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Technology in the late twentieth century: humanism versus technocracy, a philosophical inquiry

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TECHNOLOGY IN THE LATE TWENTIETH CENTURY:
HUMANISM VERSUS TECHNOCRACY

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A PHILOSOPHICAL INQUIRY

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INTRODUCTION

As an artist in metal living and working in the last part of the twentieth century, I feel it to be important that my work relate to this specific period of time. That is, to look where we are going becomes more important than where we have been. The most powerful single influence on where we are going, in my judgment, is technology. The images of technology, not the things of it, become my starting place. My intent, however, is not merely to celebrate technology. That is an uncritical attitude.

My work is <u>about</u>, not <u>of</u>, technology. My questions are whether technology is beneficial or deleterious to the quality of human life. There are many people who universally condemn modern technology as anti-life, others see it as the savior of mankind. I believe neither to be true, but reality to be somewhere in between.

I will confess to two biases. At the base of my ideas and work is a humanitarian or humanistic outlook that sees the good of man as the primary concern. I also admit to a fascination, though a critical one, with the technology of the late twentieth century. It is the coming together of these two forces that generates the images of my art. My intent is to create a humanized technological metaphor. My pieces should not "look like"

technological artifacts in a literal sense; they should suggest in their images rather than tell. They use materials of contemporary technology--plastics, fiber optics and electronics, in ways that demand involvement, not mere observation, making the viewer a participant, not a spectator.

This thesis is a document dealing with the philosophical content in my work. It is an investigation of the contradiction that exists between humanistic and non-humanistic or technocratic applications of technology at this point in history.

The first chapter is a definition of terms, meanings in a contemporary context. In defining "humanism", "technology" and "technocracy", I claim no objectivity. My reference point clearly favors humanism as the center of my value structure.

The second chapter deals with the contradiction between non-humanistic and humanistic technologies in terms of making value judgments favorable to humanism. The value judgments are based on what a technology does, what its effect is on man and the world and whether, all things considered, it improves the quality of human life.

Chapter three looks at actual current technologies and makes an attempt to project into the near future. I made no attempt to be comprehensive. I chose several technologies that are representative and central to the understanding of the most vital directions and concerns we are facing.

Throughout, it should be remembered that this is a document of personal philosophy. It is the conceptual realm of my artistic production. I have endeavored to make my factual content accurate, but that content exists as a means to the forumulation of humanistic value judgments.

A note about language. Throughout, I have frequently used the words "man", "mankind" and "humanity". There is no sexist bias intended. I do not know words with a genderless content that could adequately carry meaning. They refer to men and women both.

CHAPTER I

DEFINITION OF TERMS

Technology

In order to develop a true understanding of the meaning of technology, one must look at contemporary definitions as well as historical antecedents. In considering the meaning of the word in this electronic era, the images of computers, televisions and rockets may tend to come to mind. Yet to find where technology really started in man's history, we must look back to ancient Egypt, around 4000 B.C. Primitive planting of crops and irrigation along the banks of the Nile had started there.

> At about the same time as these first attempts at irrigation, the digging stick changed its shape; it became a simple scratch plough, with a forward-curving wooden blade for cutting the soil, and a backward-curving pair of handles with which the farmer could direct the oxen which now replaced men as a source of traction power. This simple implement may arguably be called the most fundamental invention in the history of man, and the innovation that brought civilization into being, because it was the instrument of surplus.[1]

With the advent of the plough, agriculture became predictable, settlements based around the farming areas came about and nomadic life for the Egyptians became unnecessary. Communities became stable and before long need brought about the development

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[1] James Burke, Connections (Boston: Little, Brown and Company, 1978), p.9.

of measuring, counting and primitive ciphering. Social patterns developed in the communities. Civilization had begun. Man now possessed the rudiments of control over nature. Man had become a creature of and dependent on technology.

In that early agriculture example, technology was an invention, a tool, a piece of hardware. As we now know it, however, technology may be seen as much more than a simple tool or implement. Webster defines technology as:

> ...the science of the application of knowledge to practical purposes.
> ...the totality of the means employed by a people to provide itself with the objects of material culture.[2]

Technology can also be seen in terms of the imperatives needed for it to have real effectiveness in society.

> Technology means the systematic application of scientific or other organized knowledge to practical tasks. Its most important consequence, at least for the purposes of economics, is in forcing the division and subdivision of any such task into its component parts. Thus, and only thus, can organized knowledge be brought to bear on performance.[3]

In the scope of man as a thinking, reasoning and cultural animal as well as a tool maker, technology takes on a very open-ended meaning. In fact, a large part of the body of knowledge accumulated through our history can be called technology.

> Technology often is thought of as consisting of such things as machinery and chemicals, but in a broad

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[2]Webster's Third New International Dictionary of the English Language, p. 2348

[3]John Kenneth Galbraith, The New Industrial State (New York: New American Library, 1967), pp. 24-25.

> sense it includes all practical knowledge, including information about which plants are good to eat and which insects carry diseases, the words and grammatical structure with which we communicate, the models of reality that we carry around in our heads, and the social arrangements we have found effective. In the broadest sense, technology might be defined as the ability to do things. Such a definition might seem all inclusive, but it leaves out not only impractical knowledge, but questions concerning what it is we want to do, that is, our values.[4]

Technology, then, includes a large part of the body of knowledge and experience acquired throughout the history of human civilization. It constitutes the history of man's attempts to understand and exert power over nature, the creation of tools to make easier the burden of physical survival, the advances in communications and travel that have made the world seem smaller and more accessible and extended our domain to outer space, and the variety of goods and services which we have grown accustomed to using in our daily lives. In a most general way, technology is the sum of mankind's effort to ameliorate life and extend the domain of human existence with every development altering the nature of that existence.

> The development of human civilization can, in many respects, be understood as an effort by mankind to improve on the conditions of life provided by our natural circumstances. The discoveries of fire, of agriculture, of non-human sources of energy, and of various forms of

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[4] Edward Cornish, The Study of the Future (Washington, D.C.: World Future Society, 1977), p.6.

medical treatment were among the important steps by which mankind has reshaped its life from that which was originally natural for the human animal into something closer to our hearts' desires. Each of these steps has eventually resulted in widespread changes in the human society, both in the life patterns of individuals and in the institutions by which our lives are shaped. In many ways it is accurate to say that we live in a world shaped by man, rather than the one that nature evolved for us.[5]

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[5] Gerald Feinberg, <u>Consequences of Growth</u> (New York: Seabury Press, 1977), p. 41.

Humanism

Humanism as a concept and a philosophy goes back in history at least as far as the ancient Greeks. Its content, however, has not been a story of consistency. It has probably had as many meanings as the different ages that have heard it espoused. Even today, there is no "standard" definition. Each writer has his or her own understanding of the word, each with its own implication. Yet, through time, in some form, man has been at the center of the idea.

> Renaissance Humanism was first and foremost a revolt against other-worldliness of medieval Christianity, a turning away from preoccupation with personal immortality to make the best of life in this world. Renaissance writers like Rabelais and Erasmus gave eloquent voice to this new joy in living and to the sheer exuberance of many sided existence. For the Renaissance the ideal human being was no longer the ascetic monk, but a new type--the universal man--the fully rounded personality, delighting in every kind of this-earthly achievement. The great Italian artists, Leonardo da Vinci and Michelangelo, typified this ideal.[6]

Over the centuries, humanist philosophers have come to see a certain commonality in all people, yet with all the variety and differences that are the mark of mankind.

> Terentius's statement, "I believe that nothing human is alien to me", was an expression of the Humanist spirit, echoed centuries later by Goethe's "Man carries within himself not only his individuality

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[6]Corliss Lamont, Humanism As A Philosophy (New York: Philosophical Library, 1949 , p. 29.

> but all of humanity, with all its potentialities, although he can realize these potentialities in only a limited way because of the external limitations of his individual existence."[7]

Today there are probably as many definitions of humanism as there are philosophers to explain it. There are some views held in common. Many believe in the perfectability of man. Life should be lived to be enjoyed, not to deny pleasure for the sake of asceticism. It is philosophy of reason rather than emotion and embraces the scientific method as a tool of analysis and understanding. It believes in man's ability to create a human order in the world and to create his own world around him. It believes in the power of man. It is a philosophy of optimism which, in the end, has the center of its essence being man, stating that man is a creature of choice and free will.

