History and Theory, Theme Issue 42 (December 2003), 82-93 ISSN: 0018-2656

II. THE NATURE OF "NATURE"

3.

NATURE AND TECHNOLOGY IN HISTORY

THEODORE R. SCHATZKI

ABSTRACT

This essay sketches an expanded theoretical conception of the roles of nature and technology in history, one that is based on a social ontology that does not separate nature and society.

History has long been viewed as the realm of past human action. On this conception, nature is treated largely as an Other of history, and technology is construed chiefly as a means for human fulfillment. There is no history of nature, and the history of technology becomes the history of useful products.

The essay discusses the changes wrought in these understandings by a social ontology that depicts social existence as inherently transpiring in nexuses of practices and material arrangements. The first implication is that the domain of history should be expanded from the realm and course of past human activity to the realm and course of past practice–arrangement nexuses. In turn, this wider conception transforms the significance of nature and technology in history.

Until recently, most accounts of the relationship between society/history and nature have presumed that society and history are separate from nature. On my account, by contrast, nature is part of society: a component of the practice–arrangement nexuses through which social life progresses. Human history, consequently, is a social–natural history that encompasses the varying presence and roles of nature in human coexistence. Technology, meanwhile, is not just useful products, and not just a mediator of society/history and nature. It also is (1) something through which humans manage social life and the nature that is part of it, largely by drawing nature into this site and thereby conjointly transforming society, technology, and nature in history; and (2) something that, over time, plays an increasingly central role in the nexuses where social life transpires. Through technology, in short, social–natural history takes form and advances.

This essay aims to broaden the concept of human history by reconsidering the roles of nature and technology in it. Behind this reconsideration stands the conviction that recent history and theory have vitiated the traditional construals of nature and technology as outsider and handmaiden, respectively, to history. More specifically, the essay sketches the expanded conception of the roles of nature and technology in history that follows from a philosophical social ontology that does not dichotomize nature and society.

History has long been, and is still today, widely construed as the realm and course of past human activity.[1] This means that historians study human actions,

1. For example, R. G. Collingwood, *The Principles of History*, ed. W. H. Dray and W. J. van der Dussen (Oxford: Oxford University Press, 1999).

what determines actions, and what actions bring about. Anything constituted by, bearing on, or brought about by actions counts as historical fodder. What determines action has usually been considered to be mental phenomena such as beliefs, hopes, and desires, whereas what results from human activity has typically been taken to be artifacts and further activity. The focus of history, as a result, has emphatically been human beings. Apart from environmental determinists and historical ecologists or environmentalists of various stripes, nature has largely been ignored. Technology, moreover, has been almost universally construed as a means for furthering human ends, as artifacts people produce, together with the skills and knowledge these artifacts require and engender, so as to facilitate their lives. According to this way of thinking, technology, unlike nature, is part of history. It is so because it shapes, facilitates, and is brought about by human activity.

Whatever is part of history has a history. On the standard line of thinking, consequently, there is a history of technology but not of nature. The history of technology is simply that slice of the total realm of human activity that is tied to technology. In addition to technological objects, this slice includes the actions that generate, use, or result from technology, the knowledge and skills technology requires and engenders, and, it should be added, the complexes of these matters that are given such designations as computer networks, assembly line manufacturing, medical practices, and scientific investigation. Nature, by contrast, is not, on the standard view, part of human history. Hence, it has no history. Or rather, any conception of nature as a historical entity or realm—such as those of Whitehead, Alexander, and contemporary biological evolutionary theory[2]—works with an expanded notion of history that does not attribute to generic history any particular connection to humans and human history (for example, history as events in time, as development, or as contingency). On these wider conceptions, the history of nature simply is, or pertains to, the temporal course or development of nature. There is no history of nature as something peculiarly related to humans and their history. At best, nature and its history form a backdrop against which (human) history takes place.

