TECHNOLOGY AS A FORM OF CONSCIOUSNESS: A STUDY OF CONTEMPORARY ETHOS

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A GROWING interest in the rhetoric of science has led to work on the forms of scientific arguments, on the nature of the community within which scientific discourse takes place, and on the values which establish the conditions necessary for doing science. However, little work has been done which distinguishes the rhetoric of science from that of technology. It is true that modern science and technology are intertwined and greatly dependent on each other. But they are distinct activities—arising from distinct motivations, judged by distinct criteria, and requiring distinct sets of values. Rhetorical analysis which recognizes this distinction is potentially more penetrating, more accurate, and more helpful as criticism.

Technology can be provisionally defined as the manipulation of the contingent and local to achieve material results, to distinguish it from science as the study of the universal to achieve verifiable understanding. Technological results are judged as more or less effective; scientific understanding is judged as more or less verified (in other words, more or less agreed upon).[1] Seen thus, science and technology bear different relations to the study of rhetoric. The rhetorical character of science is dependent upon the abstracting and symbolizing inherent in human knowledge and upon the communication necessary to achieve verification. In technology, these two conditions are not primary. Because technology is not fundamentally a matter of knowing but a matter of doing, its rhetorical consequences may be found by looking closely at the activities or actions we understand as "technological." Action is a primary shaper of mental character, and customary, collective action is a shaper of cultural character. Character shows itself in discourse as *ethos*, our understanding of personal character as interpreted against a cultural set of possibilities. Ethos, as a disposition[2] which, when held in common, comes to seem "right" or "ethical" or persuasive, is an index of culture. Our technological culture should be expected to give rise to an ethos of technology.

Action can be understood as a connection between internal intention and external intransigence. A person learns to manipulate this intransigence to accomplish his or her intentions. Piaget's genetic epistemology suggests that it is through such manipulations that concepts are formed. The human mind de-

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[1] For a collection of attempts to define technology and to distinguish it from science, see *Philosophy and Technology: Readings in the Philosophical Problems of Technology*, ed. Carl Mitcham and Robert Mackey (New York: The Free Press, 1972).

[2] Lane Cooper's gloss; see his "Introduction" to *The Rhetoric of Aristotle* (Englewood Cliffs, N.J.: Prentice-Hall, 1932), pp. xxii-xxiii.

velops its features, its character, in interaction with the external world. Character then serves as a predisposition to further actions. Aristotle said much the same thing: "Character is manifested in choice; and choice is related to the end or aim."[3] Choice, character, and ethos are here seen as rooted in consciousness, which has been built from action. The actions an infant performs in learning eye-hand coordination, the actions a potter goes through in perfecting a bowl, and the actions an engineer performs in designing a highway—all have their inevitable repercussions on consciousness and ultimately on discourse.

Interpreting action, which is the main task in this approach to ethos, requires some understanding of the purposes which inform action; it requires an ability to share the consciousness which makes the action reasonable. It requires, as von Wright put it, acquaintance with "a community of institutions and practices and technological equipment into which one has been introduced by learning and training. One could perhaps call it a life-community."[4] A life-community —or a culture. In this way, action is related to both the personal formation of mental character and the collective development of cultural character. "Mind," as the anthropologist Edward Hall has observed, "is internalized culture."[5]

The concept of ethos stands neatly between individual character as shaped by action and cultural character as determined by a complex of interacting systems, one of them being that culture's technology. To probe the rhetorical nature of technology, then, this essay will examine the ways in which technological activity both reflects and shapes forms of thought, and in this way approach the rhetorical dimension of ethos. In studying the ethos, or character, of technology, we will inquire after the aims and methods of technology; we will examine the products of technology for the reasons that explain their existence, that is, for the character of the choices or the forms of consciousness[6] that they presuppose.

A preliminary distinction will be helpful in separating universal features of technology from culturally dependent ones. Hall discusses technology as "extensions," which permit the human species to solve problems and to evolve without changing biologically. Primitive tools are perhaps the earliest extensions. Tools assist in our interference with the external world; they extend the immediate biological capabilities. Almost simultaneously, however, comes the need to manipulate the tools themselves, to improve the tools, to make a tool to make tools. The stone axe can be sharpened, the shape improved, a handle attached; additional supplementary tools are sought, created, and begin evolving themselves. According to Hall, once human extensions (tools, language, institutions) begin evolving, a phenomenon called "extension transference" begins. The extensions seem to take on purposes of their own; they become distant from the original human capability they first extended and advance at the expense of that capability. Habits of behavior, institutions, further technology, and ways of talking and thinking get built up around the original extension. Hall thus

[3] *The Rhetoric of Aristotle*, ed. Lane Cooper, bk. I, ch. 8.

