lower the costs of making an exchange. But as my illustrations demonstrate, it is as equally possible to affect alienability, rivalry, and exclusion cost with a technical as with a legal change, and that change may or may not be a focus of design.

5 Changing Things by Design

The material dimensions of alienability, rivalry, and exclusion cost represent a "given" or natural infrastructure in which informal institutions evolve, either by chance or by design, and a set of background conditions against which formal institutions are formulated and enforced. When those background conditions change, by chance or by design, the entire significance of social institutions can be altered. All of which raises the question: if changes in the formal institutions of society are appropriate targets for political philosophies and theories of justice, why not also the technological transformation of alienability, rivalry, and exclusion cost? This is, I take it, a somewhat more focused restatement of a question that has been asked many times before. Herbert Marcuse's *One Dimensional Man* suggests that the failure to subject technical systems to normative scrutiny is both a political and a philosophical failure. The political failure resides in the increasing power of capital and commercial interests to dominate all forms of discourse in industrial society, while the philosophical failure consists in positivist doctrines that created an epistemological space in which questions about technical efficiency were regarded as "value free," (Marcuse, 1966)

For most people involved in the practice of design, Marcuse's characterization of technology has seemed to be too metaphysical, too Heideggarian, and simply too vague to be of much use. Langdon Winner has had more success in calling for critical evaluation of technology and technical change by describing what he calls "the technological constitution of society." This is a material and organizational infrastructure that predisposes a society toward particular forms of life and patterns of political response. Winner illustrates his idea with a number of examples, notably technological systems such as irrigation systems or electric power grids that dispose societies toward centrally administered, hierarchical relationships of political power (Winner, 1986). We should notice that what accounts for such tendencies is the way that these systems affect the alienability, rivalry, and exclusion cost of the respective goods, water, and energy, that they produce and distribute.

Centrally administered irrigation systems in the ancient world and contemporary electric power grids succeed in part because they represent technical solutions to real problems, but they also have the effect of converting goods that are comparatively non-rival with high exclusion costs, into goods that are just the opposite. Water and energy are virtually everywhere in most locales, though frequently not in large enough concentrations to accomplish certain critical tasks such as agriculture or manufacturing. In their natural state, water and energy have high exclusion costs; it takes a bit of trouble to keep people from having access to them. Natural water systems such as rivers and springs also serve a number of purposes

simultaneously and in this sense are comparatively non-rival goods. Though generally depleted in use and in that sense naturally rival, energy in the form of wood and mineral fuels or localized wind and water mills is relatively specialized in the types of work it can be expected to perform. One type yields heat and the other mechanical power, and further technology is needed to reconfigure them for other purposes. Thus water and energy are relatively non-rival under these configurations of the material world. The irrigation system and the power grid reduce exclusion cost as they increase rivalry, and the result is goods that are far more amenable to centralized control and to commodity exchange than water and energy are without these technological infrastructures. What is more, both systems provide a way to alienate their respective goods from a local setting, much as wagons and roads transform the alienability of grain. Thus, alienability, rivalry, and exclusion cost are part and parcel of what Winner has called the technological constitution of society. These traits specify the politically important design parameters of a technological system more clearly.

However, if the conceptual framework made available by institutional analysis allows us to sharpen the questions we wish to direct at technology, it also results in a deflation of the thesis that technology needs to be questioned. First it is clearly specific tools and techniques as utilized in specific situations that give rise to the material consequences I have been illustrating, not "technology" as a metaphysical force. Second, not all of these material changes will rise to the level of political importance. One would hardly object to better locks on the ground that they lower the exclusion costs for people who use them. That is what locks are supposed to do. Third, Marcuse's belief that there is a dominant logic or trajectory of technology is weakened, rather than strengthened, by the institutional analysis. Technological change has the potential to affect alienability, rivalry, and exclusion cost in myriad ways. Xerox copiers, computers, and the Internet have raised the exclusion cost for goods such as texts, audio recordings, and images, at the same time they have made them less rival. As a result, these items are less easy to control and less like commodity goods. Not surprisingly, those who benefited from the old material structure have moved quickly to encourage the enactment of formal legislation that would restore some the rivalry and lower the costs they incur in excluding what they take to be unauthorized use.

Finally, even if technology should be questioned when alienability, rivalry, and exclusion cost are affected, it is not at all obvious what the answer should be. Analysts who use the word "commodification" generally think that this kind of change is a bad thing, but economists who talk about reducing transaction costs generally think just the opposite. In both cases, there may be an understandable but false assumption that the material infrastructure of the world is relatively fixed, so that the processes in question always involve manipulations of law and policy. This assumption may then map transformations in alienability, rivalry, and exclusion cost onto rather well-worn political ideologies. Hence, "commodification" is bad because it favors capitalist or bourgeois interests, while lowering transaction costs is always good because it allows rational agents to more successfully maximize the satisfaction of subjective preferences. Even if this is generally correct for changes in formal institutions, which I doubt, it will simply not do as a sweeping analysis of technical change.