A variety of developments has begun to chip away at the hegemony of this general conception of (human) history. Most centrally, its subversion is part of the general reconsideration currently underway of the relationship between society and nature. It has become tenuous, theoretically, to construe this relationship either reductionistically or oppositionally. This development, in turn, challenges the opposition between history and nature that is a facet of the venerable concept of history and that parallels, and maybe depends on, the society–nature opposition.[3]

2. A. N. Whitehead, *Process and Reality* (New York: Macmillan, 1929); S. Alexander, "The Historicity of Things," in *Philosophy and History: Essays Presented to Ernst Cassirer*, ed. Raymond Klibansky and H. J. Paton (Oxford: Oxford University Press, 1936), 11-25; and S. J. Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (New York: W. W. Norton, 1994).

3. Motivating reconsideration of the society–nature relationship are a variety of intellectual or real-world phenomena or developments: on the one hand, the inadequacy of neurophysiological approaches to human behavior together with the ascendance of nonreductive accounts of human activity such as rational choice theory, the inadequacy of social constructionism together with the implacability of

The current essay is situated amid this development. The transfigured notion of history it defends is based on a particular, practice-centered social ontology.[4] According to this ontology, social life inherently transpires as part of nexuses of human practices and material arrangements. Practices, such as those of science, politics, religion, building construction, and cooking, are open, spatial–temporal manifolds of activity that are carried on by multiple individuals. "Material arrangements" are arrangements of humans, artifacts, organisms, and things (where artifacts and things are distinguished, roughly, by whether human activity does or does not intentionally or significantly effect them). Practices and arrangements are bound together into nexuses in various ways. For example, practices transpire at particular arrangements, require particular arrangements, change because of specific arrangements, and establish and modify arrangements; arrangements, meanwhile, secure and require certain practices, lead to changes in practices, and house particular practices. Saying that social life inherently transpires as part of nexuses of practice and materiality means that all human coexistence takes place as a feature of, or by way of, such nexuses. For example, conversation through the internet transpires *as* part of contemporary electronic communication practices and *as* mediated by a technological set-up that embraces computer monitors, electronic connections, and satellite signals. It cannot occur otherwise. This modal proposition holds of all human coexistence: human coexistence is *inherently* tied to extant practice– arrangement nexuses. I dub the nexuses of practices and arrangements, as part of which social existence occurs, the *site of the social*.

One feature of this ontology is that more or less all human activity occurs within the scope of some practice or other. Indeed, an action, more precisely stated, is a moment of a practice or practices. A second feature is that activities occur at and amid particular arrangements. It follows from these two features that history, construed as the realm and course of past human activity—embracing activity, the determinants of activity, and its products—transpires only within human practice–arrangement nexuses. Human activity and its course are thus an abstraction from a fuller reality, namely, the social site, the realm and course of practice–arrangement nexuses. Hence, whatever justifies dignifying the course of human activity with a name—"history"—and making it the topic of its own academic discipline, at once justifies conceptualizing history more fully, and thus more propitiously, as the course of that complete phenomenon of which the course of action is, inherently, a part. In short, once activity is seen to be embed-

realism, and the emergence of more flexible forms of evolutionary and ecological theory; on the other hand, advances in genetic research and in prosthetic technology as well as widespread environmental degradation and changes in nature for which humans are responsible. Such developments, in conjunction with the rise of parallel processing, the internet, nanotechnology, and a philosophy of technology worth its name, have also challenged the standard construal of technology as, simply, useful products of human endeavor. Theorists have begun to appreciate and grapple with the far greater significance of technology for human existence.

4. See T. R. Schatzki, *Social Practices: A Wittgensteinian Approach to Human Activity and the Social* (New York: Cambridge University Press, 1996) and T. R. Schatzki, *The Site of the Social: A Philosophical Exploration of the Constitution of Social Life and Change* (University Park: The Pennsylvania State University Press, 2002).

ded within practice–arrangement nexuses, it is a small step to expanding the notion of human history, from the realm and course of past human activity to the realm and development of past practice–arrangement nexuses. On this wider conception, the course of human activity is one—albeit the most crucial—component of history. (Because, moreover, the arrangements involved have over time increasingly become the products of human activity, these arrangements, like human life more generally, have become steadily more historical in character.) I urge, accordingly, that human history be conceptualized as the realm and course of the social site, of activity-embracing nexuses of practices and arrangements. Notice that my suggestion is that the realm and development of past nexuses delimits the *domain* of historical phenomena. A historian is under no obligation to study nexuses *as opposed to* activities. My point is simply that any historian who studies human activity in effect makes a cut out of a broader realm to which the activity concerned is inherently tied. I add, in case someone questions the point of drawing a particular boundary for history, that in the present context I am only following out the demarcational consequences of joining the traditional delimitation of history to my social ontology.

