Theorizing Technological and Institutional Change: Alienability, Rivalry and Exclusion Cost

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Abstract
Formal, informal and material institutions constitute the framework for human interaction and communicative practice. Three ideas from institutional theory are particularly relevant to technical change. Exclusion cost refers to the effort that must be expended to prevent others from usurping or interfering in one's use or disposal of a given good or resource. Alienability refers to the ability to tangibly extricate a good or resource from one setting, making it available for exchange relations. Rivalry refers to the degree and character of compatibility in various uses for goods. The paper closes with a note on how attention to these factors might be useful ways to conceptualize what Langdon Winner has called "the technological constitution of society," and what Andrew Feenberg has theorized as "secondary rationalization," as well as within more practical contexts of technical research, development and design.

Keywords: industrialization, capitalism, institutional economics, biotechnology

Philosophy has long been concerned with the nature, rationale and legitimation of formal institutions such as law, education and social bureaucracy, and has traditionally reflected on informal institutions in the realm of culture, habit and tradition. Yet the plasticity of the manner in which material reality also frames human interaction has often escaped philosophical inquiry. 20th century social science developed penetrating analyses of formal and informal institutions on many levels, yet like philosophers, social scientists have neglected the implications of their ideas for the transformation of the material world. To contextualize this theoretical gap, I begin by retelling a familiar story of modernization in succinct form as a story of institutional change and then shift abruptly to an equally succinct discussion the three analytic concepts that appear in the title: alienability, rivalry and exclusion cost. I will briefly discuss how philosophical evaluation of changes in formal or informal institutions has centered on one or more of these factors, while also offering examples of technical change where changes in exclusion cost, alienability and rivalry restructure human relationships in very similar ways. After these stage setting exercises, we arrive at the main philosophical task: to merge these concepts into our explanatory framework for industrialization, technical change, the growth of capitalism and the emergence of the modern era. The concepts of alienability, rivalry and exclusion cost and the theoretical framework of institutional change allow us to pose questions that have been asked by Herbert Marcuse, Langdon Winner and Andrew Feenberg in a new way: If technology is in part responsible for the shape of our institutions, and if institutional change in the sphere of law and custom can be subjected to philosophical critique and democratic guidance, why shouldn't technology be subjected to the same critique and guidance? A more pointed form of the question can be posed to scientists and engineers at work in technical innovations: why shouldn't technical designers account for factors such as exclusion cost, alienability and rivalry in considering alternative

designs? Why shouldn't the developers of technology be socially and politically accountable for consequences accruing from alterations in alienability, rivalry or exclusion cost, as well?

The Political Economy of Institutional Change

Philosophers and other social theorists have long focused on underlying structures or patterns of social organization, attempting to understand both the mechanisms and implications of change within them. But these structures and patterns have been thematized in almost innumerably many different ways. I want to focus on patterns and transitions associated with transformations that have been characterized as rationalization, commodification and institutional change. It should be obvious why the philosophy of technology should take an interest in these transformations, for they are closely associated with industrialization, the rise of capitalism and with various theses of technological determinism. The diffuse body of theory that has been associated with these transformations can be summarized for present purposes as emphasizing the transition from informal to formal institutions.

Institutions are standing practices or patterns of human activity that can be described in terms of rule-governed behavior. *Formal* institutions are those that are explicitly articulated as rules, and that are reproduced and enforced by organized social entities, especially the state. Hence, formal institutions are laws and public policies. *Informal* institutions are standing practices that subsist on the basis of common knowledge, tradition and culture. They are reproduced through legend, lore, apprenticeship, imitation and perhaps all manner of common experience. Their enforcement mechanisms can include approbation, praise, shunning or group inclusion but consist mainly in the way that they constitute the framework for successfully negotiating the most basic tasks in social life (Commons, 1931). Although vague, this simple set of definitions provides a basis for interpreting the last millennium of European history as the gradual displacement of informal institutions by formal regimes of law and policy.