[4] Georg Henrik von Wright, *Explanation and Understanding* (Ithaca, N.Y.: Cornell University Press, 1971), p. 114.

[5] *Beyond Culture* (Garden City, N.Y.: Doubleday Anchor Press, 1977), p. 192.

[6] I use this term as an internal counterpart to "form of life," which has come from late Wittgenstein through Toulmin and was recently used in Thomas S. Frentz and Thomas B. Farrell, "Language-Action: A Paradigm for Communication," *Quarterly Journal of Speech*, 62 (December 1976), 333-349.

distinguishes early, or "low-context," technology from later, more advanced, or "high-context" technology. What was flexible becomes rigid and difficult to change; the tool becomes an end in itself.

The same distinction has been put differently by Bertram Morris: he considers that the context of primitive technology is myth and the context of modern technology is ideology. Early tools and techniques are absorbed into the culture in which they are developed: "the artisans of a primitive society must appeal through myth and ritual to supernatural aid for the success of their practices."[7] As technological systems grow, however, they themselves become a major part of a culture's explanatory system; this is high-context technology. The system of action and conceptualization necessitated by tool-making takes over—it "scientizes" culture; this is ideology.[8]

Some have seen in the apparently relentless development of technology a force beyond human control. Jacques Ellul, for example, sees in "la technique" a self-generating autonomous force which controls civilization; "technique pursues its own course more and more independently of man."[9] Others see in this perspective an abdication of human responsibility for human creations. Samuel Florman's critique of the antitechnologists makes the point that tools are responses to human purposes, that "a basic human impulse precedes and underlies each technological development."[10] The distinction between low-context and high-context technology moderates this disagreement about the autonomy of technological development. If technology is not a demon with purposes of its own, neither are human purposes as simple as they once were. They have become complicated by tools and machines. People have not only their own needs to satisfy but those of their tools: production, maintenance, improvement, coordination. High-context technology comes to seem relentless, inevitable. It is so significant a part of our culture, of social reality, that it fundamentally affects the ways we think and speak and write; it affects, inevitably, what we believe to be ethical.

The following two sections identify several specific features of consciousness which can be traced to technological forms of action. Some aspects of this "technological consciousness" are general ones—caused by the intervention of technology between human intention and the external world, and characteristic of low-context technology. Other aspects are peculiar to the high technology of Western society in the twentieth century—characteristic of the way high-context technology has developed.

I

Hall has suggested two characteristics of technology in general. One, already mentioned above, is that technological developments begin as means and become ends, as extension transference absorbs them into the culture. This transformation leads us to believe in technological inevitability, which in turn strengthens and validates the transformation. The second characteristic is that, as we change from needing to manipulate the external world to needing to manipulate our tools, the tools come to seem less like extensions of our-

[7] "The Context of Technology," *Technology and Culture,* 18 (July 1977), 402.

[8] Morris's use of "ideology" seems identical with that of Jürgen Habermas, "Technology and Science as 'Ideology,'" in *Toward a Rational Society,* trans. Jeremy S. Shapiro (Boston: Beacon Press, 1970), ch. 6.

[9] *The Technological Society* (New York: Alfred A. Knopf, 1964), p. 135.

[10] *The Existential Pleasures of Engineering* (New York: St. Martin's Press, 1976), p. 61.

selves and more like parts of the external world. We become alienated from our own creations; they become objects which must be controlled. We separate ourselves from our creations and lose something of ourselves in the process. Our capabilities, which the tools extend, become part of the external world and something which must be controlled. Purposes become external to human motivations and attach to the tools created by those motivations. This is the beginning of our belief in "objectivity," the belief that external reality is the only determining check on our knowledge of it. Objectivity serves both our need to control more and more of the world and our willingness to let machines embezzle purposes from us.

Tool-using induces yet another feature of mind. Von Wright has argued that action is essential for the development of the idea of cause and effect. Action is the bringing about of a state of affairs that would not otherwise be. We establish a causal connection "when we have satisfied ourselves that, by manipulating one factor, we can achieve or bring it about that the other is, or is not, there. We usually satisfy ourselves as to this by making experiments."[11] The actions of producing, manipulating, and modifying tools, which are meant to manipulate and modify other states of affairs in the world, promote linear, incremental, causal forms of thought.

Briefly, then, these are fundamental features of the character of *Homo faber*: the acceptance of means as ends and of the proliferation of these substitute ends; the relinquishment of purpose to the external world; a self-justifying objectivity; and linear, cause-and-effect reasoning. These are not novel observations about the ways we think and talk; what is important here is the way in which these familiar features can be ultimatey attributed to the technological impulse and the degree to which that impulse is central to human nature.