> Humanism . . . focuses attention on freedom depicted as enlightened choice. It is here that human dignity is found to consist in the individual person's reliance on his faculties of knowledge and will.[8]

> Humanism in its social creed proclaims the freedom of all men to fulfill the potentialities of human life and it maintains that man's natural intellect is the primary faculty by which he can achieve this end.[9]

The humanist believes that:

> . . . the chief end of human life is to work for the

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[7]Erich Fromm, ed., Socialist Humanism (Garden City, New York: Anchor Books, Doubleday & Company, 1965), p. vii.

[8]Ralph Barton Perry, The Humanity of Man (New York: George Braziller, Inc., 1956), pp. 22-23.

[9]Ibid., p. 127.

happiness of man upon this earth and within the confines of the Nature that is his home. This philosophy of enjoying, developing and making available to everyone the abundant possibilities of this natural world is profound in its implication, yet easy to understand and congenial to common sense.[10]

The implications of this idea have to do with man both as an individual and as a part of a larger group--the human race. It recognizes that the differences between people are or should be less significant than the unity of mankind as one race. We become responsible to each other through political, social and economic interdependence and responsible to ourselves to develop our own individuality. This responsibility takes on the quality of becoming a moral imperative and demands self-respect and respect for the lives and individuality of others.

> . . . Humanism is the human decision to give moral equivalence to all men as human beings. Acceptance of interdependence and the solidarity of interests as the basis of human relations means acceptance of a share in joint responsibility for creating for all the conditions of a life worthy to be called human, a human providence in which each may be his own end without mockery.
>
> . . .On the basis of this interdependence, there remains the inalienable responsibility of each for himself as his own end. It is the glory of Humanism that here it is unprescriptive but may be exemplary. Personal life is choice not obligation, a work of art not a set task, an offering not a requirement, a creation not a prize.

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[10]Lamont, Humanism As A Philosophy, p. 7.

> Abstractly, then, Humanism is a concept of man focused upon a programme for humanity. Concretely, it is my idea of, and my commitment to, my part in that programme, which includes not least life that is in my own hands.[11]

Humanism takes on political content in a very general way. It is against authoritarian and totalitarian forces which dehumanize people and deny their freedom to self-determination. Thus, it must support democracy. The humanist would feel compassion for the suffering of humanity and have the unity of mankind as an ideal.[12] These imperatives become the inner-directed responsibility of the humanist.

> ...The word "responsibility" has lost its original meaning and is usually used as a synonym for duty. Duty is a concept in the realm of unfreedon, while responsibility is a concept in the realm of freedom.
>
> This difference between duty and responsibility corresponds to the distinction between the authoritarian and humanist conscience. The authoritarian conscience is essentially the readiness to follow orders of the authorities to which one submits. It is glorified obedience. The humanistic conscience is the readiness to listen to the voice of one's own humanity and is independent of orders given by anyone else.[13]

The combination of the humanist belief in freedom and opposition to fatalism, universal predestination or any kind of determinism and humanism's inherent optimism leads to the belief in human beings possessing a true freedom of action making them "within reasonable limits, the masters of their own destiny."[14]

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[11]H. J. Backham, "A Definition of Humanism," in The Humanist Alternative, ed. Paul Kurtz (Buffalo, N.Y.: Pemberton Books, 1973), pp. 36-37.

[12]Kurtz, The Humanist Alternative, pp. 6-7.

[13]Erich Fromm, The Revolution of Hope (New York: Harper & Row, 1968), pp. 81-82.

[14]Lamont, Humanism As A Philosophy, p. 20.

> . . . Humanism believes that man has the power and potentiality of solving his own problems successfully, relying primarily on reason and scientific method to do so and to enlarge continually his knowledge of the truth.[15]

The ramifications of this attitude are very serious in considering the power of mankind. The belief that mankind is the master of its destiny can lead to the idea that man can do anything that can be conceived and that he has the physical power to do. This might be seen as the "flip side" of humanism. The ultimate end of this is that man, being the center of his world and employing reason and scientific method as his tools, sees the whole world as the theater of his actions and everything in it as props to be used as he wishes.

If carried to its ultimate logical end, the power mankind has over the face of this planet ceases to have limitations. Many of the things mankind does to create energy, produce manufactured goods, make the chemicals our society consumes, or grow the food we eat have dire ecological consequences which are frequently not considered seriously by the powers that be. All of this is done in the name of human progress. While those who lead these actions may not be philosophers who study and consider humanism, it <u>is</u> the mode of thought that pervades much of the contemporary world society today. Its belief in the power of man can become the arrogance of man's power, and of the

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[15] Ibid. p. 20.

power of pure reason and scientific method. It becomes a power without limitations. Though it may not have gone this far yet, it is possible that "humanism and modern society have opted, albeit unconsciously, for the assumption of human power."[16]

We come to see then, the two faces of humanism:

> In the best sense, "humanism" is simply the expression of an interest in man; in the worst sense, it is the interest become a monomania, excluding interest in anything else. Insofar as it develops such exclusiveness, humanism contradicts its own intent, for interest in man implies interest in those things in which man is interested; and in what is man not interested?[17]

This contradiction becomes a corruption of humanism. It fails to perceive the whole meaning of humanism and fails to understand and take responsibility for man as part of a planet that is itself an organic whole.

This duality, man alone versus man as a part of a whole, is a central problem in a consideration of man, humanism and technology. It is at the heart of the ecological destruction which is now starting to threaten life on this planet. The humanist must finally ask, if nothing is left on earth but man, how can man survive?

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[16] David Ehrenfeld, The Arrogance of Humanism (New York: Oxford University Press, 1978), p. 21.

[17] Charles Hartshorne, Beyond Humanism (Lincoln, Nebraska: University of Nebraska Press, 1937), p. 1.

Technocracy

In the narrowest sense, technocracy is "government by technicians; a management of society by technical experts."[18] Its real meaning extends well beyond such definition to the kind of society that technocracy represents. It can only exist in an advanced technological society, a society where technology plays a central role in the very existence of its people, touching virtually all phases of life. Such a society, in reality, has only become possible in the mid- to late-twentieth century.

> No one doubts that the phenomenon of technology dominates our age. Up to the nineteenth century techniques evolved very slowly: their transformation was hardly perceptible in the course of an individual's life. At present, technological development is accelerated and invades not only working life, but also family life and leisure time; war and peace depend upon it; it transforms our natural surroundings and our living condition. Moreover, it takes hold of our very souls: present techniques--such as advertising and propaganda--manipulate and condition the human mind.[19]

Technological presence thus becomes an all-enveloping part of our lives. We grow with it, live with it, and may not notice it because it is always there.

We have seen technology represent practical human knowledge, at least in the most abstract and ideal sense. It also is a system of gathering information, of production and of

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[18] Websters Third New International Dictionary, p. 2348.

[19] Mathilde Neil, "The Phenomenon of Technology: Liberation or Alienation of Man?" in Socialist Humanism, ed. Fromm, , , , p. 334.

organizing its members to its own best advantage. Thus technology becomes, or creates, technocracy.

> As Jacques Ellul has pointed out, technology is not only a matter of tools, instruments, machines and computers. It also characterizes a society insofar as it is organized, systematized or rationalized into an efficient organization: as in an army, an efficient business or a bureaucracy. Here all the human parts are integrated with each other into a practical, efficient, smooth-running organization where no time, effort or materials are wasted, where the product or the service is quickly, correctly and inexpensively created, and where a minimum of loss, error and cross purpose is achieved.[20]

Efficiency becomes a primary goal of a technocracy. It wants to run well and smoothly like a well oiled machine. Rather like a "corporate individual", it creates priorities that serve its well-being and increase its strength and power. These goals have been broken down into substantive goals, or goals in overall direction and procedural goals, or how to achieve the substantive goals. The following can be called primary technocratic goals:

<u>Substantive Goals</u>:
Technological growth
Growth in human control over nature
Growth in efficiency
Scientific growth
Economic growth (at least at this time)

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[20]Langdon Gilkey, "The Religious Dilemmas of a Scientific Culture: The Interface of Technology, History and Religion, " in <u>Being Human in a Technological Age</u>, ed. Donald M. Borchert and David Stewart (Athens, Ohio: Ohio University Press, 1979), p. 80.