Philosophers of the Enlightenment and early Modern Age were deeply complicit in this displacement, typically viewing formal institutions as superior in virtue of their capacity for explicit articulation, widespread application and critical evaluation. A rule that cannot be clearly stated cannot be criticized or justified, much less enacted by a civil authority, even if it can be reliably followed by those who are appropriately socialized. Thus philosophers' predilection for argument, demonstration and verbal disputation disposed them to regard formal institutions as inherently rational. Or perhaps we should say, as C. B. MacPherson (1962) did, that those interests most consonant with the evolution of property rights and state authority naturally aligned themselves with philosophers who were advocating explicit, rational evaluation of society's rules. But the philosophical bias in favor of formal institutions began to wane in the Romantic period, as the new wave of philosophy begins to pine for a lost sense of belonging and community solidarity. In 1897 the German sociologist Ferdinand Tonnies (1855-1936) theorized modernization as a transition from *Gemeinschaft* to *Gesellschaft*, and in 1914 Max Weber (1864-1920) characterized it as a process of rationalization toward increasingly bureaucratic decision making.

For Karl Marx (1818-1883) and subsequent Marxists, the alienation or estrangement of labor is a turning point in this long process. Marx's *1844 Manuscripts* explore the metaphysical and moral significance of this event, but in what, exactly, does the alienation of labor consist? Economic historian Karl Polanyi (1886-1964) described it as a series of legal and policy changes by which manorial social relations give way to capitalist relations. Under traditional social relations,

peasant labor was bonded to a particular parish or parcel of land. By common consent (or at least accepted practice), laborers were both minimally maintained by the liege lord, but also unable to work for compensation beyond the parish borders, except by the express permission of parish authorities. This system stifled the development of the factory system, which demanded large numbers of laborers at specific locations. It was abandoned in favor of a system of wage labor that, just as John Locke (1634-1704) had argued, made each individual the owner of their own labor, but which also obligated them to sell it at the going rate in order to obtain subsistence. These legal and policy changes thus allowed labor to be alienated both from the soil and from the social relations in which it had previously been embedded, and to be sold as a commodity good on a competitive market (Polanyi, 1944).

British labor historian E. P. Thompson (1924-1993) argued that, in fact, a more extensive set of transformations had contributed to the making of a working class, transformations that predated the industrial age by centuries. These included the alienation of ordinary food from the circumstances in which the production, distribution and consumption of grain had been embedded so that it could be traded as a commodity good. Before modernization, the grain growing in an English field would have been considered the common property of the parish. An elaborate system of informal concessions governed the share to which each parishioner (not to mention the lord) was entitled, as well as the tasks such as harvesting, milling, or baking that each was obligated to perform. Although this system might be theorized as a regime of exchange in which goods and services are traded at fixed prices, Thompson analyzes it as a "moral economy" governed more firmly by mutual expectations than by formal institutions of ownership and regulated exchange. The system was gradually monetized during the early stages of modernization, with entitlements becoming defined as forms of income and many exchanges taking the form of cash sale. As roads and wagons improved, the farmers who harvested and bagged grain (not to mention the lord) saw opportunities to sell it in other villages or wherever prices were best, ignoring the informal expectations (the assessments and shares) that governed the distribution of grain under traditional practice. How are we to interpret this situation? Do the farmers have a right to seek the best price for their grain, or is it the common property of the village?

Natural law philosophy tended to notice a few key things about grain. First, the farmers who come into first possession of a parcel of grain through the labor of sowing and harvesting can easily keep tabs over its location and use, and it is fairly easy for the grain to change hands by sale or gift. Furthermore, once consumed for one use, the grain is gone. It cannot be re-eaten by another. These natural characteristics of grain were seized upon by natural law theorists, who saw a sack of grain as something naturally fit for property rights. Thus, the natural law theorists endorsed the of farmers' right to claim ownership of the grain, and redefined the sack of grain as a commodity good, replacing the informal moral economy with the formal institution of state sanctioned commodity exchange, (Thompson, 1971). Thus did Marxist theoreticians theorize the transition from informal to formal norms as one of commodification where economic practices of production and distribution are disembedded from more complex social relations and become available for monetized exchange. Thus also did they theorize political economy as a tool for capitalism and commodification.