II

A second aspect of this inquiry is to look at the features of technology which are characteristic of our own high-context technology. What effects do the increased complexity of technology and its increased penetration of our entire culture have on our modes of thought? I will be able to make only a few preliminary suggestions, for the subject is both wide and deep.

One of the primary differences between primitive and modern technology, according to Morris, is the development of tools into machines. Tools are literal extensions of the human body—they "are fashioned to unite man and object." Machines, on the other hand, insert themselves between the person and the object. The person's "direct relation is to the machine, that is to its controls, which in turn regulate its moving parts. Thus, the relation between him and the product is not directly felt and indeed is better understood through the intellect than through the feelings."[12] Machines increase the distance between the human purpose and the external accomplishment of it—continuing and exacerbating the modes of thinking we have already noted. But the difference between low- and high-context technology is more than one of degree.

As contexts have become more rigid and the layers of control more complex, individual people become less competent to manage technology, even single tools. We no longer make our own tools, and few of us can maintain and repair them. Machines are made by or-

[11] Von Wright, p. 72.

[12] Morris, p. 411.

ganizations, on assembly lines, and are used by groups. Technological extensions thus become more and more distant from personal intentions and actions. Responsibility for design, construction, and use is diffused to the group. Consequently, the group or organization must also be controlled so as to serve the machines which are serving collective purposes. The group becomes another extension, itself a "machine tool." Organized intelligence, as Galbraith has said, is the important resource in technological society.[13] That organization costs something. Time, money, and energy must be closely husbanded to offset the costs of control and integration. High technology thus promotes efficiency, an interest in minimal routes between means and ends. Daniel Bell has called this the technological imperative, and Wylie Sypher the "dread of waste."[14] In Ellul's extreme view, the principle of efficiency has escaped from machinery to pervade all of Western culture.

We have, then, two related phenomena: the goal of efficiency and the absorption of the individual person into the corporate group. The desire for efficiency makes the integrating qualities of large organizations seem useful; the requirements of complex organizations make efficiency seem essential. The character of modern technological thought is closely bound up with its nurturance in the corporation and the bureaucracy. Because group requirements take precedence over individual intention, organizational psychology and studies of corporate character become relevant to the study of the technological ethos.[15] High technology requires these large organizations, and many of their pressures contribute to what we recognize as aspects of contemporary character: conformity, authoritarianism, competition, depersonalization.

The goal of efficiency and the ascendancy of the organization are compatible with another feature of contemporary technological consciousness. This is the tendency to conceive of the world as a closed system. The need to predict and control aspects of the material world which are being manipulated leads to the belief that the entire relevant world has been accounted for. Once it has, the solving of problems is a matter of calculation, of mechanical procedure. This aspect of technological thinking is clearly exhibited in the example of computer problem solving, discussed in Joseph Weizenbaum's *Computer Power and Human Reason*.[16] The process of machine computation becomes a model for the ethos of technology.

A machine requires an algorithm, or "effective procedure," to do its task. The algorithm is a complete and consistant set of rules which tells the machine precisely how to behave from one moment to the next. If we wish a computing machine to solve a problem, we must be able to provide it a set of rules for doing so, and to do that, obviously, we need to understand the problem. To achieve this kind of understanding, to make the set of rules complete and consistent, the context in which the problem exists must be conceived of as closed—circumscribed and enumerable, and therefore describable in terms of definitions and operations. If we wish to tell

[13] *The New Industrial State*, 2nd ed. (Boston: Houghton-Mifflin, 1971).

[14] *Literature and Technology: The Alien Vision* (New York: Random House, 1968), p. 6.

[15] Two recent and widely noted works of this type are Michael Maccoby, *The Gamesman: The New Corporate Leaders* (New York: Simon and Schuster, 1977) and Rosabeth Moss Kanger, *Men and Women of the Corporation* (New York: Basic Books, 1977).

[16] *Computer Power and Human Reason: From Judgment to Calculation* (San Francisco: W. H. Freeman, 1976).

a machine how to solve a problem, we must understand the problem in these kinds of terms. The hasty conclusion has been that if we understand a problem at all, we can tell a machine how to solve it. We have been led to define understanding, as Weizenbaum points out, as being able to write an effective procedure for.