Procedural Goals:
Increasing use of analysis, planning and precise calculation
Increasing use of impersonal, standardized and formalized criteria
Increasing use of precisely defined functions and specializations
Increasing routinization and atomization of functions
Increasing integration of functions within a formalized organization
Increasing mechanization and automation of jobs
Increasing evaluation of workers in terms of functions and roles[21]

This discussion of technocracy, so far, has not primarily looked at people so much as the technocratic "machine". People, in a sense become secondary. The purpose of people in this system takes on the quality of "means" more than "ends". Rather than try to make the system suit human needs, it is designed to make people fit into it. As our economy, technology and institutions now exist, it is the purpose of people to fit into the needs of the system, of the economomy, rather than to design the economy to suit human needs. People often are "referred to impersonally as manpower."[22] Individuals become dehumanized as they lose control of institutions and organizations, and of their own lives.

As every advanced technological society has discovered, human beings are not so much masters as the

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[21]Bernard Gendron, Technology and the Human Condition, (New York: St. Martin's Press, 1977), p. 58.

[22]Daniel Yankelovich, "Two Truths: The View from the Social Sciences", in Being Human in a Technological Age, ed. Borchert and Stewart, p. 102.

> servants of the organizations they have created, servants in the sense that they find themselves "caught" and rendered inwardly helpless within the system insofar as they participate in it at all.[23]

These ideas begin to sound like the creation of automatons, people as machines, clanking along, swinging arms in unison, marching as near robots. Happily, this does not seem to be the case. Not at this point; hopefully not ever. The question does come up though, of how much freedom individuals have? Are people, even creative people, serving the goals and needs of the technological-technocratic order without realizing it? Some believe this to be the case.

> Any considerations. . .concerning creativity, aesthetics or the moral meaning of what is being done, any suggestions that might compromise the efficiency, the smooth-running of the whole team, are ipso facto "impracticable" and so by these standards irrational. Thus does the individuality of each lose its transcendence over the system; individual minds and consciences cease to be masters and become servants, devoted only to the harmony and success of the system. Human beings are present and are creative, but only as parts of a system; their worth is judged only with regard to their contribution as an efficient part; they are lured into being merely <u>parts</u> of a machine.[24]

Dehumanizing images such as these increasingly begin to resemble the dystopias that have appeared in twentieth century fiction by Alduous Huxley, George Orwell, Stanislas Lem and a

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[23]Gilkey, "The Religious Dilemnas", p. 80.

[24]Ibid., p. 81

wide range of science fiction and speculative fiction writers. They may be exaggerations of current reality, but are extrapolations of directions that are present in contemporary technological societies.

> Brave New Worlds are dictatorships by technocrats; they are dictatorships by scientists, engineers and other experts. The source of technocratic power is knowledge, not wealth or ideological fervor. Technocrats want order, efficiency, and maximal control over nature and history; they think misery and poverty are dysfunctional relative to these ends and therefore want happiness and affluence for all. Technocrats do not assert their power through the use of crude, painful, and inefficient techniques of old, such as incarceration and torture; they resort to the more scientific and benign techniques of behavorial engineering, such as conditioning and pharmacological, electrophysical and genetic manipulation.[25]

These totalitarian images _may_ not happen, but they should be carefully considered, for they may be possible. If they are to be prevented, it may be through awareness of what _can_ come to pass.

Another view of the power of technocracy is the idea that man has made a religion of his technology; that

> . . . _man has made technology sacred_. Instead of being treated as a means to make life more human, it has become an end in itself. The objects created by technology--whose workings are not understood by most consumers--have become mysterious, the objects of a new cult. The occupation of a technician has a quasi-religious attraction. Like the priests of the ancient civilizations, the technocrats, physicists, engineers, and economists constitute a ruling class which dominates the ignorant masses by its mysterious knowledge, its power, and its high rewards.[26]

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[25]Gendron, _Technology and the Human Condition_, p. 93.

[26]Neil, "The Phenomenon of Technology," p. 339.

From the point of view of the common man, technology may seem to be running amok, controllable only by the technician-priests. Our everyday objects become black boxes, things we know how to use, but do not understand. We often may feel that we have no real control over them, especially if something should go wrong. Only the expert becomes qualified to fix or control the defective object or machine.

A classic metaphorical example of the technician-priest being solely able to regulate a technology running wildly out of control is in the Walt Disney movie, "Fantasia." The Sorcerer's apprentice, a neophyte priest-in-training figures out how to start a process, the animated broom water-carriers, but cannot turn it off. Without the power to regulate the technology, the result is catastrophe. It takes the return of his master, the great Sorcerer himself, to stop the brooms and scold his disrespectful apprentice. The analogy to the nuclear plant accident at Three Mile Island is too close for comfort.

One product of technological- technocratic society, in the extreme, is identification with the machine on a personal level; seeing oneself as a machine or a computer. Such psychological phenomena are not without precedent, as cited in this rather bizarre case, with an analogy made to technocratic man.

> . . .The condition of man today . . . resembles the pathetic state of Dr. Bruno Bettelheim's psychiatric patient: a little boy of nine who conceived he was being run by machines. 'So controlling was this belief,' Dr. Bettelheim reports that the pathetic child 'carried

> with him an elaborate life-support system made up of radio tubes, light bulbs, and a breathing machine. At meals he ran imaginary wires from a wall socket to himself, so his food could be digested. His bed was rigged up with batteries, a loud speaker, and other improvised equipment to keep him alive while he slept.'[27]

If this seems terribly extreme, one need only consider the practice of contemporary medical science of keeping terminally ill patients alive by the extensive use of life support systems long after their bodies should have died.

Perhaps the most far-reaching definition of technological society is that espoused, in 1968, by Zbigniew Brzezinski. His vision goes past technocracy to a society determined largely by electronics: the communications media and computers.

> . . . The approaching transformation will come more rapidly and will have deeper consequences for the way and even perhaps for the meaning of human life than anything experienced by the generations that preceded us.
>
> . . . The far-reaching innovations we are about to experience will be the result primarily of the impact of science and technology on man and his society, especially in the developed world.
>
> . . . America is already beginning to experience these changes and in the course of so doing it is becoming a "technetronic" society; a society that is shaped culturally, psychologically, socially and economically by the impact of technology and electronics, particularly computers and communications. The industrial process is no longer the principal determinant of social change, altering the mores, the social struction and the values of society.[28]

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[27]Lewis Mumford, transcript of untitled speech, in Technology, Power and Social Change, ed., Charles A. Thrall and Jerold M. Starr (Lexington, Mass.: Lexington Books, 1972), p. 5.

[28]Zbigniew Brzezinski, "America in the Technetronic Age," Encounter, January 1968, p. 16.

> . . . The transformation that is now taking place is already creating a society increasingly unlike its industrial predecessor. In the industrial society, technical knowledge was applied primarily to one specific end: the acceleration and improvement of production techniques. Social consequences were a later by-product of this paramount concern. In the technetronic society, scientific and technical knowledge, in addition to enhancing productive capabilities, quickly spills over to affect directly almost all aspects of life.[29]

Whatever particular definition of technocracy one chooses, the implications are similar: a society that is run by and shaped by the particular form and instruments of its technology with the extent of its power largely a function of the power, nature and pervasiveness of that technological sector.

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[29] Brzezinski, "American in the Technetronic Age", _Encounter_, January 1968, pp. 17-18.

CHAPTER II

HUMANISM VERSUS TECHNOCRACY: THE CONTRADICTION

We live in a society that is struggling with profound social, political and economic problems. Disparity between races is increasing; labor problems including widespread alienation from and disillusionment with work abound; the environment is being poisoned; the economy is inflating nearly out of control; many people search in vain for meaning in their lives.