One lesson to take from this attenuated overview of social history is the emphasis that is placed on the decline of informal institutions and the rise of formal ones. The theoretical focus is on the creation of a social apparatus that formulates and enforces the principles according to which human activity is to be guided. Much attention is given to state actors, but non-state

bureaucracies (such as the Dutch East India Company) are active in more detailed accounts of the transition, and they become more and more active as laws of incorporation become common. A second lesson is that the capacity for rational rule-governance, as well as for rational revision of rules, depends upon the recognition of social relations that can be disembedded from the thick practices of common custom. Thus if institutions and their transformation are to be made into a subject for philosophical deliberation or public choice, there is an implicit bias against customs and traditions that emerge through evolutionary or adaptive social processes. As we shall see, this carries over into a bias favoring the deliberative review of formal institutions instead of material practice. The third lesson is that the process of disembedding often involves the creation of alienable goods, goods whose production and distribution can be controlled. This process centers on altering the *alienability,* the *exclusion cost* and the *rivalry* of goods.

Alienability, Rivalry and Exclusion Cost

Until fairly recently, neo-classical economic theory assumed that a rational person would always exchange a good "A" for a good "B" whenever the person preferred having "B" over "A". This assumption had long been recognized as exceedingly unrealistic in virtue of the fact that circumstances of the exchange could override the preference for "B" over "A". The individual would have to know that the opportunity for exchange was available, for example, and the greater value of "B" would have to be sufficient to make it worthwhile for the person to take the trouble to make a trade. Furthermore, in the real world, trading "A" for "B" sometimes means that one also has to accept "C", as anyone who has ever purchased a puppy can attest: cuddles and endearing looks come bundled with training responsibilities and interruptions in the dead of night. This extra baggage can make the whole package seem less attractive than it otherwise might. Such circumstances have been theoretically characterized as "transaction costs," by new institutional economists, who have made numerous strides to make economic theory more realistic. Alienability, rivalry and exclusion cost are three among many factors that have been analyzed as contributing to transaction cost. For the most part, institutional economists have not abandoned the neo-classical assumption that rational behavior is always concerned with economizing, and as such, they have tended to think that reducing transaction costs is always a good thing (North, 1990). Although I do not share these framing assumptions, I will borrow heavily from the institutionalists' characterization of alienability, rivalry and exclusion cost in order to make my own theoretical points.

Alienability is the degree to which a good or potential item of use can be extricated from one setting or circumstance so that it can be transported to or utilized in another. A critical aspect of alienability is the ease with which something in the possession or employ of one human being can be transferred to the possession or employ of a different human being. The right to life is characterized as an inalienable right because life can only be lived by specific individuals, it can't be given or sold to someone else. Hence the *right* to live can only be exercised by the person whose life is at stake, it cannot be alienated from that person and exercised by someone else. Alienability is in this sense a metaphysical characteristic of goods that determines whether the goods can be meaningfully subject to exchange. Alienability is a necessary prerequisite for any item of property, at least as this notion has been understood in the natural law tradition. Most analyses of alienability focus on formal legal institutions rather than metaphysics, and the question is whether it is legally permissible to alienate a good (often labor) and to offer it for exchange. But since laws can change, legal alienability can change. It is situational rather than metaphysical. Both legal and metaphysical alienability may seem to be absolute: something is alienable or it is not. But an institutional focus shows that alienability can come in degrees.

Making it easier to "unbundle" goods—to alienate one good from another—affects transaction cost, and dramatically affects the price. "I will take your puppy for $100 if you agree to supervise the housebreaking, but I will only give you $10 if I must do it myself." Thus, in addition to pure metaphysical alienability (something that is just not the *kind* of thing that can be alienated) and pure legal alienability (it's legal to alienate that thing or aspect or it's not), there is a relative and negotiable domain in which the cost of alienating the good is reflected in whether the good is typically exchanged or not.