It should be stressed that activity remains crucial to history on this expanded conception of its domain. In the first place, actions, as the moments of practices, are absolutely central to practice–arrangement nexuses. More deeply, one condition of the existence of history qua the development of the social site (or, for that matter, qua the course of activity) is the historicity of the individual lives bound up with it. By the historicity of an individual life I mean the past being part of someone's present—for instance, that earlier events, someone's own previous actions, and extant artifacts and built structures determine or condition present activity. I am claiming, consequently, that one condition of practice–arrangement nexuses taking a course is that the activity-streams of the individuals involved in the nexuses are conditioned by the past. In other words, the condition of the existence of objective history is the historicity of human action.[5]

This reconceptualization of history has implications for the roles of nature and technology in history. Consider, first, nature. What, to begin with, is nature? By "nature" I mean any thing, process, or event, or any aspect of a thing, process, or event, that exists, happens, or changes not as a result of human activity; in other words, nature includes that which is not under the control of, or shaped by, human activity. To the extent that existence, occurrence, or transformation observe laws or principles, a thing, process, or event is natural when its existence, occurrence, or alteration are subject to laws and principles that are not of human making. This definition of nature descends from Aristotle's concept of a natural entity as an entity that obeys principles of motion rooted in its inner nature. Aristotle contrasts such entities with craft objects, whose principles of development (change) are imposed upon them through human activity. My definition diverges from Aristotle's in two principal ways: first, it jettisons the notion of essence (*telos*, form) and is noncommittal about the source or location of the principles or particulars responsible for change; second, it widens the domain of nature beyond

5. For more on this Diltheyean–Heideggerian insight, see T. R. Schatzki, "Living Out of the Past: Dilthey and Heidegger on Life and History," *Inquiry* 46 (2003), 301-323.

substances to include any aspect of entities, including artifacts and social entities, whose being, occurrence, or transformation is not under human control or subjected to human determination. These divergences imply that objects cannot be cleanly partitioned into such familiarly prominent classes as natural and artifactual, and that entities of any sort can have natural aspects. Although a house, for instance, is both a human artifact and a social phenomenon, the physical properties of its construction materials, according to which it bears weight, withstands blows, liquefies under certain conditions, and the like, are facts of nature. Even such entities as synthetic polymers, whose molecular structure is the result of human ingenuity, evince natural properties such as bonding possibilities and catastrophic behaviors under extreme temperatures or pressures.

The contrast term to "natural" is "artifactual." An artifact is an entity whose existence results from intentional human activity and that is subject to principles of organization or change bestowed on it by such activity. Just as artifacts can have natural aspects, natural objects—for example, just about any extant forest—can have artifactual features. Entities also exist whose mix of natural and artifactual aspects is so profound or confounding that they are equally natural and artifactual. Examples are bottled milk, sexual desire, certain genetically-altered life forms, and English gardens. The terms of the nature–artifact distinction are not mutually exclusive.[6]

I noted above that the chief phenomenon, in response to which the traditional conception of history as the realm of human activity is breaking down, is a nascent challenge to both reductionist and separatist accounts of the relationship between society and nature. From the 1970s into the 1990s, discussion of this relationship was dominated by the opposition between naturalism and constructivism. Both these positions are monistic reductionisms. Whereas naturalism construes society as a part of nature and seeks to understand society on the basis of the principles governing nature, constructivism construes nature as a product of society and aims to understand nature by reference to features of social life. Sociobiology old and new and Edinburgh sociology of science, respectively, are paradigmatic for these two positions. Beginning in the 1980s, a third position,

