

Heidegger, Marcuse and the Critique of Technology

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Criticism of technology is nothing new. We hear it constantly. Technology is poisoning us, making us fat, wasting our time, spying on us, and depriving our children of an education. This kind of popular critique of technology has a long history and roots in much more serious concerns about modern society. The 20th century is, after all, the century of total warfare, of genocide, and the invention of what may be the most powerful propaganda machine in history, namely, American television. In the course of this century many important thinkers questioned the idea of progress. Among these thinkers Heidegger and Marcuse are especially interesting.

It is not easy to recapture the potent force of their criticism in an environment in which many of their ideas have become clichés. Their complex philosophical language makes the task still more difficult. Both Heidegger and Marcuse believe that the question of technology concerns not merely the social problems they criticize but the very nature of the rational and the real. In order to break through the fog surrounding their ideas I will begin by reconstructing in simpler terms some of the background to their theories. This background concerns three essential aspects of social life: culture, technology, and craft. I do not pretend to present an elaborated “theory” here, but I do want to provide enough of a sketch of one to facilitate the interpretation of these difficult thinkers. This explanation of their work would almost certainly meet their disapproval but I believe it is useful for gaining initial entry to the theoretical domain they open for us.

Culture supplies the meanings things take on as they enter the social world. But culture is not merely attributed to things. It is also present in everything we do. It is culture that distinguishes our actions from natural events by making it possible for ourselves and others to “read” our meaning and purpose. In another sense culture bears a significant resemblance to nature. Indeed, culture is what we take for nature, the usually unquestioned and unquestionable premises of our thinking, acting, and speaking. For the most part we operate on the basis of these premises without formulating them consciously.

Cultural assumptions are more stable and widely shared than mere matters of opinion. But they too can be called into question although always against a background of other assumptions that are not thematized and challenged. Culture evolves but generally not through direct challenge so much as through gradual changes in practices and taste of which people are scarcely aware at the time. Culture is more or less securely armored against challenge and change depending on the nature of the social system. A stable and isolated tribal society is more likely to preserve its culture than a rapidly changing modern society in global contact with other modern societies. As a consequence culture is far easier to question, hence far less “cultural” under modern conditions. Its weakened hold is due to the impact of technology.

In common usage, premodern “craft” is contrasted with modern “technology.” Both are ways of making artifacts using tools, but they differ in the scale of their activities and their cognitive basis. Craft employs hand tools in small workshops whereas modern technology operates at huge scales and has correspondingly huge impacts on nature and society. Traditional crafts serve and express their culture, while our technology is in constant motion, disrupting social institutions and destabilizing cultural life. The difference is in large part a function of the application of scientific and engineering knowledge to which craftsman did not have access in the past.

While important, these distinctions miss the most basic difference: the cultural roles of technology and craft. What distinguishes technology most fundamentally is the differentiation of technical activity from other types of social activity. Specifically, technical knowledge is separated out from the prevailing aesthetic and ethical values. The separateness of these categories seems obvious to us. We do not expect technical know-how to involve artistic creativity, or building things to involve ethics. But in craft they form a single complex. The craftsman knows the “right way” to make things and this involves realizing the essence of the artifact in the appropriate materials. Technical knowledge and skill are required but aesthetic and ethical principles also contribute to the outcome. Without their contribution it is impossible to specify a culturally acceptable artifact. Considerations such as beauty are thus not conceived as subjective values in the head of the craftsman but as objective facts about the world, like other culturally secured beliefs.

The notion of differentiation that enables us to formulate our difference from this pre-modern worldview was introduced by Max Weber. Weber observed the tendency of modern societies to separate functions that were united in earlier times. For example, offices and persons are no longer indissolubly linked in a modern civil service. No longer are social functions inherited, but instead positions are “filled” by qualified personnel. Modernity involves the generalization of such distinctions. Differentiation is more or less complete depending on the domain. For example, the separation of offices and persons is considerably more effective than the separation of business and government.

The differentiation of knowledge of nature from other cultural spheres leads to the development of modern science, based on rational procedures and experiment and validated by an expert community. Under this dispensation science achieves considerable independence of other social institutions. Something similar happens to technical know-how. It is gradually formalized in technical disciplines that resemble and are enriched by science. This gives the illusion that technology is just as autonomous as science, but in fact technology is far less differentiated. All technical activity is deeply marked by culture and this is just as true of modern technology as of the crafts of premodern societies. But the mark of culture on technology is much harder to identify, at least for us who belong to the modern world.