In a culture increasingly dominated by the hardware and effects of technology, the temptation becomes strong to blame many of our problems on that technology. The Industrial Revolution, a relatively slow process, was the catalyst of tremoundous change and social upheaval from the late 1700's to the mid-twentieth century. Since approximately the end of the Second World War, we have been experiencing the beginning of a Technological Revolution whose power promises to dwarf that of the Industrial Age. The effects of the Technological Revolution, positive and negative, on the world in general and the United States in particular in the last third of a century have been awesome. The possibilities exist, simultaneously, as benefits to man almost beyond imagining and as worldwide nuclear or ecological catastrophe. The negative effects, socio-economic as well as military and ecological, are hard not to dwell on as they carry the potential quality of finality, of psychic or physical

destruction. To blame technology is convenient, but to blame technology becomes buck passing. To say that technology is anti-humanist because these problems relate directly to technology is avoiding the essential responsibility. We, mankind, are responsible for our world and for the technologies we create.

> There is no design or purpose in technology other than that given by men. What is also certain is that the scale of technological innovation and the scope of its effects are increasing rapidly in the Western world. We have created marvels and monsters of a size and dimension heretofore undreamed of; it is becoming increasingly imperative that we begin to assume responsibility and control of our machines and destinies.[30]

> It is therefore a warranted inference that technology does not, indeed cannot, determine itself. The physical and chemical properties of materials do not cause them to leap into the shape of man's artifacts. Only man, in fact, designs and shapes every particular technology. Once created and used, the given technologies have important bearing on man's life. But the point of decision to make particular use of knowledge of nature is in man, not in the options afforded by nature.[31]

> Furthermore, the significance of technology lies in its use by human beings. Take, for example, the telephone. If we regard it only as a collection of wires through which current passes from a transmitter to a receiver, it would seem to have little interest, except for the telephone technicians and repairmen. But the significance of the telephone lies in its use-in transmitting messages. It is the communications function of the telephone that gives it importance, and the function of technology is its use by human beings.[32]

As human use of technology defines its function, so it is

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[30]Thrall and Starr, Technology, Power and Social Change, p. 156.

[31]Seymour Melman, Technology, Power and Social Change, ed. Thrall and Starr, p. 51.

[32]Melvin Kranzberg, Technology, Power and Social Change, ed., Thrall and Starr, p. 114.

by the effects of technology on humanity and our world that we must evaluate its quality as humanistic or not. It is only by performance that we can set criteria. The contradiction between humanism and technocracy or humanistic and non-humanistic technologies is not what they are, but what they do. Stereotypes are not effective definers of those qualities. It is not safe to say that a horse-drawn wagon is a humanistic means of transportation and supersonic jet aircraft is not. That definition is dependent on the manner in which they are used and the purpose and effect of that use.

In an examination of contemporary technology, answers are not always apparent at surface inspection or by snap judgments. It may be necessary to follow a technology through a chain of possible, probable or actual consequences before being able to make an evaluation. This process is called "end product analysis."

> . . . For real objectivity, we must increase our perspective and broaden our view, and to do this it is often necessary to ignore claims and counter-claims concerning methods, intermediate goals, and theoretical objectives, and look exclusively at the final results of a technology . . .
>
> For the want of a better term, I call this process "end product analysis". End product analysis is the necessarily informal study of effects that sum up many causes.[33]
>
> The basic requirement for such an analysis is the ability to distinguish short-term effects and objectives from long-term one. What is needed is the firm conviction that the proof of the pudding is in the eating, plus a powerful sense of perspective.[34]

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[33] Ehrenfeld, The Arrogance of Humanism, p. 59.

[34] Ibid., p. 63.

It becomes necessary at this point to briefly examine some thoughts on the nature of humanistic and anti-humanistic technologies. To the extent that man serves the needs of the productive system in a technocracy, that he becomes means rather than ends, that the structure and function of a technocratic system depersonalizes man, such a technocratic order is non-humanistic by definition. Yet, it is not necessarily the technology that is non-humanistic. It is the organization and goals of the power structure that sets the goals and manages the technology that is anti-humanist. Technology is what we make it.

Sometimes, in making an analysis, we come up with greys, rather than black and white answers. The development of mass production is such an example. To the person laboring on the assembly line, the work may be boring, repetitive, mindless and depersonalizing. Mass production, for the worker, may not be conducive to the development of individuality. The response by workers to their work experience in recent years has often been high absenteeism, sabotage in auto plants, or, out of boredom, simply poor productivity. Yet, it is possible to organize mass production in ways that does humanize workers. Such an example is the Saab suto assembly plant in Sweden, where crews of workers build entire cars, maintaining high productivity. Mass production technology can be humanized. The result of mass production has been goods that are affordable by the general

public that would have been luxury items in earlier days. This is a positive, humanistic quality.

> It is not technology but in its misapplication that depersonalization occurs. For example, it is technology, in its broader understanding, that has brought us mass production and the discount store which moves enormous volumes of merchandise at minimal profits. It is the discount stores--the K-Mart, the Goldblatt's, the A & P--which have enabled many poor to dress tastefully and in respectable fashion and to eat moderately well, thereby enabling them to walk inconspicuously side by side with the customers from Nieman-Marcus.[35]

There is thus an ambivalence that is valid and proper when examining the end product of many technologies. This conflict is not always resolvable.

> Technology is variously credited with overcoming disease, polluting our atmosphere and waterways, freeing humankind from want, reducing men to cogs in vast industrial machines, pushing back new frontiers of knowledge thereby eliminating human ignorance, and producing destructive powers capable of wiping out life from the earth.[36]

Technology then, in the abstract, is by itself neither humanistic nor non-humanistic. It is a matter of what it does and how it is applied. In many instances, this has to do with value choices made by the powers-that-be who make the decisions

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[35]Gerald F. Kreyche, "The Meaning of Humanness: A Philosophical Perspective," in Being Human in a Technological Age, ed., Borchert and Stewart, p. 39.

[36]Borchert and Stewart, ed., Being Human in a Technological Age, p. 1.

and control the technologies. Unfortunately, all too often what guides those policy makers are values which are anything but humanist: excessive profit, power, greed and a lack of concern and caring for fellow human beings. Recent history has seen more than one instance where corporate management, aware of inherent danger or flaw in a technological product they were marketing, chose profit over human values. A classic example is the Ford Pinto case. Management, allegedly deciding it was cheaper to deal with lawsuits from injured parties or their next-of-kin, did not attempt to recall or fix the dangerous rear gas tank on the Pinto. That decision cost lives. A similar situation existed in the case of the Dalkon Shield intrauterine device. For a number of years, the manufacturer chose to settle lawsuits with injured women rather than withdraw their product. The problem becomes one of ethics.

> I would define anti-humanistic technology as any technology that embodies predominantly selfish, paranoid, or destructive values. It is not simply nuclear weapons, ICBMs, ABMs, chemical warfare agents, but non-military technologies proposed mainly for purposes of pride or profit rather than for human dignity. Time and circumstances are always relevant to any consideration of action <u>vis-à-vis</u> technological development. Space exploration, for example, as such is not anti-humanistic; it becomes anti-humanistic when it absorbs resources needed for sick and hungry children and adults. Automobiles are not in themselves anti-humanistic. They become anti-humanistic when their manufacturers refrain from engaging in the technological development work necessary to insure that their pollutant potential is eliminated or significantly reduced. They become anti-humanistic when persons who profit from their sale succeed in holding back the development of mass

> transportation systems that would make large numbers of them unnecessary and would make thousands of acres of concrete deserts or highways unnecessary . . . This is not to say that technology is neutral; but rather that we must consider time and the special circumstances in which it is introduced as relevant facts. . . . Technology is part of the social process, and will change only when broader social changes in fact take place.[37]

To create and maintain a humanistic technology, we must look to traditional positive human virtues and values, values that fully enhance the quality of life on this planet.