It is important to note, however, that a fairly large component of sociability depends on the degree to which various items or goods are alienable or in fact alienated from one another. For Thompson's peasants, the fact that it was rather difficult to separate large quantities of grain from inland locales where it was grown prior to the advent of canals, better roads and boats or wagons made for a situation conducive to the embedded relations of production and exchange that were characteristic of manorial society. Here, the inalienability of grain from place was a situational rather than a metaphysical necessity, or even a legal practice. Farmers and lords may have had a legal right to sell grain but they were very limited in who they could sell that grain to. Other situational forms of inalienability include the impossibility of separating a musical or theatrical performance from the person of the artist prior to the invention of photography and audio recording. A sixteenth century minstrel might have had the legal right to sell the right to enjoy his performance of a song to someone who was not physically present and able to hear it in person, but this is not a right that would have occurred to anyone, much less had much cash value. After Edison, the right becomes meaningful. Prior to the legal reforms documented by Polanyi it was also legally impossible to separate the labor power of a worker from the parish in which he had been born.

These situational types of inalienability can be changed, in the latter case by changing the law and in the former cases through material transformation. But we may speculate that in virtually every case it is difficult to imagine how goods might be alienated one from another until it has become obvious that it can be done. In our own time, traits that might have been thought to be inalienable characteristics of certain plants or animals can now be readily encoded in genetic sequences and transferred to totally different plants and animals through genetic engineering. These traits (or at least the genes that confer them) have even been alienated from organisms altogether and put on the market all by themselves in the form of licenses that plant or animal breeders may purchase so that they may then transfer the trait to different organisms. It would have been difficult to conceptualize the growth rate of a fish as something that could have been alienated from the species or type of fish prior to this development in genetics. If you want fast growing fish, you would have to get fish that grow quickly. But growth rate has now been alienated and it is now possible to build a fast growing fish (or a fast growing anything) simply by buying the gene construct (Muir, 2004).

Rival use or *rivalry* is the degree to which alternative goods or uses of goods come into competition with one another. One way in which two alternative uses of a good can compete with one another is when they are consumed in use. Eating the grain is a comparatively rival use because it can only be eaten once, and this use exhausts the possibility of its being used by another person or in another way. Enjoying the scenic beauty of the waving fields of grain is a non-rival use because not only can more than one person obtain this good from a single field of grain, scenic beauty can be enjoyed again and again. Economists also use the concept of rivalry to describe the relationship between two or more goods that can be substituted for one another and which therefore come into competition with one another in market relations. Thus beans and corn

may be rival in that both can be eaten, and food shoppers may opt for beans when the corn is too expensive. But beans and corn are non-rival in other markets: you can't use beans to make Tennessee whiskey, so a moonshiner is never in the market for beans.

Rivalry is thus situational, and situations can change. Since antiquity, farmers have made use of seeds by saving a few from each year's crop and planting them in the following spring to grow another crop. This year's crop of corn or beans produces food, but some of the corn and beans that could be eaten can be used as seed, which can be planted again. In this sense, using a seed to plant a crop is a qualified non-rival use. It does not deplete the amount of the good available for future uses, though it does make the good temporarily unavailable while the crop is in the ground. Genetic use restriction technologies (GURTs), or so-called "Terminator" genes, can be used to create seeds that when sown as a crop will not produce more seeds. Although the corn or beans from a GURT crop can be eaten, if a farmer saves them to plant, she will be sorely disappointed for they are infertile and cannot function as seeds. GURTs thus transform the use of seeds to sow a crop from a non-rival to a rival use (Conway, 2000).