In the first place, the cultural context shows up in design. Since modern design emphasizes function and functions appear self-evident to us, it is easy to overlook its dependence on culture. But cultural limitations become obvious when devices are transferred to alien cultures, for example, when a computer with a Roman keyboard is exported to

China or Japan where the language cannot be represented easily by our alphabet. The necessity of adaptation testifies to the cultural relativity of Western computer design.

But there is a more paradoxical way in which modern technology depends on culture: its so-called “value freedom.” We take it for granted that technologies are merely efficient means serving functional goals. Separated from values, technology appears to be a product of pure rationality. But this appearance is illusory. Value freedom is a tendentious way of signifying the differentiation of technology from the ethical and aesthetic values that restricted it to culturally secured designs and goals in premodern societies. As such, technology is available for any use whatsoever.

Modern technology falls under the formal norm of efficiency, but efficiency does not determine the particulars of design and use. Liberated from such particulars, technology can be designed to serve temporary and shifting purposes. This suits it for employment by organizations, another cultural constant of modernity. Like technologies, organizations are generally defined by rather narrow formal goals such as profitability. These goals are no more able than efficiency to determine any particular outcome of production. For that, the leaders of organizations must rely on their understanding of the market and their interpretation of legal and administrative rules. In the absence of specific cultural direction, these considerations decide what to make and how to make it. In so far as such decisions lack a stable basis in the culture, technology pursues ends that appear more or less arbitrary. This strange cultural void is itself the culture of technology we hardly question.

To us it appears universal but it is not compatible with most cultures, but uniquely with ours. This is clear, for instance, from Lauriston Sharp’s account of the effects of the distribution of steel axes by missionaries in an Aboriginal community in Australia. The community prized the stone axes made by its adult male members. These axes were not available as pure means in our sense but were bound up with various rituals of ownership and use. Men alone were authorized by the traditions of the tribe to own and loan out the axes to women and children for their customary tasks. When missionaries distributed steel axes to anyone who helped with the work of the mission, this system broke down. The social hierarchy, the trade and social relations, even the cosmology of the tribe collapsed and its members were demoralized. Thus replacing a product of craft by a modern technology implied a profound cultural change and not merely an increase in efficiency.

But is this a problem for us as well? The criticism of technology to which we are accustomed generally focuses on the use of technology to achieve particular ends of which we disapprove. We would like to reform the organizations that command the technology and make them serve public purposes. Social movements and state regulation aim to achieve this. But the philosophical critique of technology goes considerably further. Although philosophers do not generally use my sociological terminology, they identify what I have called “differentiation” as the problem to be addressed.

In so far as the differentiation of technology belongs essentially to modern culture, this criticism appears strange. Can it be that the philosophers want us to return to the pre-modern past? Yet the reason for their general discontent is not so hard to understand. Modern societies are fraught with meaninglessness, manipulation, and rationalized violence. Dystopia and Apocalypse beckon as surveillance and nuclear technologies advance. The long run survival of modern society is very much in doubt. Could it be that our technology, or at least, the way in which we are technological, threatens us with early self-destruction? This is the question of the radical critique of technology.

This question provokes many others in turn. We would like to know what it is about differentiated technology that leads to such disastrous consequences. After all, many good things flow from technological advance as well. Why is the issue not simply the bad uses to which technology is put? Why is a total critique necessary? If the radical critics do not want to give up the fruits of modern technology, what is their alternative? For example, might criticisms of specific technologies be combined in some package that addresses the larger issues raised by the critique? If not is there some other escape from technological disaster? In what follows I will address these questions through a presentation of some of the basic ideas on technology of Heidegger and Marcuse.

Heidegger's critique of technology is ontological, not sociological. This ontology is so contrary to common sense that it is very difficult to understand. We tend to think that reality is "out there" while our consciousness is an inner domain that gains access to things through the senses. Heidegger rejects this model. He invents his own vocabulary in which terms such as revealing, disclosure, Dasein, and world substitute for concepts such as perception and consciousness, culture and nature.

As Heidegger explains it, our most basic relation to reality is not perception as we usually understand it. That is a theoretical construction. Abstracting from our actual experience, we tell ourselves about such things as light rays entering the eye and activating the retina, sound waves causing vibrations in our ear drums, and so on. But we originally encounter our world not through causal interaction between nature and the senses, but rather through action directed at meaningful objects. These primordial encounters later become objects of reflection, but Heidegger rejects the notion that we can explain them in a philosophically significant sense from that standpoint. Instead, we need to start out from what is first, our actual experience, and treat it as an irreducible ontological basis.