> . . . Technology does not make humanistic values obsolete. Humanistic values can be made obsolete only by anti-humanistic or non-humanistic values. . . . No new values are engendered by technologic change. Some old values may either be strengthened or distorted. To the extent that technology redefines existing life support systems and makes them include wider configurations of transportation, communications, manufacturing, mining and agriculture subsystems, to that extent traditional values of cooperation and concern for human need rather than individual profit should be strengthened. If these values are not strengthened, we are in the presence of a social, not a technological, pathology.[38]

Leaving negatives behind and keeping in mind the points already raised about human values and ethics, what is a humanist technology? As concepts of value are our starting point, then so must be an understanding of ethical humanism.

> . . . An ethical Humanist today is one who relies on the arts of intelligence to defend, enlarge and enhance the areas of human freedom in the world. Ethical Humanists may differ from each other, but they respect those with whom they disagree. They are not fanatics of virtue.

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[37]Robert Boguslaw in Technology, Power and Social Change, ed., Thrall and Starr, pp. 110-111.

[38]Ibid., p. 110.

> They recognize that good conflicts with good, right with right, and sometimes the good with the right. To these conflicts they bring the only value that is also the judge of its own efficacy and limitation--human intelligence.[39]

It is that intelligence which we must apply to the problems facing mankind in the world today and to the possibilities that we will face in the future. Technology is a tool, a means to achieve desired ends; ". . . its good depends on the will which employs it."[40] This must not be forgotten in the context of a world where scarcity is very much a factor, where large populations suffer lacks ranging from hunger to starvation, where resources are dwindling and where competing super-powers carry destructive potential never before seen on earth. Man's discoveries of science and technology, given the proper direction, also carry with them the possibilities of dealing with these and other problems, and further, of opening up whole new vistas of accomplishment and exploration heretofore only dreamed of. The directions we will take are in the control of man's will, remembering that we are all members of one race on a small world.

> . . . Using the powerful critical tools of science and logical analysis, modern man now recognizes that the universe has no special human meaning or purpose and that man is not a special product of creation. Anthropocentrism has been laid to rest. Modern man now realizes that he is responsible in large measure for his own destiny. Living on a minor planet on the edge of a small galaxy in a vast universe, man has come to see that

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[39]Sidney Hook, "The Snare of Definitions," in <u>The Humanist Alternative</u>, ed. Kurtz, p. 34.

[40]Perry, <u>The Humanity of Man</u>, p. 92.

> he cannot look outside himself for salvation. His future, if he has any, is within his control.[41]

Operating within the bounds of human nature, man now faces serious choices. For better or worse, our future is in our hands with our powerful technology as our tool.

> Mankind does not change, and retains always the capacity for evil as well as for good. At the most we can suggest opportunities whose technical imperatives will make it easier for mankind to choose peace rather than war; diversity rather than repression; human simplicity rather than inhuman mechanization. Technology must be our slave, and not the reverse.[42]

Technocracy, as previously shown, has programmatic guidelines for its goals and effective functioning as a system. So too can programmatic guidelines be set, in general terms, for the function of a humanist technology as it sets to deal with problems of man. It is not a matter of stating what the technologies or technological suggestions <u>are</u> in a material sense, so much as what they <u>do</u> and what their <u>effects</u> are in relation to man and the natural world.

> These considerations should be in our minds as we examine . . . technical suggestions. . . . I would put them forth in the form of guiding principles:
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> 1. A proposal to improve the human condition makes sense only if, in the long term, it has the potential to give all people, whatever their place of birth, access to the energy and materials needed for their progress.

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[41]Paul Kurtz, ed., "The Meaning of Humanism," in <u>The Humanist Alternative</u>, p. 5.

[42]Gerard K. O'Neill, <u>The High Frontier</u> (New York: Bantam Books, 1978), p. 18.

> 2. A technical "improvement" is more likely to be beneficial if it reduces rather than increases concentrations of power and control.
>
> 3. Improvements are of value if they tend to reduce the scale of cities, industries, and economic systems to small size, so that bureaucracies become less important and direct human control becomes more easy and effective.
>
> 4. A worthwhile line of technical development must have a useful lifetime without running into absurdities of at least several hundred years. . . .
>
> Finally, as we strive to find solutions to the physical problems faced by mankind, we must realize, with humility, that we can offer no panaceas. There are no Utopias.[43]

The first three principles deal with improving the "physical" conditions of life and essentially anti-technocratic goals: people having more power to control their own lives, decentralization and the reduction or elimination of factors that depersonalize life. Cities such as New York have long ago passed the point of being controllable or governable by anyone or group of people, including the Mayor and City Council. Small cities remain manageable.

The fourth principle deals with a very serious problem whose "absurdities" are the direct result of our technology. This problem is potentially more serious than the threat of nuclear destruction for the survival of humanity and our world. It is the waste and destruction of our planetary ecology and the continuing depletion of our natural resources.

Recent events have made the pollution and poisoning of

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[43]Ibid., p. 17.

water resources prime news. Love Canal is not an isolated incident. There are hundreds, if not thousands of chemical waste dump sites scattered around the United States. In many of them, chemicals have combined to form new, more noxious, more carcinogenic, more mutagenic and dangerous compounds. Much of the pollution is in aquifers or underground water tables--for many areas the only source of water. The cost of cleaning up these areas, once a suitable technology can be developed, will be enormous. Some are so bad that they will have to be abandoned forever as water sources.[44] Acid rain from American and Canadian industry has been lowering the pH of lakes in the Adirondacks and Ontario Provinces to the extent that some already can no longer support life. Some are crystal clear, like a well-filtered and chlorinated swimming pool containing as much life as one: no plants, no frogs, no fish, no insects or even microbial life.

Not only is our environment becoming despoiled, but our resources are disappearing--by our own hands. The "energy crisis" has created an awareness of the limits of the world's reserves of petroleum. Other resources are also being depleted, and present potential future problems of mammoth proportions.

> [The ecology crisis] . . . refers not only to the problems of technological and industrial pollution of the water, air and earth and the despoilation of whatever natural beauties are left--though these are serious

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[44] CBS, "60 Minutes," 15 March 1981.

> enough problems, and with energy and resources short will only get worse! It refers centrally to the exhaustion through expanded industrial production of the earth's available resources, in the end a more serious problem.[45]

> There is little question now, given present trends, that key non-renewable mineral resources (such as lead, mercury, manganese, tin and tungsten) will be severely depleted in the not too distant future. The only issue is how long before the real crisis hits. The problem is simply that the extraction of non-renewable mineral resources, already very large, is growing every year at a rate approaching 4 percent. It is obvious that this cannot last forever, and that the rate of growth of mineral extraction has to be stopped at some time or other, preferably sooner than later.[46]

Not all of our technologically "caused" environmental problems are the result of waste of resources or a lack of care and regard for man and the ecology that companies such as Hooker Chemical have shown at Love Canal and elsewhere. Some have come about through the desire to "solve" a problem or improve living conditions, using tools of technology and the belief that "something ought to be done because it is technically possible to do it."[47] When that "something" is done, there may be deleterious side effects not predicted, causing the need for technical solutions to those problems, causing side effects not predicted . . . .

A classic example of this is the attempt by scientists and engineers to control the "curse of the Nile", the annual flooding of the Nile River which for thousands of years had

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[45] Gilkey in Being Human in a Technological Age, ed., Borchert and Stewart, pp. 82-83.

[46] Gendron, Technology and the Human Condition, p. 177.

[47] Fromm, The Revolution of Hope, p. 32.

disrupted the lives of Egyptians and naturally fertilized and irrigated the Nile region and its Delta. Man-made irrigation would thus have to be created. The main method of creating irrigation reservoirs and controlling flooding--in Egypt and around the world--is the damming of rivers. As the following illustrates, damming can cause unforseen problems.