Alienability and rivalry are critical to the creation of exchange relations because they influence the degree to which a good is amenable to the process of and the need for exchange. Goods that cannot be alienated one from another effectively become a single good for the purposes of exchange, if they can be exchanged at all. Rival goods are depleted by use, and hence must be obtained and replenished prior to any use, or they may substitute for one another, also affecting the need to obtain them through exchange. Thus, whether exchange takes the form of sale, gift or grant, it is primarily alienable and rival goods that are the object of exchange. Or to put this in somewhat different terms, although human beings can exchange glances, insults and affection, it is the exchange of alienable and rival goods such as a sack of grain, a team of oxen or a day's work in the fields that constitute the paradigmatic form of the economic social relationship.

The degree to which alienable and rival goods precipitate social relations characterized by commercial exchange also depend on the ease with which the various uses of a good can be limited or controlled through access or possession. *Exclusion cost* is the outlay in time, trouble and expenditure of resources that is required in order to prevent others from having access to a particular good or item of property. Like alienability, exclusion costs are in large measure a function of the material characteristics of the goods human beings utilize and on which they rely. Oxygen and vitamin D are alienable and rival goods, but it is fairly difficult to prevent people from having access to air and sunshine. It is, in contrast, fairly easy to keep jewels and trinkets where no one else can get them hence the latter have more typically been understood as saleable items than the former. Items with very high exclusion cost are unlikely to be traded commercially.

Like alienability and rivalry, exclusion cost is amenable to situational variation. Situational change in exclusion cost has often taken the form of material manipulation of either the goods in question of the circumstances in which they reside. Locks and fences are the classic technologies of exclusion, and a better lock will lower the cost of excluding others every time. It has also been possible to reduce exclusion costs through the development of informal institutions. Simply declaring that certain parties have an exclusive right to use a good will suffice in many cases. Queuing for service is among the most venerable of informal institutions in Western cultures, and everyone recognizes that the person at the front of the line has an exclusive right to be served next. If being served next is the good in question, we may thus say that for the first in the queue, the cost of excluding anyone else from this good is very low. By common consent, customary

recognition of this right saves everyone a load of time and trouble, making the cost of many daily transactions far more reasonable.

When customary rights of exclusion are threatened, it is always possible to bring in the coercive power of the state to back them up. The police represent a formidable way of lowering exclusion cost for all manner of private property. A person who would have to guard or defend an item of property can call on the police to do it, and the knowledge that arrest and prison are among the possible consequences of an unlawful taking raise the cost of theft, simultaneously lowering the cost of exclusion. Copyright and patent laws represent formal institutions that place the coercive power of the state behind a broad array of exclusive practices, even when no tangible property exists. The legal remedies of intellectual property law vastly reduce the cost of preventing others from using one's intellectual creations through intimidation, bullying, spying and other forms of self help.

Alienability, rivalry and exclusion cost represent features of the various items and entities in the world, including personal services as well as material things, that collectively determine which items and entities come to be the object of exchange relations, and which ones remain embedded within a more inchoate and presumptive context of social practice. It is very likely that anything alienable, rival and excludable will be regarded as an item of personal or private property. It should not be surprising that when goods are lacking in one or another of these three dimensions, a few people try make up for it either by passing laws or by changing the world in a material way. As institutional economists have developed their analysis of these traits, they brought the economists' bias that enabling transaction is always a good thing. They also bring the social scientist's bias of focusing on social practice, and especially on formal institutions. As such, they have tended to focus on legal or policy reforms that would lower transaction costs. But as my illustrations demonstrate, it is equally possible to affect alienability, rivalry and exclusion cost with a technical as with a legal change.