6. I acknowledge the divergence of my definition of nature from other contemporary philosophical characterizations. Perhaps the most influential alternative is nature defined as the object of the natural sciences. The circularity of this characterization is palpable and serious. Meeting this objection by assigning the label "nature" to whatever is studied, or rather, to whatever is successfully studied, in chosen sciences such as biology, physics, chemistry, and their hybrids, is conceptually respectable. This definition, however, wears its historical limitations on its sleeve. Moreover, the desire to define nature thus seems to rest on presumptions about the ultimate unity of science and its subject matters. Another philosophically popular definition is nature as the realm subject to nonhuman law. Besides, again, possibly being circular, this definition suffers from uncertainty as to whether principal dimensions of biological evolution are subject to law and, thus, part of nature. My neo-Aristotelean definition embraces at once the realms of physical and biological phenomena, which these science-oriented definitions highlight, and the world of surrounding experiential objects (oceans, sky, stars, forests) that humans encounter. This capaciousness makes it much more propitious than are the science alternatives—and also much more suitable than are characterizations that highlight experienced circumjacent nature alone (for example, G. Böhme, *Die Natur vor Uns: Natur-philosophie in pragmatischer Hinsicht* (Kusterdingen: SFG-Servicecenter Fachverlag, 2002)—for the purpose of conceptualizing the relationship between nature and history. Of course, there is no correct definition of nature, no fact of the matter as to what nature is. Any proffered definition can have only this sort of relative superiority.

which I call interactionism, opened up. Challenging the reductions of society to nature and nature to society, it contends that society and nature are distinct entities, or better, distinct realms and that the two realms of society and nature interact. The vast range of contemporary theories that describe themselves as contesting the "dualism" or "opposition" between society and nature fall into this category. Espying pervasive intertwinings, interminglings, amalgamations, and interactions between natural and social phenomena, these theories call for and sometimes supply fresh conceptualizations of the society–nature interface. Examples of this general approach can be found in diverse disciplines, from ecology,[7] through sociology[8] and anthropology,[9] to history.[10]

However, in challenging the long-standing Western theoretical practice of segregating society from nature, interactionist approaches unwittingly uphold a key conceptual move that underlies such segregations: the separation of society from nature, the idea that theoretical work should begin from the presumption that society and nature are substantially, and not just analytically, distinct. This idea engenders the strategy of combatting the reductive tendencies of both scientistic thought and its humanistic-social theoretical contrahants through an assumed prior division and active rejoining of things, properties, and forces social and natural. The cyborg, as both an entity and figure of thought, is emblematic here. Another familiar example is landscape. Part social and part nature, these entities combine and thereby do not reduce society and nature. Although this combining strategy thwarts the thorough and unambiguous division of relevant objects into distinctly social and distinctly natural ones, and in this way "blurs the boundary" between the social and natural, it at once upholds this boundary by treating ambiguous objects as combinations of entities, properties, and forces that have been cleanly separated into distinct realms. Instead of either X or Y, the logic is now X plus Y.

It is just as pernicious to conceive of society (or social entities, properties, or forces) as something substantially distinct from nature (or natural entities, properties, and forces) as it is to reduce society to nature. Human action and coexistence were born both amid and from nature, and they have remained inseparable from it ever since. Human action, for instance, has always been effected via the subsystems of a natural object, namely, the human body; indeed, it is the molar activity of this natural object. No matter how much bodily systems (for example, the muscular or hormonal systems) are molded as a result of the embeddedness of individuals in social contexts, that and how human activity is the molar activity of this physical object always rests on natural properties of that object. As a result, nature mediates all face-to-face interactions among humans and, in conjunction with the physical properties of technology, all interactions among people. Nonartifactual objects such as animals, plants, and climatic or geological phenomena, furthermore, have always been integral to human coexistence. In short,

7. For example, M. Fischer-Kowalski and H. Weisz, "Society as Hybrid between Material and Symbolic Realms: Toward a Theoretical Framework of Society–Nature Interaction," *Advances in Human Ecology* 8 (1999), 215-251.

8. For example, P. Dickens, *Society and Nature* (Philadelphia: Temple University Press, 1992).

9. For example, R. Rappaport, "Nature, Culture, and Ecological Anthropology," in *Man, Culture, and Society*, rev. ed., ed. Henry Shapiro (New York: Oxford University Press, 1971), 237-267.