Heidegger argues that the subject of action is not consciousness or the mind, but what he calls Dasein, a German word that can refer to human being. It is our whole self that engages with reality, not a specialized mental function. Heidegger calls the things Dasein encounters in action, "ready-to-hand." This locution refers to the way in which they are given in that specific aspect by which they can be used. His examples are tools which we encounter in use through grasping them and setting them to work. In this context we do not focus on the objective properties of tools but rather on the correct way to handle them.

Dasein is essentially “in” a world of ready-to-hand things. By world Heidegger means something like what we refer to metaphorically as “the world of the theater” or “the Greek world.” Such worlds are contingent on human concerns without being subjective. They are an aspect of what truly is as revealed from a perspective. Perspectives open aspects of reality to view while concealing other aspects. They are not so much creative as disclosive and what they disclose is a meaningful complex of some sort. The world is a network of ready-to-hand things in a system of such meanings.

While Heidegger would certainly reject the concept of culture introduced above, it is helpful for understanding this concept of meaning. A hammer is a hammer only insofar as it is culturally signified as such. Outside of any cultural context, it is just an oddly shaped piece of metal and wood. Thus the meaning of the hammer is in fact constitutive of its being a hammer. This is obvious in the case of paper money. A hundred dollar bill is only worth a hundred dollars because the meaning of money is culturally established. Even a legal definition of the bill would fail if we did not understand the money as money. Heidegger employs a parallel argument in an ontological account of the objects of experience. On this account what is usually called culture—shared meanings—is not merely a coincidence of subjective states but founds a world.

These are some of the concepts with which Heidegger approaches the contrast between craft and modern technology. He takes Greek *techne* as his model of craft. This is an undifferentiated technology that binds aesthetic and ethical values to technical considerations. The meanings that underlie it are fixed by the culture so securely they cannot be modified or questioned. These meanings are not strictly functional in our modern sense but include other elements. The Greeks invented a philosophical terminology in which to refer to the complex meaning in which all these considerations are united, calling it the “*eidos*” or “essence” of the thing.

We tend to think of the concept of essence as prescientific, but our artifacts too are often richly signified in much the same way. For example, a house is also a home. Along with the functional good of shelter, it provides welcome and privacy, a locus for the rituals of family life, and a testimony to the taste of the owner. Technological thinking isolates function as essential and this attitude is confirmed by the fact that function can be specified in a technical discipline. It appears to be a separate thing, an infrastructure to which superstructural evaluative associations are attached. The resulting abstraction is substituted for the whole in an ontological synecdoche characteristic of modernity.

In his discussion of the Greeks, Heidegger explains the unified structure of essence in terms of the four causes of Aristotle, the final, formal, material, and efficient cause. The final cause is the purpose of the artifact. Its formal cause is the shape it must assume in the course of production. The material cause is the raw materials. And the efficient cause is the activity of the craftsman who makes the artifact. Together they define the work of craft.

This sounds quite commonplace, but, Heidegger claims, we think so only because we misunderstand it on modern terms. He insists that the efficient cause is not a cause in

our modern sense at all. The craftsman does not make the object in accordance with his intentions in a relation of cause and effect as modern common sense would have it. Rather the craftsman "gathers" the other three causes and thereby "brings forth" the object of his actions. Craft, Heidegger argues, is a way in which things become what they truly are.

What does this rather obscure complication of Aristotle's apparently simple theory really mean? To understand Heidegger's answer to this question, we must shift our focus. As we have seen, for Heidegger, what things are, their essence, consists first and foremost in their meaning. Heidegger thus insists that we view technical making primarily as the realization of a meaning in an artifact. On this account, everything is what it is through conforming with its purpose and form.

This way of thinking about productive activity leads to paradoxical results, at least so they seem to us. What the material becomes at the hands of the craftsman is not arbitrary but corresponds to a destiny inscribed in its very nature. Heidegger writes, for example, that for the Greeks the potter's clay takes on form under his hands but more significantly, it loses its formlessness. It is as though the clay achieves its true end in becoming a pot. In sum, for the Greeks craft does not create through causal interaction with materials as does modern technology but reveals things which nature unaided cannot bring into the world.