Technology, Social Practice and Political Change

Now it is time for a few observations that may seem profound if they do not seem altogether obvious. First, a fair proportion of internal political conflict over the last millennium has either involved or been precipitated by changes in the alienability, rivalry or exclusion cost of goods. State-led efforts to rationalize embedded activities of production, distribution and consumption by enacting laws that create formal institutions for exchange are at the bottom of social critiques offered by Marx, Polanyi and a host of other social theorists. For example, in *Wage Labor and Capital,* the *1844 Manuscripts,* and *Das Capital,* Marx challenges the viability of the institution of wage labor on various grounds, sometimes stressing the moral plight of the wage laborer, other times arguing that the social prerequisites for the reproduction of the labor force were simply not met by the institution as it had taken shape in 19th century Europe. But the institution of wage labor was a function of legal changes that had altered the alienability of labor power in two senses that are not clearly articulated among the four that Marx mentions in his famous analysis. First, the laws and customs that had tied labor power to land were eliminated, allowing labor power to be alienated from a specific geographical locale, and hence also the social setting in which it had theretofore been embedded. Second, labor power had previously been a bundled good, thoroughly entangled in the person of the laborer and not to be had without also accepting at least minimal responsibilities to sustain the person.

The first of these alterations in the alienability of labor power is a knife to the heart of *Gemeinschaft*, the intense local sociability that we perhaps nostalgically associate with the pre-industrial world, while the second is the source of most left-leaning complaints against capitalism. It was, of course, also possible to see this change as progressive in virtue of the way that labor markets allocate labor power to society's most valued use. The use of formal institutions to change the alienability of labor power thus lies at the core of social theories such as Tonnies' that stress industrial society's loss of community solidarity, socialist theories that stress capitalism's inability to meet the basic needs of the poor, and neo-liberal theories that stress the compensating benefits of industrial growth. This is all old news, of course, but what remains striking in the social theories of industrialization is the bias toward formal institutions. For material changes in alienability, rivalry and exclusion cost are every bit as important in creating the watershed transformations that led to the industrial world.

To take one example, labor power that is highly specialized is comparatively non-rival. To be sure, to the extent that labor is a function of time spent working, all labor is highly rival, because nothing is more thoroughly depleted by use than time. However, work that requires a lot of skill or special training can be done by many fewer workers in the pool. Thus, the deskilling often associated with machines and assembly line operations converts labor power into a more rival good. Work that can be done by almost anyone creates a labor market in which many more workers compete for jobs, driving down wages. Deborah Fink's study of late 20th century meatpacking shows how packing companies introduced new technologies requiring considerably less skill precisely as a union-busting tactic that redefined work rules and brought a new group of unskilled (mostly immigrant and female) workers into the workforce, (Fink, 1998). If low-skill, low-wage workers are able to perform work once done by those who have the skills, strength and stamina needed for traditional meat cutting, there are more rivals (more types of labor) that substitute for one another from the employer's perspective. Such materially and technologically based changes in labor needs for manufacturing are emblematic of industrialization.

For a second example, let's return to E. P. Thompson's peasants, who rioted when local farmers asserted that their right to sell grain in a neighboring village was in fact a right to seek the best price in more extensive commodity market created by expanded modes of transport. Here what had once been assumed to be community property, if not by legal right then by the informal norms of the "moral economy," became a more readily and hence more thoroughly alienable good, protected by private property rights and available for sale to the highest bidder. Although grain itself was not changed in this transition, as it has been in the case of Terminator seed, what was changed was the material infrastructure—wagons and roads—and it was this technological change that made grain into a good that was practical to alienate from the local community for the first time. As noted above, these transformations preceded the period of industrialization by several hundred years, but they contributed to the process we know as modernization as surely as did the creation of a factory system.

Much ink continues to be spilled over industrialization, modernization, capitalism and technological determinism, and the analysis (not to mention the examples) that has just been given cannot be disentangled from the raging debates over how and whether these things fit together or don't. Tom Misa, Phillip Brey and Andrew Feenberg have published a collection of essays by multiple authors which examine the tensions that animate these debates through a number of different theoretical and disciplinary perspectives. The main thrust of most essays is that modernization theory and empirical studies of technology are passing like ships in the night, and that more focused attention on the gap between these two bodies of scholarship would be a

good thing (Misa, Brey and Feenberg, 2003). Although the argument thus far has drawn upon the literature of modernization and the debate over technology and the engines of history to create a philosophical context, my goals are not to take sides in that debate as much as to fall in line with Misa,. Brey and Feenberg's call for a kind of theory that would fill in the gap. Thus, the short version of the long story of how we got where we are today will now be set aside (at least for awhile) in pursuit of new theoretical goals.