10. For example, D. Worster, "Transformations of the Earth: Toward an Agroecological Perspective in History," *Journal of American History* 76 (1990), 1087-1106.

society cannot be rigidly separated from the realm of nature. Latour advocates abandoning the conceptual distinction between nature and society.[11] Although this position is not persuasive (the terms remain useful in comprehending human existence), he is right that the distinction must not be transformed into a dualism; that is to say, the distinction must not be reified into two distinct, non-overlapping realms—even if it is added that the two realms interact or combine.

The social ontology outlined above satisfies this desideratum, for it allows that entities can *at once* be social *and* natural beings. Something is social if it helps constitute human coexistence, or more expansively, if it is a component of the social site. The social site, recall, is composed of the nexuses of practices and material arrangements as part of which human coexistence transpires. Any constituent or dimension of these nexuses is *eo ipso* a social phenomenon. Something is natural, moreover, if it is, happens, or changes on its own, maybe according to principles or laws that are not of human making. It turns out that entities that satisfy this definition of nature are part of the social site, that components of nature are *part of* the social realm, a dimension *of* society. (Examples will be discussed shortly.) In addition, because natural things and processes have been part of the social site from the inception of that site, this ontology does not presume that nature and society have ever been substantially distinct. From the beginning of social life, there have existed aspects of human life that have been at once social and natural. In short, this ontology does not tolerate any separation of society from nature. Whereas interactionism abandons the social–natural distinction as a substantial partitioning of entities only to embrace it as a clean separation of constituents, properties, and forces, the practice-centered ontology of this essay abandons all such separations and recognizes that entities of any sort can be *at once* social and natural.

Nature is part of society in three principal ways. The first is that natural organisms and things are elements of the material arrangements, in conjunction with which practices compose the social site. Examples of the things involved are natural objects with which humans form arrangements (for example, iron-ore deposits, oceans, and mountains); artifacts (such as houses, swings, mines, oil drilling platforms, and observation decks); and other organisms (such as trees, termites, birds, or bears). These arrangements help make up the site of the social because states of human coexistence such as working together, playing, and sightseeing, as well as states of being such as being a coworker, playmate, and participant in the economy, transpire, in part, by way of these arrangements.

A second way nature is part of the social is that the entities that compose arrangements have a physiochemical composition and are, accordingly, part of the greater physiochemical stratum in which material entities are linked.[12] The exact significance of material composition for sociality is a matter of some controversy. At a minimum, its existence requires that coexisting humans cope with the manifestations of the physicality of humans, technology, organisms, and

11. Bruno Latour, *We Have Never Been Modern*, transl. Catherine Porter (Cambridge, Mass.: Harvard University Press, 1993).

12. Compare G. Deleuze and F. Guattari, *Thousand Plateaus*, transl. Brian Massumi (Minneapolis: University of Minnesota Press, 1987).

things, for example, tornado winds, parasite invasion, electrocution, bodily discomfort, torture, centers of gravity, high-speed impacts, thirst, mechanical breakdown and wear, and pollution. The physicality of humans, technologies, and things also shapes human practices, for instance, which actions can be and are carried out, which goals can be and are pursued, which tasks can be and are carried out for the sake of those goals, and how they can be executed when and where. The properties of wood, for instance, lay down sequences of actions that must be followed if trees are to be felled, axe handles produced, animals clubbed, houses built, and paper produced. It is likewise patent that materiality determines and anchors arrangements. The physicality of entities helps determine their spatial-temporal location as well as their possible combinations and relations, and the physicality of combined entities often contributes to the inertia of the resulting combinations. Indeed, the composition and structure of the human body and the perdurance of built structures are important determinants of continuity and longevity in human practices.

In addition, any system of human labor involves an interchange between the physical systems that are skilled bodies and the material technological set-ups with which they interact, such that any given total nexus formed by bodies, set-ups, and materials exhibits regularities different from those marking other labor systems.[13] Examples of such systems are the handicraft, tools, and iron of the smith; the mechanical skills, machines, and product components of the assembly-line worker; and the cognitive abilities, electronic assemblage, and fuel rods of the nuclear power plant control-room worker. Labor systems also depend on natural regularities that characterize their material dimensions, such that the varying dynamic material properties of different systems always result from, and are maintained by, human actions in conjunction with natural processes.