This conception of craft conforms with an old story about Michelangelo. When asked how he made his statue of David, he replied, "I just cut away everything that wasn't David." We feel this to be paradoxical since it presupposes the existence of the statue prior to its actual production, but something like that describes Heidegger's version of the Greek worldview. Like the statue of David, essences in Heidegger's interpretation of the Greeks, are realized not so much through a positive act of production as through the exclusion of the inessential, of that which deviates from the essential nature of the thing awaiting realization. Hence the concept of essence can be thought of as a limit, *peras* in Greek, which specifies the thing among the infinite possibilities available. The Greek view of nature was teleological and attributed essences in this sense not just to artifacts but to nature as well. The cosmos was an order created from a primordial chaos by limitation.

Heidegger contrasts this Greek understanding of making with our modern technology. Technology too is a mode of revealing, but it does not reveal things in their essential nature. Instead what is revealed is a world of resources and components. The meaning of modern artifacts is simply their functional connection to other artifacts in a system of production and consumption. Heidegger calls this system the "enframing" of being. It is not confined to things but encompasses human beings as well. Humans become mechanical parts in systems that surpass them and assign them their function. They begin to interpret themselves as a special type of machine. The proliferation of operating manuals for every aspect of human life from childrearing to divorce to career choices to exercise testifies to the enframing of the human. The role of humans in the revealing of

being is occluded. We no longer wonder at the meaningfulness of things. The system appears autonomous and unstoppable. This is a Brave New World.

Heidegger's critique of modern technology does not address any particular technology. Its object is the technological revealing that stems from the modern ambition to dominate all of being. Heidegger argues that this technological impulse is prior to science, by which he means that viewing the world as an object of domination is a condition for understanding it in modern scientific terms. Why? Because technological thinking eliminates the essences that preceded modern science and reduces meaning to function. New cognitive paths are opened when the making of artifacts is so reduced and differentiated from other dimensions of the culture. With the elimination of teleology and ritual significance, nature is available for analysis and quantification and a modern mathematical and experimental science is finally possible.

Although his criticism of technoscience is harsh, Heidegger does not propose a return to the Greek worldview. He recognizes the validity of modern science but challenges its forgetfulness of another order of truth, the truth of revealing. But if regression is not the solution is there another way to get beyond the technological era? An active attempt to do so, Heidegger claims, would just be more of the same, more technology. He hints at the possibility of renewing the power of art to transform the world and suggests that the very extremity of the disaster into which technology is leading us might inspire a change. In his last interview he seems to despair, saying, "Only a god can save us."

While Heidegger ended up in despair, his student Marcuse found reason to hope. Marcuse was a Marxist and so offered a social explanation for the evolution from craft to technology that Heidegger had explained as an ontological destiny. Marcuse takes over much of Heidegger's analysis of ancient Greek thought. Although he does not employ Heidegger's terminology, he has a similar view of the role of meaning in defining a world. And he agrees with Heidegger that the Greek idea of making was based on a specific notion of meaning as essence.

But whereas Heidegger emphasizes the ritual aspect of Greek essence, Marcuse identifies essence with potentiality. When Aristotle claims that "Man is a rational animal," he defines what a human being can be at his or her best, not the common condition. In this version of the Greek worldview, being has two dimensions, a first empirical dimension, the objects as they are given in experience, and a second essential dimension of ideal form. The tension between the two dimensions is a permanent feature of existence. Things exist and develop in time, striving toward their essential nature. Our understanding of that striving depends on the imaginative grasp of what things can become. It cannot be limited to empirical observation of what they already are.

Of course Marcuse recognizes that the imagination is conditioned by culture, and in the Greek case this set limits to the potentialities of women and slaves we can easily transcend. However, the idea of potentiality survives the discovery of these limitations and is still vital to understanding the modern world. Without it there can be no critical reason.

And this is precisely the problem today. By contrast with this Greek conception, technological rationality reduces everything to a single dimension. The higher world of essences collapses into everyday existence. According to Marcuse one-dimensionality characterizes modern societies increasingly as they advance. Scientism leads to a rejection of the imaginative relationship to reality in which essential truth is discovered. Without a transcendent reference the existing society becomes the horizon of all possible progress. Everywhere the tensions between the two dimensions are redefined as technical problems to which solutions are available on the terms of the given system. Democracy, for example, is defined by the existing institutions and is not held up as an ideal against which to measure them in view of improving them. The one-dimensional society resembles Heidegger's enframed world in so far as it appears as a closed system of technical action that excludes any fundamental change from within.