Technology: An Institutional Approach

We may thus focus on three modes of transformation for the institutional infrastructure of society. The first of these is formal and reflects the processes of bureaucratic decision making that were the focus of Weber's sociology. Institutions reflect the rules of the game for social interaction. Legislation, the courts and the administrative agencies of government each bring to bear various rule-governed procedures for revising those rules. The second mode is simply cultural change, the gradual transition in expectations, shared beliefs, custom and tradition that supports a vast array of informal institutions, most of which, like the clothing on our backs, fail to be particularly evident to us at the very moment that we participate in their social production and reproduction. Finally, there is technical change, the intentional modification and manipulation of the material world. Technical change shares an element of mindful deliberateness with formal institutional change. Technical changes, in other words, come about because some person or group intend for them to happen. Yet technical changes are often taken up gradually, with numerous adaptations and modifications that Andrew Pickering calls "tuning," (Pickering, 2005), and in this sense they share an apparently haphazard and evolutionary modality with cultural change.

Although it has long been obvious that technical change has a critical role in shaping history, it is perhaps still not widely accepted that some types of technical change also operate in the modality of institutional change. Part of the reason for this is that institutions seem to have a normative character that material objects do not have. Institutions are rules about what people are permitted to do. The institution of queuing for service is only effective because people think that they ought to behave as the institution demands. Take away this "ought" and you take away the institution. Ethics and political theory are normative discourses that attempt to state what *people* ought to do in given circumstances. There are no normative theories that attempt to state what things ought to do under any circumstances. Things are notoriously uncooperative when it comes to philosophical persuasion. Most people are inclined to think that they lack the capacity to follow normative advice in the fashion that philosophers have been most inclined to give it. The fact that many of our students also seem to lack this capacity has not persuaded philosophers to think that the problem might lie in the way that normative theories are articulated. Despite Bruno Latour's efforts to persuade us otherwise, philosophy as a discipline continues to insist that norms for things are a waste of time because things do not have minds and are incapable of intentional action.

It may be difficult to see things in the world as having any institutional significance at all simply because we do not, in the age of disenchantment, understand the material world as able to support a normative dimension. But there will not be institutions forbidding actions that are physically impossible. We do not, for example, have institutions that dictate when it is and is not appropriate to become invisible. Yet our need for decorum and privacy would surely have led people to form customs governing the practice of disappearing from view while remaining present as an observer if this were a capacity that people actually had. Similarly, although property rights, work rules and a host of other social institutions specify norms for the alienation of goods, for rival use and

for the right to exclude others from access to goods and services, it would be rather surprising if there these institutions did not closely track the material possibilities for alienation, rivalry and exclusion cost. Just beyond the domain of sheer metaphysical possibility there lies the socially crucial domain of cost. Here, the relative *ease* of alienation, controlling rivals and excluding others may be almost as determinative as metaphysical possibility in affecting whether we have formal or informal institutions. In places where it would be very difficult, that is, very expensive, to exclude others from access to sunshine, you can bet that there will be no informal norms (no rules) about whether or when it is appropriate to do so.

Furthermore, as long as material transformation of the world is comparatively minor or slowly paced, the process of adaptation and adjustment in social institutions that occurs in response to these changes will probably be absorbed into the background noise of ongoing cultural change. It is only when material changes result in relatively large changes in alienability, rivalry and exclusion cost that technical change can be distinguished from ongoing cultural change. Furthermore, it is only when such large scale changes become sufficiently frequent that it will become clear to people that technical change operates as a distinct modality of institutional change, as a class of human originated events having a patterned (if only vaguely predictable) impact on the texture and importance of human interaction. When this modality becomes clear, it will be obvious that even though things do not have minds, they do have normative implications. The material dimensions of alienability, rivalry and exclusion cost represent a "given" or natural infrastructure in which formal and informal institutions evolve, either by chance or by design. When those background conditions change, by chance or by design, the entire significance of social institutions can be altered.