A third way nature is present in society is in the form of biophysical flows that pass through practice–arrangement nexuses, above all flows of matter-energy[14] and of organisms and genes.[15] Material arrangements are crystallizations of such flows; among other things, moreover, practices capture flows. It might be added that practice–arrangement nexuses are also embedded in surrounding natures, these natures being the closest thing to the proverbial Other of society or history: geology, broader habitat, undiscovered resources. These are pertinent to social life and history in shaping future courses of activity and future practice–arrangement formations.

Just as nature is part of society and not something substantially separate from it, so too is nature part of human history, the realm and course of practice–arrangement nexuses. Objective history is not simply an affair of humans and their artifacts. Nature is also part of this history in all the ways and more that it is part of society. To begin with, different pieces and swaths of nature factor in different historical episodes (as components or determinants of arrangements, as causes of

13. Cf. S. Moscovici, *Essai sur l'histoire humaine de la nature* (Paris: Flammarion, 1977).

14. For example, C. Dyke, *The Evolutionary Dynamics of Complex Systems: A Study in Biosocial Complexity* (New York: Oxford University Press, 1988); and R. Adams, *The Eighth Day: Social Evolution as the Self-Organization of Energy* (Austin: University of Texas Press, 1988).

15. For example, W. McNeill, *Plagues and Peoples* (Garden City N. J.: Doubleday, 1976); M. De Landa, *A Thousand Years of Nonlinear History* (New York: Zone, 1997).

events, as phenomena to which practices react), the total pageant of history thus embracing myriad aspects of nature in multiple ways. Plants and animals, for instance, are essential parts of endless historical episodes, just as the stars and their constellations are key components of many, mostly distinct, ones. The human body, moreover, in so far as it is not intentionally shaped or controlled by human activity, is an omnipresent component of social life and mediator of human practices, just as are those physical properties of artifacts that are likewise not shaped or designed by human action. Human history, accordingly, is a social-natural history: a perpetual development that encompasses the omnipresent and varied active presence of nature in human life. History does not just occur on the backdrop of nature, as many modernists have it; nor is it simply intertwined with nature qua substantially distinct realm, as contemporary interactionists have it.

Consider, now, technology. To begin with, by technology I mean, to use Carl Mitcham's typology,[16] a certain range of objects, material objects more specifically, as opposed to a certain form of activity, knowledge, or will (though activity and knowledge are inseparable from these objects—see below). One familiar and oft-cited feature of these material objects and artifacts is that humans produce and/or use them as means toward realizing their needs and desires.[17] To emphasize this feature of technology, however, is to abstract technological things and those who use them from the broader and richer reality that is the history-composing social site. To begin with, this instrumental characterization strongly suggests that needs and desires are givens, at least vis-à-vis technology. Many desires and needs, however, reflect the contingent state of the social world people live in, including its technology. For instance, people acquire many of their desires and needs through learning to carry on the practices amid which they mature and as a facet of their doing so. What they want and need also obviously reflects the range of artifactual and natural objects they encounter. So desires and needs evolve coordinately with changes in practices and technological objects. Like desires and needs, moreover, the use of technological objects (for instance, a telephone) is embedded in the activities that compose practices; how telephones are used depends on the character of and connections among such contemporary communication activities as ordering take-out, maintaining privacy, keeping in touch with relatives, and avoiding telemarketers. At the same time, specific techniques develop for the use of technologies, and practices metamorphose in response to novel technologies. Activities and techniques change, as a result, as new technologies are introduced. Finally, just as new technologies must cohere with extant practices, even as they wreak transformations in these practices, they must cohere with extant material arrangements, even as they alter these arrangements.

What all this suggests is that technology is integrally woven with the nexuses of practice and materiality through which people coexist. It is not the case that technology is simply a means through which people pursue their desires and needs. This fact is further reflected in the fact that technology is not just an

16. C. Mitcham, *Thinking through Technology: The Path between Engineering and Philosophy* (Chicago: University of Chicago Press, 1994).