This system, according to Marcuse, has its origins in capitalism. Capitalist enterprise crushes the autonomous development of its human and natural materials in order to extract the maximum profit from them. The system that evolves out of these origins is essentially alienated whether it takes a capitalist or communist form. It is a system of technocratic domination that manipulates the underlying population ruthlessly through propaganda and consumerism. As they are absorbed into the large scale organizations that run a modern society, the individuals' very survival depends more and more on unthinking conformism.

But there is a deeper issue. Like Heidegger, Marcuse asserts the intrinsic complicity of modern scientific-technical rationality with domination. He formulates the problem in terms of the notion of value neutrality. Technoscience is value-neutral in the sense that it posits no ends. Ends belong to the users and are subjective. This seems to mean that technoscience is innocent of its most terrible applications: "Guns don't kill people, people kill people." But Marcuse denies the innocence of science and technology. And indeed it is rather difficult to believe guns are entirely innocent, much less nuclear weapons.

He argues that neutrality as between the developmental potential of objects and arbitrary goals is not truly neutral. A rationality that cannot distinguish between the essential growth and development of human and natural beings and such narrow purposes as military power or profit lends itself to the capitalist project of domination. So-called neutral reason is in fact destined to serve those with the power to use it for their arbitrary ends. Its form is appropriate to their needs. In this sense its apparent neutrality is in fact a bias toward domination. This bias is made possible by the separation of productive activity and its rationality from the imagination.

Having posed the problems in this way, Marcuse believes he can find solutions that were closed to Heidegger. His emphasis on the complicity of technoscience with capitalism suggests the possibility of radical change in a socialist society. Marcuse believes that socialism could restore the second dimension. Its suppression was relatively rational under conditions of scarcity which could only be met by narrowing intelligence to the demands of the struggle for survival. But modern technology is rapidly abolishing scarcity.

The imagination can take on a productive role under these new conditions and contribute to realizing the second dimension in reality.

Marcuse provides us with answers to some of the questions I asked in the beginning of this paper. Attributing the problems of modernity to capitalism poses the challenge of technology at the social level. At that level we can connect specific problems such as the exploitation of workers or the pollution of the environment with a general alternative that would correct these and other still more fundamental failings of modern societies. This requires, according to Marcuse, a radical change in our understanding of rationality. A teleological rationality such as that of the Greeks expressed a life-affirming ethos and this showed up in the design of artifacts. This explains what it is about differentiated technology that leads to disaster. Once technical practice is no longer bound by essences nothing limits it to the service of life. Modern technoscience serves the interests of powerful organizations instead. This is not to say the Greeks were above pursuing evil ends with the tools at their disposal. The point is rather the structure of their culture which Marcuse contends was truly different and contains lessons for us. But what are these lessons?

Marcuse calls for a reunification of differentiated cultural spheres in a reformed scientific-technical rationality. Technology, aesthetics, and ethics must be brought together once again in a unified culture. He is especially concerned with the split between science and art. Art is the imaginative domain in which the second dimension is expressed most fully. Art idealizes the real and so conserves hopes denied by scarcity and oppression. Similarly, our conception of rationality must no longer focus exclusively on control but must respect the potentialities of its objects. But Marcuse also rejects the suggestion that we return to a qualitative physics, that is to say, to a premodern form of knowledge. Thus despite the suggestive results of his critique, its core conception remains vague. Without more to go on, we are left suspended between two possible formulations of his program.

On the one hand he might be calling for the creation of a totally new kind of rationality but this solution is unimaginable. If we could describe this rationality, we would already have created it and Marcuse could certainly explain it to us in detail. On the other hand he may intend something much more modest. Perhaps he meant that the focus and deployment of the existing scientific and technical knowledge might be changed in a new social context. This second solution is more plausible but it remains to be seen how it differs from a mere change in the use of technology of the sort which Heidegger and Marcuse dismiss as insufficiently critical. It would be disappointing to return after all these complexities to a common sense position requiring no such preliminaries. Indeed, according to their arguments, nothing fundamental would change if organizations still wielded neutral technology in the interests of arbitrary goals. Heidegger's pessimism would seem to be confirmed by such a meager upshot of Marcuse's version of the critique.

But perhaps there is another way to reformulate Marcuse's argument that he missed but that conforms loosely with his intent. I can only sketch this solution briefly here but I

want at least to hint at it to show that the path we have been following with Heidegger and Marcuse is not a dead end.