Changing Things by Design

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). Today, philosophical positivism no longer maintains much influence over the practice of science and engineering, though its legacy no doubt lingers in the form of uncritical attitudes and institutionalized organizational practices that penetrate deeply into the social complex of technical innovation, development and regulation (Thompson, 2004). Resistance to Marcuse's demand for a critical philosophy of technology lingers, as well.

This lingering resistance may in part simply reflect the continuing influence of powerful economic interests, but Marcuse's characterization of technology has seemed too metaphysical, too Heideggarian, in fact too vague to provoke much critical reflection on the part of many. 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 in fact 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 and 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, however, 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, meaning, again, that the "markets" in which people access these goods will be distinct. The irrigation system and the power grid reduce exclusion cost as they increase rivalry, and the result is goods (i.e. water on tap or electrical energy at the wall outlet) 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, in fact, specify the politically important design parameters of a technological system more clearly.

Andrew Feenberg has been among the most recent theorists to call for the evaluation of technology in ethical and political terms. He has done so by arguing that technological systems undergo two phases of rationalization, one that might be characterized fairly positively in terms of technical parameters, and a second that has to do with the way that technological means and artifacts interface with networks of human actors. It is the second phase of interface that, in Feenberg's view, should be the focus of political and philosophical critique (Feenberg, 1999). But how can we characterize the boundary between humans and non-humans in a manner that allows us to bring traditional categories of political philosophy to bear? There are probably many ways to do this, some of which will clearly stress social parameters such as who stands to profit in terms of money or prestige when a given technology is widely adopted. Yet if technical systems rearrange the material world in ways that affect the alienability, rivalry and exclusion cost of goods, this will certainly impact the networks in which humans will be enrolled. Thus with Feenberg's secondary rationalization as with Winner's technological constitution, alienability, rivalry and exclusion represent ways to ask the philosophical and political questions in more pointed terms.

However, if the conceptual framework made available by institutional economics 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 of all, it is clearly specific tools and techniques as utilized in specific situations that give rise to the material consequences I have been illustrating. We are not doing philosophy of technology in its woolliest, most metaphysical incarnation today.

Pragmatism is implicit in my general approach (see Hickman, 2001). 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, for all the inspiration I have taken from his writings, Marcuse's thought that there is a dominant logic or trajectory of technology is weakened by this 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 that they have made them less rival. As a result, these items are less easy to control and less like commodity goods today than they were in Marcuse's lifetime. I paid good money my copy of *One Dimensional Man,* but readers of this article will have (very likely) accessed it for nothing on the Internet. Not surprisingly, those who benefited from the old material structure have moved quickly to encourage the enactment of formal legislation that would restore some of 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. Lawrence Lessig's detailed studies of the way that technical codes affect alienability, rivalry and exclusion cost for software, the Internet and e-commerce suggest that when we question technology in this way, we will need to look closely at the actual implications of a specific technical change before we will be in a position to speak about whether it is good or bad (Lessig, 1999).

In conclusion, getting clear about alienability, rivalry and exclusion cost can help both innovators and philosophers of technology do some of things that they have long aspired to do better. In the case of technical innovation, these institutional factors represent parameters that go a long way toward predicting some of the most socially sensitive and historically contentious elements of a technical change. Be advised that such modifications will require careful planning and a well-crafted participatory process of design and implementation. For philosophers, they get us to at least some of the details that really matter when technical change occurs. A focus on alienability, rivalry and exclusion cost thus provides a promising way to integrate the philosophy, sociology and economics of technology, and to clarify some of the more obscure mechanisms that have been associated with technological determinism and social history. They also represent elements of specific technologies such as genetic engineering or information technology that serve as boundary objects linking alternative networks of actors, and bridging normative with classically technical domains. As such, they provide a focal point for the ethics of technology, and should be considered in any attempt to identify the elements of a novel technology that are most in need of deliberation and public discussion.

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