17. For example, J. O. Gasset, "Man the Technician," in *History as a System and Other Essays toward a Philosophy of History* (New York: W. W. Norton, 1941), 87-161.

instrumental feature of human life. Technological entities are sometimes produced to have symbolic or expressive value; prominent examples include flags and the Statue of Liberty. Noninstrumental practices (such as rituals) also sometimes develop around technological objects. A good example is the development of family rituals centered on television coincident with its mass introduction in the 1950s. Indeed, technological objects can be generally characterized as humanly produced material objects of value with which people engage. Winner has captured the interwovenness of life and technology by appropriating Wittgenstein's suggestive turn of phrase "form of life" and describing technology as a form of life.[18] Much the same idea is embodied in the neo-Heideggerian idea that objects—in this case, technological objects—can be "world-disclosing" or "world-building."[19] These two ways of thinking concur with the present account in rejecting any analysis of technology as mere instrumentality and in pointing out how technologies and human lives are mutually embedded, enabling, and determining.

One virtue of thinking about technology this way is that it facilitates recognition that technology is co-responsible for the oft-noted fact that, over time, humans have increasingly lived in artifactual, as opposed to natural, settings. Once homo sapiens, or their predecessors, became cognizant of the intentional intervention in, manipulation of, and transformation of entities, including themselves, this self-consciousness spawned endless further attempts to alter the world. This process inevitably led to transformations, at first, of the artifactual dimensions of natural objects and, subsequently, of artifacts. It also led to practices' ever-increasing dependence on, connection with, and centeredness upon technology. Indeed, once human practices began to be dependent on, connected with, and centered on technology, the perpetuation of and intensification of this situation was inevitable. I do not mean that technology "determined" that this complex relationship would be perpetuated and intensified, or that technology has slowly formed, Ellul-like, an inescapable system that today dictates human life. I mean simply that any increase in technology is coordinated with changes in the practices and material arrangements of social life, which state of affairs then forms a starting point for, first, the development and introduction of new technologies, and, second, the emergence of coordinated changes in practices and arrangements, which state of affairs then forms a starting point for subsequent change, and so on. This process is one of increasing technologization, where by "technologization" I primarily mean, not that humans surround themselves with more technological objects (this is not always true), but that their lives become increasingly dependent on, bound up with, and even centered on such objects. Incidentally, the process of increasing technologization is not necessary or unchangeable. However, the instrumental character of technology, together with the mutual embeddedness and course of technology and practices,

18. L. Winner, *The Whale and the Reactor: A Search for Limits in an Age of High Technology* (Chicago: University of Chicago Press, 1986).

19. M. Heidegger, "Building Dwelling Thinking," in *Poetry, Language, Thought*, transl. A. Hofstadter (New York: Harper, 1971), 143-162; cf. A. Davison, *Technology and the Contested Meanings of Sustainability* (Albany: State University of New York Press, 2001).

makes the process—once technology has appeared—self-generating, and thus inevitable, unless something intervenes. It follows that a prominent feature of history understood as the realm and course of past practice–arrangement nexuses is the self-organizing and self-propelling increasing technologization of these nexuses (except in places where something prevents this).

Wittgensteinian forms of life and neo-Heideggerian worlds are not affairs of humans and technology alone. Nature, as conceived in this essay, is part of them. Consequently, a form of life is not just a *social* form of life, as in Winner, but a *socionatural* form of life.[20] This fact underwrites the realization that technology, *pace* the usual conception, is not just something that mediates humans (or society) and nature.[21] To begin with, technological objects either are alterations of natural things, transformations of natural things into artifacts, or reworkings of artifacts already derived from nature. In all cases, the materiality of technology is part of the pervasive physiochemical stratum that embraces everything separated as either social or natural. In Mitcham's words, "Technology . . . include[s] all humanly fabricated material artifacts whose function depends on a specific materiality as such."[22] One implication of this fact is that history, as a process of increasing technologization, *eo ipso* embraces changing configurations of nature. The introduction of atomic energy into the fossil fuel economy, for instance, encompassed changes in configurations of nature that reflected the new technical and material requirements of building and maintaining nuclear power plants and of deriving energy from fission. A new set of natural entities and processes therewith became part of history. Indeed, so linked are practices, technologies, and nature in history that the introduction of new practices usually brings with it new technologies and changed configurations of nature, just as the introduction of new technologies transforms practices and reconfigures nature in history, and encounters with new natural phenomena (for example, viruses, nuclear fission) lead to changes in practices and technologies.