This seems to me to be an important feature of modern technological thinking. It is, basically, the substitution of closed-system logic for open-system reason. In a low-context technology, the tool is open to the pragmatic test; success and failures are explained by reference to external cultural terms, like witchcraft or myth.[17] In this sense, the technical system is open. In high-context technology, the technical system expands, but the explanatory system contracts. The pragmatic test does not so much match the artifact or method against the cultural conception of reality but reality against the technology. Obviously, if a bridge falls down, it has still failed the pragmatic test, but our understanding of the failure is different—it is ideological. We explain in terms of the technology itself, rather than by reference to external terms. We close the system.

In a complex technology, made rigid by its supporting context, it is easier to conceptually change reality than it is to rebuild the technical system. We do not consciously and deliberately change reality (we cannot will the bridge to hold when it won't); rather, we abdicate our understanding of reality to the terms of the technical system. A computing system, for example, will permit the asking of only certain kinds of questions, will accept only certain kinds of "data," and has a set of fixed (and often forgotten) criteria. Likewise, the engineer conceives of a limited range of relevant questions. The highway engineer, for instance, has learned to ask and answer questions such as how to calculate the angles and curves for an interchange, how to route an interstate highway through hilly terrain, and even how to determine minimum social impact of a route through an established neighborhood. He or she does not ask questions or seek answers about whether a bus system or bicycle paths or a change in commerce or tax structures might better serve whatever transportation problem is being dealt with.

Although the engineer works in the open system of the natural world, while the computer programmer works in a closed system which is artificial, the engineer has come to think like the programmer because his technique calls for efficiency first. The bureaucracy does not have time for research, for trial and error, for invention: it pressures the engineer for material results. The engineer is no longer a craftsman who is tested by his materials at every step. The complexity of the conceptual systems and the organizations within the engineer works shield him or her from the experimental test. The engineer's job is to get answers, and you can be sure of getting answers and sure of the answers you get, only when you're working in a closed, "formal" system. Craft has been mathematized. Procedure has been bureaucratized. In a discussion of the role of nonverbal thought in technology, Eugene Ferguson has criticized engineering education and practices along these same lines:

> The Bay Area Rapid Transit is a classic result of systems engineering uninformed by minds that visualize the mundane things that can go wrong in such a system. Absurd random failures

[17] See, for example, E. E. Evans-Pritchard, "For Example, Witchcraft," in *Rules and Meanings*, ed. Mary Douglas (New York: Penguin Books, 1973), pp. 24-25.

that have plagued automatic control systems are not merely trivial aberrations; they are a reflection of the chaos that results when design is assumed to be primarily a problem in mathematics.[18]

The engineer closes his conceptual system to achieve certainty and efficiency. One result of this circumscribed consciousness is optimism. In a closed system, all problems are solvable, or conceivably solvable. And, happily, all solutions are testable in practical terms, so they will be recognizable. In fact, according to Samuel Florman, engineers until recently took some delight in thinking of themselves as "saviors of mankind." This crusading self-righteousness has abated in the wake of antitechnology criticism and practical failures, but self-doubt has never been a common problem for engineers.

Another result of closing the conceptual system is the collapse of invention. A closed system has a finite set of units and operations and cannot accommodate any new relations between them.[19] In a strict sense, anything discoverable within a closed system is a tautology—a restatement of what was already there. Invention opens a system, to discover and accommodate something which it did not include before.

And this brings us to the problem of science. How much of what has been said here about the forms of consciousness promulgated by technology applies to science? I believe that much does not, and for the very reason that in science, almost by definition, conceptual systems are not firmly closed. Science is now understood as a continual attempt to open up a system which is never fully adequate. The scientist's conceptual system, a theory for instance, must be closed to be manageable, but closure is provisional.[20] Says Bronowski: "In science, . . . ambiguities are resolved for the time being, and a system without ambiguity is built up provisionally, until it is shown to fall short. This is why the results of science at any given moment can be presented on an axiomatic and deductive machine, although nature as a whole can never be so presented because no such machine can be complete."[21] Technology has borrowed method from science but has not borrowed the reasons which go along with the method. The closed system has become more than the convenience it is to science—it has become a self-justifying necessity. The technologist's optimism replaces the scientist's skepticism.

Oddly enough, the roots of science, in natural philosophy, promote closed-system, deductive thinking; and the roots of technology, in craft, promote open-system thinking. Science has become a craft, to the extent that it relies on experiment, on manipulation and technique; technology has become a philosophy, to the extent that complex conceptual systems, drawn from technology itself, intervene between the technologist and the material world. These intermediaries constitute the ideology of high-context technology.

III

Our culture is a highly technological one, and the ethos which it inspires must necessarily be technological. The actions we engage in, their purposes, and the conceptual habits they encourage de-

[18] "The Mind's Eye: Nonverbal Thought in Technology," *Science*, 197 (August 26, 1977), 835.