> One of the many series of residue problems initiated by massive irrigation stems from the need to build dams in order to provide the irrigation water in the first place. The Aswan Dam on the Egyptian Nile illustrates a few of the difficulties. First, there is the residue problem of the large quantity of silt normally carried by the Nile. This silt is now settling out in the still waters of Lake Nasser behind the dam. The silting of reservoirs is a global problem, especially severe in countries such as the United States, many of whose reservoirs are now forty or fifty years old and are filling up with mud. Some major dams have lost nearly fifty percent of their reservoir capacity in less than five years, but silt at even one-tenth of this rate is a serious problem for which there is no quasi-solution.
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> Second, the fertile silt accumulating in Lake Nasser was once spread over the Egyptian fields by the annual floods. This must be replaced by expensive fertilizer. Third, the decreasing amounts of silt and fresh water now entering the Eastern end of the Mediterranean Sea from the Nile have caused a reduction in marine fertility and an increase in salinity which have, in turn, destroyed the Egyptian sardine fishery. Fourth, the great increase in the number and length of Egyptian irrigation canals has caused the proliferation of the snails that spread the dread parasitic disease schistosomiasis. . . . And fifth, there is the problem of the salting of soils, which results from excessive evaporation of water at the surface of soggy fields, leaving behind heavy deposits of salts from the fertilizer and the water itself. The quasi-solutions to this problem alone produce more residue problems than everything else listed so far.[48]

. . . In the Soviet Union . . . over-damming and

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[48]Ehrenfeld, The Arrogance of Humanism, pp. 109-110.

> diversion of river water for irrigation is causing two great inland seas, the Caspian and the Aral, to shrink rapidly. The Soviet quasi-solution of diverting the north-flowing Siberian rivers southward has, itself, many actual and potential residue problems, not the least of which may be world-wide climate change.[49]

The Indian subcontinent is very densely populated and very hungry. The need for arable land is intense. Any method of being able to create additional land that can be cultivated should be a boon to the local population. If it is simply a matter of bringing water to dry land to make it bloom, the problem should be simple--unless the technologists are forgetting something. . . .

> You have only to fly over the Indus plain in West Pakistan to see what misplaced technical enthusiasm can do. There, one acre of land is being lost to cultivation every five minutes by salination and water-logging. In the last twenty-five years barrage engineers have done their job efficiently, canal builders have capably spread the irrigation waters over the land; the soil chemists and the soil physicists have done their job to the best of their knowledge; the peasants have moved in and cultivated what was a desert. But one decisive factor was ignored: the whole system depended on "inland delta drainage" which meant that the surplus water would drain back into the Indus; but the incline is 700 feet in 700 miles so that the natural drainage was ineffective. The water table rose to within inches of the surface, drowning the roots of the crops, bringing up salt from below. The surface irrigation water evaporated and deposited more salt until the whole landscape shimmered with crystals. It will take another twenty-five years and 2,500 million dollars to restore the damage.[50]

For perhaps the first time in history, man now has the power to dominate nature, to eliminate parts of nature, to some

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[49] Ibid., p. 110

[50] Lord Ritchie-Calder, "Putting Ethics to Work", in The Humanist Outlook, ed. A.J. Ayer (London: Pemberton, 1968), p. 161

extent to control nature and even, with genetic engineering, to supercede nature. This is essentially an outgrowth of the humanist attitude that man is the master of his destiny. This power becomes <u>hubris</u>. Mankind begins to believe that anything is possible and within human capacity. The three previous scenarios are examples of this power become arrogance. We start to believe that we are separate from nature. Ecological despoilation is but one example of this belief. The very individuals who dump poisonous waste must believe it won't hurt <u>them</u>, even if they care not for others. This is the attitude of arrogance of power, of hubris: "I can do anything," or "I can make anything better."

Our power to solve our problems is also the power to compound them. The power of our creativity may be the power of our destruction. Thus can the tenets of humanism, carried logically and rationally but without humility, and extended into science and technology, become the dialetical contradictions of the best of humanism.

> If a valid science and reliable technology can really compound our problems rather than dissolve them, what does <u>that</u> mean about man and the history he helps to create? Do we really increase our dilemmas by using our intelligence, our inquiry, our techniques? What does <u>that</u> mean about us? When these questions are asked, it becomes evident that the user of knowledge and technology, and so man himself, is the cause of this ambiguity. . . . Can it be true that human creativity, in which we have so deeply believed, is in some strange way self-destructive, that there is in human freedom an element of the "demonic", and that intelligence and informed freedom,

> far from exorcising the fates of history, can create their own forms of fate over which they also have no control. As is evident, all the great philosophical and especially religious problems about human life are implicitly raised here, problems unanswerable by science and unresolvable by technology, and yet raised by both of them the moment the future they seem to create becomes oppressive and menacing rather than bright and promising.[51]

Matters of moral and ethical judgment are too important to be left to science and technology. Science and technology should be used as tools only after humanly and humanely considering these matters.

We must learn and accept that we are part of nature, not separate from it. We have the capability of causing irreversible changes in the natural order--and we do not always understand the consequences. We do not know what effect the loss of a species may be, what unknowable risks they may be to our civilization. Our long-term survival may well depend on the diversity inherent in that natural order.[52] We cannot know or forecast what all the effects of our actions and our alterations on nature may be. An example of this uncertainty is the process which causes deserts to expand as a result of man's actions, sometimes with the best of intentions.

> One of the several mechanisms we have for creating deserts is worth examining briefly. The process begins with over grazing by cattle,

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[51]Gilkey in <u>Being Human in a Technological Age</u>, ed. Borchert and Stewart, pp. 78-79.

[52]Ehrenfeld, <u>The Arrogance of Humanism</u>, pp. 188-189.

> sheep, and goats. When the vegetation is reduced, more light-colored bare sandy soil is exposed, and this increases the albedo or reflectivity of the landscape. When the albedo increases, more sunlight is reflected, and the land becomes somewhat cooler. Air passing over this landscape is heated less than usual and tends to rise less. This, in turn, decreases cloud formation, which decreases rainfall. Lower rainfall prevents the regrowth of vegetation, the albedo increases further, etc. And so, the desert expands. The British scientist W. Ormerod, . . . has pointed out that our well-intentioned and brilliant scientific efforts to eliminate the disease of cattle trypanosomiasis in Africa may in some areas lead to heavy expansion of cattle herds, overgrazing, and possibly the acceleration of events that are now causing the Sahara to expand southward along a broad front. Here the problem of irreversability can be seen to be augmented by the complexity of environmental interactions. Few things are as simple as we have, in our arrogance, made them out to be.[53]

We must, for the sake of our survival and in the best humanist tradition, assume a humble attitude toward nature, and accept our place in it. We can describe the laws of nature and use them for our own ends, but we must not and in reality, cannot break them. The laws we do not understand or try to break will thwart us in unexpected ways. Ignorance can be disastrous.[54]

> It has been said repeatedly that we must see man's relation to nature in terms of how he has tried to dominate nature and society. We need to correct course,

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[53]Ibid., pp. 115-116.

[54]Perry Pascarella, Technology: Fire in a Dark World, (New York: Van Nostrand Reinhold Company, 1979), p. 63.

> rethink our relation to nature, and see man as a part of the total harmony of nature. Man is part of the total complex scheme of nature, so much so that he needs less hubris, less sense of our right to expect whatever we wish from nature. We need to see the organic relationship of the whole web of nature, including man. Whatever we do in pursuit of the technologies of the future should be pursued in that spirit of humility rather than of hubris.[55]

Once we accept these realities, we become free to act toward the benefit of man. Knowledge of real limitations can be freedom, because it defines the parameters within which we must function. We can thus apply the power of our creativity to solving our problems for the good of all mankind, with science and technology as our tools, guided by a humble humanism. For mankind this could constitute collective enlightened self-interest.

This is a very ideal vision, and one that may never come to pass because of the economic and political realities of the world as it is. All to often, people operate from the lust for power, greed and narrow self-interest that becomes destructive instead of the enlightened self-interest that can truly build a better world.

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[55]Max Lerner in Technology, Power and Social Change, ed. Thrall and Starr, p. 41.

