern society based on planning and design. This is why I discuss margin of maneuver in the historical context of modern organization and technology rather than in ontological terms – I discuss these matters in *Questioning Technology* (Feenberg 1999, 112–122).

van Diest draws out the consequences of his concept of ontological underdetermination in considerations on flexible, knowledge-based organizations. In these organizations, he argues, experts attain such a high degree of autonomy that the organization is contingent on their willing support. Their margin of maneuver, on my terms, is so great they are no longer controlled by the organization, which becomes dependent on them rather than *vice versa*. Such reversals of power between employers and employees certainly have democratic potential.

Like van Diest, I have argued for a continuum of democratization rather than a sharp break between undemocratic and democratic paths. Nevertheless, I still do believe there is a tipping point beyond which it is no longer possible to maintain capitalist control and the profits contingent on it. Whether changes in production of the sort van Diest

highlights will reach that point is doubtful, and in fact not particularly relevant to the partial democratizations that are actually occurring today in organizations of this type.

On the broad question of democratization of technology and the societies dependent on its advance, we are all in agreement. There is potential waiting to be seized, not a predetermined fate. Let us hope that reflection on science and technology encourages ever more democratic initiatives in the future.

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