[19] J. Bronowski, "Humanism and the Growth of Knowledge," in *A Sense of the Future* (Cambridge, Mass.: The MIT Press, 1977), p. 76.

[20] Here I am pressing the distinction between the consciousness of individual scientists, who may certainly be closed-minded, and the consciousness promulgated by science as a communal enterprise—the ethos of science as opposed to the ethos of a particular scientist.

[21] Bronowski, "The Logic of the Mind," in *A Sense of the Future*, p. 72.

lineate the consciousness which formulates our discourse. This essay has suggested that we must understand two aspects to the forms of consciousness created by technology—the universal and the historical. Some features of the ethos of technology, in other words, are central to human consciousness. These are characteristics of tool makers and users and accompany low-context or primitive technology as well as, presumably, more advanced technology. Other features of the ethos that we attribute to technology are related to the particular way in which Western technology has developed, to the cultural and historical context which has both created it and been created by it. These are the characteristics of large bureaucratic organizations and mathematical methods of precision and control.

What persuasive force do the actions arising from technology exhibit in discourse? What features of discourse come to seem "ethical" or persuasive because of the particular cast of mind we acquire from living in a highly technological culture? A complete examination of the characteristics of modern public discourse, or even of what is called technical communication, is beyond the scope of this inquiry. I believe that what has been noted here will not be inconsistent with features of technical and bureaucratic prose that have been widely noted: impersonality, nonresponsibility, turgidity, narrow-mindedness. In addition, closed-system thinking has effects on discourse which I believe are both important and pervasive. Closed-system thinking substitutes "effective procedures" for invention and self-contained knowledge of the system (isolated expertise) for dialectical discovery of agreements. In a closed system, there is a correct solution discoverable by one who knows the system. The discourse demanded by and generated by a closed conceptual system not only precludes discovery and change but effectively equates logic with rhetoric. Logical form suffices for rhetorical substance. The system can accommodate whatever can be put into acceptable form—whatever can be read into the machine, whatever can be couched in standard report format. Decisions about the adequacy of Environmental Impact Statements, for instance, have largely been based on whether procedure was observed rather than on whether substantive issues were addressed. Weizenbaum believes that we have almost come to the point where "every genuine dilemma is seen as a mere paradox . . . that could be untangled by judicious application of cold logic."[22]

Closed systems have powerful and serious limitations. Developments in mathematical philosophy during the 1930s showed that a formal system "can never be complete yet cannot be guaranteed to be consistent."[23] These limitations affect not only the application of computer routines to social problems but any attempt to apply closed-system thinking to the phenomena of the world, which must be construed as an open system. This is the crux of Weizenbaum's discussion of the limitations of computer power: the decision-making processes that human beings employ are not reducible to effective procedures because an abstract game can never be as large as the phenomenal world. Calculation cannot replace judgment, nor logic reason. The ideological context of technology contributes to what has been called the fragmentation of our culture and thus to the difficulty of making social decisions through rhetorical processes. Paul Goodman called technology a branch of

22 Weizenbaum, p. 13.

23 Bronowski, "The Logic of the Mind," in *A Sense of the Future*, p. 59; he cites work by Gödel, Tarsk, Ramsey, Turing, and Church.

moral philosophy: "It aims at prudent goods for the commonweal and to provide efficient means for those goods."[24] The ideology surrounding high-context technology has prevented the achievement of communal understandings of prudence and efficiency. The only understandings of these values which we can share are those dictated to us by the technical system itself, but we have no extra-technological basis for achieving consensus on those values. Technological ideology prevents that. Insofar as features of the technological ethos I have described fail to seem "ethical," that ideology is incomplete. Any disagreement about technology as ethic is an indication of cultural pluralism and a sign that technology is not the entire basis for contemporary ethos.

We might have thought that technology, our means of interacting with the external world, would bring us closer to it. But technology is not a "purer" form of knowledge or action; it encourages its own forms of consciousness, which are the more powerful just because we may think them truer, or more transparent, or more objective than others. This is the insidious aspect of technological consciousness—it would hold that it itself does not exist. The intersubjective view assumed by this essay makes perceived reality a matter of both personal action and social consensus; "character" is dependent on both. If we believe that our relationship with the world is objective, that the external world determines our knowledge of it, then the concept of ethos evaporates—there can be no character to our knowledge or action, other than the idiosyncratic or the mistaken. That loss is the most rhetorically powerful consequence of technology.

24 "Can Technology be Humane?" in *The Ecological Conscience: Values for Survival,* ed. Robert Disch (Englewood Cliffs, N.J.: Prentice-Hall, 1970), p. 106.