CHAPTER III

LOOKING FORWARD

> . . . The fact is that technology, far from dehumanizing man, is actually an instrument of civilizing man. Indeed, it has been one of the prime elements in the creation of civilization. All of us--even those who deplore it--recognize that, by calling ours a technological age. It is called that, not because all men understand technology, but because we are aware that technology has become a major disruptive as well as creative force in the twentieth century. But man has always lived in a technological age inasmuch as his life and culture have always been bound up with his technology.[56]

Looking forward to the last decades of the twentieth century, we are entering a period in human history that may be unprecedented for the rapidity and nature of its technological change and its concomitant social change. World population is growing at an explosive rate, particularly in the less developed countries. Food production is uncertain and bound up in politics of antagonism. Sources of burnable energy are dwindling and/or highly polluting. Nuclear fission and breeder reactors carry tremendous risks. Mineral resources have become clearly finite. The risks of nuclear war may be greater than at any time since the early 1960s.

On the other hand, recent developments in electronics are revolutionizing many industries and lowering the prices of many

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[56]Kranzberg in Technology, Power and Social Change, ed. Thrall and Starr, p. 113.

consumer goods using subminiature and integrated circuits. Computers are becoming everyday tools of modern life. The growth of modern medicine (partly through the aid of computers) is enabling many people to lead fuller and longer lives. The exploration and use of outer space is about to enter a new era with the launching of the space shuttle, an event with possibly more practical significance than landing on the moon. There is a growing awareness of the damage we have done to our environment that may be in time (optimistically) to save it before reaching a point of ecological no-return. We have come to a time when we can no longer look to the past for answers to today's questions.

> Our sociological theories, our political economy, our scientific potentialities and achievements, our religious and metaphysical principles and our doctrine of education are derived from an unbroken tradition of great thinkers and of practical examples from the age of Plato in the fifth century B.C. to the end of the last century. The whole tradition is warped by the vicious assumption that each generation should substantially live amid the conditions governing the lives of its fathers and should transmit those conditions to mold equal force the lives of their children. <u>We are now living in the first period of human history for which this assumption is false</u>.[57]

This is a period of great uncertainty. We can see potentialities and possible scenarios in the near future, but no assurance of positive and humane societies in the future. The

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[57]Ruth Nanda Anshen, "The Tree of Life", Foreword to <u>Consequences of Growth</u> by Feinberg, p. xix.

seeds of both catastrophe and a humanistic, positive growth are sown. What actually transpires may be somewhere in between or may contain elements of both.

> The problems of the world may not find a solution that we call comfortable, and there is no more reason to believe that we will be able to work everything out than there is to believe that everything good is coming to a permanent end.[58]

In order to "be able to work everything out", mankind must take control of decisions being made and exercise awareness of our place in the natural order of things. We can no longer afford the excessive glut that sees the United States, with six percent of the world's population consume as much as forty percent of the world's resources.[59] Decisions must be made with human needs in mind and not technological or technocratic priorities as our definitions.

> Our model can no longer be the machine or the mechanical organization or the electronic system, but the organism, or rather societies and associations of organisms, whose members exhibit bi-polar activities of all living organisms: change, yes, but change without destroying continuity; growth, yes, but always limited growth; balance, but a dynamic balance, constantly shifting, like the acid-alkali balance in the body; autonomy and self-direction, surely, but autonomy within a general pattern of cooperation and mutual aid; and certainly a plentitude of power, but not unlimited power, only power sufficient to foster the good life.

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[58]Ehrenfeld, The Arrogance of Humanism, pp. 235-236.

[59]Yankelovich in Being Human in a Technological Age, ed. Borchert and Stewart, p. 101.

> An economy that was conceived on the organic model would be able to utilize to the full all the resources science and technics place invitingly before us, without being overwhelmed by them, or becoming subservient to the Power Complex.[60]

The technological array that is now in front of us is indeed dazzling in its breadth and scope. It offers a technical prowess to mankind that is full of possibility. But with all this open possibility, how much is humanistic and how much is anti-humanistic or technocratic? Do many of the possibilities serve to expand the options and potential of mankind, or are they restrictive to freedom, narrowing or enriching in personal options and individuality? Will they improve the quality of society or further separate and atomize people through reduced social contact? Will they humanize or de-humanize individuals and larger societies and social structures? Do they and will they waste or save precious resources? Looking forward at a number of present or clearly projected near future technologies, the rest of this thesis will attempt to give a response to these questions.

In many respects, it is the development of solid state electronics--the transistor--in 1955 that initiated the transition from the Industrial Revolution to the Technological Revolution.[61] For the first time, electronic devices could be made dramatically

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[60] Mumford in <u>Technology, Power and Social Change</u>, ed. Thrall and Starr, pp. 13-14.

[61] This point is debatable. It could be argued that the Technological Revolution commenced ten years earlier with the exploding of the first atomic bomb.

smaller than in the age of vacuum tubes, were less fragile, were signigicantly reduced in cost, required less power, and gave off less heat. The direct benefits of the new transistor were broad and pervasive. The military, of course, led the way; but quickly they were in use in the home--lightweight and reliable portable radios, high quality stereo systems and television, all using transistorized printed circuits as their cores. In the early 1960's, relatively sophisticated electronics equipment started to become available at affordable prices to music lovers.

At the same time, computers were developing apace. Early IBM computers in the 1950's were, by today's standards, slow, stupid and very large. Their computational and memory capacities were very low. The used vacuum tubes rather than transistors, required tremendous power and gave off tremendous amounts of heat. They were, needless to say, very expensive and fairly few were made. The federal government and the military were among the prime consumers of the early computer technologies.

The transistor was the key to the first relatively small and sophisticated computers. Though still expensive, their cost dropped dramatically and their numbers increased. Their use in the government, military and sciences greatly increased, but they also started to be used in business. Still, there were few enough of them around that they were still regarded in the public mind as pretty esoteric devices. There were viewed with awe, and some fear.

An attitude that pervaded the 1960's was the fear that computers would "take over". They clearly had tremendous power and it was unclear how it would be used. The unknown is frequently the stimulus of fear. That fear took two directions. One was the "big brother" scenario, where the government could watch over and control the thoughts and actions of a populace. Zbigniew Brzezinski's article, "America in the Technetronic Age" was an expression of this possibility. The other side of this fear was probably best expressed in Stanley Kubrick's film, "2001: A Space Odyssey". The spaceship "Discovery" is headed on a special mission to Jupiter. It is run by HAL, a computer, but theoretically the computer is under human control. It (he?) goes mad, and becomes murderous; tries to take over the ship and its mission, the idea being that it is too important to leave up to people. This was entertainment, but it seemed to express an apprehension and sense of alienation that computers instilled in people in the 1960's. They were not accessible; their mythos exuded standardization and control. The IBM card and its slogan, "Do not Spindle, Bend, Mutilate or Fold," was a symbol in that time of this fear. We would all, metaphorically, be made into punch cards. Computers inspired a sense of depersonalization that was only aggravated by the American military's "electronic battlefield" attitude during the Vietnam war. During this period, it could definitely <u>not</u> be said that computers were something that the "man-on-the-street" could relate to.

In the last decade, a single invention, arguably the most important in the last quarter century, at least, has gone a long way toward revolutionizing the entire electronics industry and people's attitudes toward its products. That invention is the integrated circuit, the IC or "chip".

> This chip consists of many layers of silicon, silicon oxide, metals and other materials sandwiched together. Microscopic electrical circuits are etched upon each layer by electron beams and other techniques, so that a single chip can contain thousands of electronic components that act together.
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> This little chip has led to the creation of machines so powerful that the entire computational capacity of that first computer can now be contained in a device that can rest on the tip of a finger.[62]

The chip has truly revolutionized electronics. For the first time, it has made devices other than just radios, televisions and stereo equipment accessible and affordable by the general public. Once a chip is designed and programmed, it can be manufactured for virtual pennies. Entire computers put on a single chip are now commonplace in the American scene. We see them now in digital watches, electronic calculators, automatic cameras and children's games, to name a few. Minicomputers pervade all aspects of our lives, and now are starting to invade the home.

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[62]William Stockton, "Creating Computers that Think", New York Times Magazine, 7 December 1980, sec. 6, p. 42.