Both of these thinkers block the obvious solutions of the sort that lead to cultural dogmatism or New Age re-enchantment. They agree that we cannot return to pre-given essences of the sort that guided the Greeks. Tradition no longer has this force in modern societies and in any case culturally established essences would appear to us moderns as arbitrary restrictions on our freedom. Nor can we recreate lost meaning by an effort of will. That would simply reconfirm the technological enframing, making a technology of culture. A different model is needed which is neither premodern nor modern in the usual sense of the terms.

There must be sources in the world around us enabling us to imagine this model plausibly. I can suggest two such sources, medicine and ecology. I do not want to argue that they hold the solution to all the problems but rather that they give us hints of what a solution would look like were it able to root itself in a technoscientific culture.

Medicine does not conform to the pattern of neutral scientific-technical rationality. It combines knowledge and value in the concepts of health and healing. In this it exemplifies a relatively undifferentiated concept of reason. Healing implies realizing a potential of the organism. That potential is called health. Health is a state of the body which medicine cannot produce. It can only help internal forces within the body to develop in a positive direction. And it is significant that "do no harm" figures prominently in the Hippocratic oath. Once again we encounter the Greek *peras*, the concept of limit. Here it is related to the fact that the human body provides the criteria of medical action. It must be protected and preserved. Its integrity governs medical practice. In this medicine differs profoundly from technological projects based on breaking things down into raw materials and recombining them at will. Could something like this medical approach be generalized?

The emergence of ecology at the intersection of science and public concern suggests that this is possible. The science of ecology explains the many interdependencies of organisms in the environment, but it offers no reason to prefer one state of nature to another. The public purpose of ecology is the protection of nature within limits set by the well-being and survival of a wide variety of species and human beings. These two natures are not precisely the same. The nature of public policy is informed by science but it is the human environment as we experience and transform it. We are concerned with its beauty and "health" as well as with strictly scientific considerations. For example, the pollutants that most concern us are the ones dangerous for human beings, and the *pathos* of species extinction only touches us when the creatures in question are close biological relatives or possess qualities we find extraordinary. This is reasonable. To favor the development of a humanly livable environment should not be dismissed as mere egoism because humans share so much with other life forms that our survival and prospering inevitably favors that of many other species.

Environmental reform requires overcoming disciplinary barriers between sciences, communication barriers between ordinary people and experts, and the organizational independence of corporations and government agencies. All these forms of differentiation favor the destruction of the environment either through narrowness of conception, experience or goals. Biology must not be isolated from engineering. The opinions of citizens engaged with local problems such as waste disposal and pollution must not be ignored by the experts charged with responsibility for finding solutions. And business must not be allowed to profit from destruction of the environment but must respect the public good.

Connections must be made between these differentiated fragments. This is a task at many levels, cognitive, social, political. The aim is not to return to more primitive forms of knowledge and social relations but to mediate modern ones in a productive synthesis. This process must issue in practical decisions guided by the life requirements of some feature of the environment, for example, a river or species, the “health” of which is at issue. Its survival is contingent on overcoming the isolation of various specialized knowledges and narrow organizational goals. This amounts to the institutionalization of the concrete object as a criterion of knowledge and practice much as the requirements of the human body form the basis of medicine.

Were modern technology committed apriori to a vision of the good life based on the harmonious development of human beings and nature, the range of choice in design and goals would be restricted. It would no longer be value free. A life-affirming technology of this sort would be bound to a mission much as are medicine and ecology today. And like these fields it would have to work with the potentialities of its objects rather than dominating them to suit narrow extrinsic ends such as profit and power.

With these models we recover some aspects of the traditional concept of essence but not its cultural rigidity. The negative side of essence, the notion of limit, is secured by our knowledge of the limits of the human body and nature. This establishes the boundaries within which the creative activity of human making must go on. We may determine scientifically what *not* to do in order to save a forest or a coral reef, but science cannot tell us what to do with the resource thus liberated. Nor can tradition inform our decisions. In this we moderns are left on our own. We must decide what to do in terms of our imaginative sensitivity to the requirements of the good life. This is the precondition for freedom and the free development of human beings in history.

Heidegger and Marcuse proposed radical critiques of technology that go far beyond the clichés with which we are familiar. Their formulations open up a space for fruitful reflection even if we cannot find satisfactory solutions in their work. That task is left to us. We have an advantage: a far richer experience of technical politics than was available to these precursors. Perhaps out of this experience constructive responses will come to the challenges to modernity they raised so provocatively.