Consequently, contrary to the standard picture (according to which technology mediates humans [or society] and nature), humans mediate nature and technology, and nature mediates humans and technology, just as much as technology mediates humans and nature. A nuclear power plant is a technological set-up that produces electricity by enabling fission and other physical processes to occur by relying on a variety of other physical properties and processes in both allowing the first group of processes to occur and appropriating their products. All of this, however, is a human set-up and is mediated by human activity and coexistence. In this case, consequently, humans (society) mediate nature and technology. At the same time, the construction, operation, and maintenance of this set-up depends on, and is effected through, a range of physical properties of and processes concerning building materials, control panels, fuel rods, communications systems, and human bodies. In this way, nature mediates humans (society)

20. Cf. R. Levins and Y. Haila, *Humanity and Nature* (London: Pluto, 1992).

21. À la, for example Karl Marx, *The German Ideology* (New York: International, 1970); L. White, "Energy and the Evolution of Culture," in his *The Science of Culture* (New York: Farrar, Straus, and Giroux, 1949), 363-393; and D. Rothenberg, *Hand's End: Technology and the Limits of Nature* (Berkeley: University of California Press, 1992).

22. Mitcham, *Thinking Through Technology*, 161.

and technology. More broadly, in fact, any use and deployment of technology, or more neutrally, any interface of humans and technology, occurs by way of the physicality of that interface: the interlocking of the physical system of the body, the physical structures of the technologies involved, and those of any instruments people use in constructing, working on, or operating this technology. Regardless of the extent to which these systems are the products of human design and intention, design and intention shape only so much of them, and nature is found wherever design and intentionality end. Finally, technology, as the standard picture has it, does indeed mediate humans (or society) and nature. Not only is human intervention into nature effected through technological objects, but technological set-ups shield humans from known natural processes and, more generally, are themselves socially transformed states of nature.

Broadly speaking, technology is a way humans manage the social site, a way they tend to the practices and arrangements, including the artifacts and natural things, that compose it. As indicated, technology accomplishes this task largely by appropriating or reworking nature, drawing it into human practices and arrangements and subsequently transforming its incorporations there (think of energy sources, the material inertia and forces involved in building foundations or axe heads, and new chemical substances). In this way, technology is essential to the socionatural changes that characterize the movement of human history qua socionatural history: the changing configurations of nature (for example, crop patterns), as well as the changing relationship of these configurations to human practice (such as the relationship of these patterns to sowing and harvesting practices), that mark human history as a socionatural history, are intimately tied to technological developments (such as the introduction of plows, irrigation systems, and mechanized farm equipment). More expansively, technology, society, and nature are so bound together in and *as* history that change in any one of them—in available technology; in human practices; in encountered, learned about, or incorporated nature—generally results in a simultaneous transformation in the other two, and in the relationships among all three of them: in an evolution or redeployment of technological objects, a metamorphosis of practices, a change in the types and configurations of natures that are part of society, and a reworking in the ways these elements relate to one another. Hence, just as technology is bound up with changes in the socionatural particulars of history, these changes usher in further historical technologization. Safety issues arising from the mesh between practices and configurations of nature in the coal industry, for instance, led to the introduction of new technologies and increasing reliance on them. The increasing technologization of the social site whose metamorphosis is history is tied to changes in the socionatural composition of that site.

In sum, conceiving of social life as inherently transpiring in nexuses of practice and material arrangement brings with it an altered conception of history. No longer simply the course of human activity and its products, including technology, against the backdrop of a nature separate from it, history now becomes, more broadly, the realm and course of self-organizationally technologizing socionatural nexuses of practice and materiality.

University of Kentucky