> The home has been the last bastion to fall to this great invasion of miniaturized machines. The debut came, as nearly everyone knows by now, with the digital watch and the hand-held calculator. These successes were followed by computerized additions to the automobile dashboard where the insect-size machines run automatic mileage, gas and oil checks; to the kitchen where ovens, coffee makers and similar appliances are guided to appropriate timings and temperatures; and to the bedroom where alarms and musical interludes, not to mention electric blankets and other heating and cooling operations, can all be controlled by the myriad brains of microprocessors.[63]

These functions have gone a long way toward humanizing the essence and use of computers. The home computer is now also starting to be commonplace. With the prices of home computers continuing to drop, it is possible that "every home will have one" by the late 1980's. This future goes even further. The home computer will not be an isolated "super-calculator". It will be able to hook into a large network via the telephone.

> If it was the microprocessor that launched the home computer revolution, it is the telephone-computer-network system that is converting the home computer into a machine that will be able to take its place unashamedly among home machine peers such as the telephone, the microwave oven and the television set.
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> By dialing certain numbers on the telephone, the computer can be made to provide news from the UPI wire. . . . , information from The New York Times Consumer Data Bank, tax tapes from Prentice Hall and stock information from Dow Jones.[64]

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[63] Lee Edson, "Computers at Home", New York Times Magazine, 30 September 1979, sec. 6, part 2, p. 108.

[64] Ibid., pp. 109, 113.

This is a far cry from the image presented by HAL. The affordable and accessible omnipresence of computers, to a great extent, has broken down that sense of alienation and fear that pervaded the 1960's.

Computers are becoming widely used in the creation of graphics. Architects can program a building into a computer, then isolate and blow up and change any part of the plan. Designers can put a three dimensional image into the computer and rotate it on the screen. Animated computer graphics are widely used in television advertising and for titling in television and movies. These functions, often with a strong aesthetic quality, further reduce the sense of distance between people and computers.

Secretaries now frequently type their letters onto a computer screen, making their corrections on the screen and letting the computer do the actual typing. Large hospitals have all their files instantly retrievable in a computer memory. Libraries are starting to use on-line search computers instead of card catalogs or microfiche. Travel agencies have computer terminals that connect directly into the airlines' booking computers.

There are but a few of the commonplace uses to which computers are being put. These applications do seem to serve the needs of people. They are controlled by us rather than managing and controlling our lives. They do make many tasks easier and

open many possibilities that are unique to their abilities. In general, these aspects of computer technology do fill an apparent humanistic function.

There is a cautionary note. We can grow to depend too much on the things they can do for us. Children today are growing up with computers--as toys and as tools, including hand calculators. Are today's children losing the ability to do arithmetic with anything but an electronic calculator? Will they lose an understanding of basic mathematics? Could a child raised with a computer do a long division problem with pencil and paper? Is such a fear really an anachronism?

These questions aside, computers can make very effective teaching machines in schools. In the near future, they have a great potential to truly individualize the educational process.

> Computers . . . make excellent teachers. They can give personal attention to hundreds of students at a time; their patience is inexhaustable; they are rarely in a hurry to get back to scholarly research; they are never sarcastic.[65]

> Computer techniques may well tend to individualize education. Biographic data on the student, his personality profile, data relating to perceptual skills, memory, and learning ability, motivational structure, and interests, plus complete data on achievement to date will permit a tutor to set tasks of reading, action and research on an individual basis, adapted to the student's level and capabilities. The tutor will be able to assess the results of this instruction with immediacy. For rote, routine, and factual learning,

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[65] Robert Jastrow, "Our Brain's Successor", Science Digest, March, 1981, p. 59.

> teaching machines and programmes can replace the teacher in many repetitive chores and free him for constructive activity and personal contact. As library facilities are automated, not only books and documents, but also films should become increasingly available for educational purposes. In turn, curricula can be individually tailored to student interests, abilities and needs. This should increase opportunities for developing creative personalities by greatly increasing the possible combinations of instructional inputs into the student population.[66]

There is another side of computer aided education which may be not quite so positive. One of the problems of education based on the student/computer interaction is the possible breakdown of the student / student interaction and the concomitant breakdown of the group dynamic in the classroom. It might tend to predicate learning on the "right answers". Could a computer deal with ambiguity? On the other hand, they might allow human teachers to be more creative in the classroom because they could be free from teaching rote or factual material.

It is hard to predict exactly what pattern will develop over time. The distinct possibility exists that human teachers will become less and less important because the computer does not need a school building. Computer learning could be done at home, where the home computer might best "know" the student. This, by reducing social contact at an age where much socialization takes place, might have a strong atomizing effect on young people, and further tend to reduce the exchange of ideas. It

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[66] Charles Dechert in Technology, Power and Social Change, ed. Thrall and Starr, p. 132.

would separate people rather than bring them together, exacerbating a tendency--already happening--in society of people to live within small, inwardly focused and individualistic nuclear families. This lack of close social ties can frequently be seen today in the aloneness of individuals in big cities. It is called "anomie".

Computer learning also has the potential for creating value change and socializing in directions "desired" by the powers that be (who design the programs). This starts to raise some very important value questions concerning a technocratic-technetronic future.

> The educational applications of modern data processing equipment extends far beyond making available documentary and other instructional materials, and providing the learner with analytic instruments. The computer also permits the use of very sophisticated simulation methods for the development of attitudes, values, decisional and perceptual skills. Simulation can be used to instill both operative habits and orientation in terms of a reference model of personality. Simulations can be used, for example, to develop the behaviors and value orientations that make for competitive efficiency in a modern industrial economy. This approach may well permit us to program rapid cultural change--even to achieve a net separation in certain critical behaviors between one generation and the next. The desirability of such procedures, and the limits of their application are ethical questions having implications for the long term development of all mankind.[67]

The prospect of computers in education presents an ambiguous picture. It is not possible to make blanket value judgments

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[67]Ibid., pp. 132-133.

of these possible futures. We must merely be aware of alternative directions and form our conclusions as events develop.

Computers are making major inroads in business at all levels, clerical and decision making. When a computer takes over decision making power, or is given that power, in more appropriate terms, one must question to what extent people in these functions start to become obsolete.

> During the last ten years, machines have taken over a large fraction of clerical jobs in the United States, such as accounting and inventory control; computers fill customer orders and manage airline reservations; and they are beginning to move up into higher levels of management, to make competent decisions on security investments and marketing strategies. . . .
> If the trend continues, many jobs in business and schools will be filled by computer brains that talk, listen and remember everything. They will be there because they cost less to keep in repair than human brains, they aren't unionized, and they never get tired.[68]

There is another side to computer science, and that is the realm of artificial intelligence research. Even at this point, computers are basically stupid, "idiot-savants". They are only as smart as their programmers. However, with the development of super-small bubble memories and the technological level of integrated circuits virtually doubling every year, artificial computer intelligence is a virtual not-too-distant future certainty.

The likelihood of true, intelligent, thinking computers

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[68]Jastrow, "Our Brain's Successor", p. 59.

could be a tremendous boon to mankind, greatly extending our intellectual capacities. The volumes of information a computer can remember and use to make conceptual connections is potentially far greater than that which even the most intelligent person is capable. This ability, harnessed by man, could open currently unimaginable avenues of discovery. It also suggests using intelligent computers in areas such as assembly lines to operate "dumb" robots, freeing human labor from much boring and repetitive work. On the other hand, they may also replace people in interesting and demanding work because they have greater power of analysis and, by certain definitions, are more reliable decisions makers.

> . . . Artificial-intelligence researchers are developing computers that can listen to spoken sentences and grasp their meaning; that can read news stories and write succinct, accurate, grammatical summaries; that employ robots, who never get bored, to work on assembly lines; that assemble data about a sick person--and suggest a diagnosis.[69]

At this point, would we be starting to abdicate our humanity and our responsiblity for ourselves to computers? Would we be allowing a machine that we designed as a tool to become master; to control our destiny and lives, because we no longer know how?

> What they [computer scientists], in fact, now conceive of as being a far more realistic threat than the chance of some nonfictional HAL plotting against humans is the possibility that the human race will become too dependent upon its machines; that we will lack the ability to understand why they reach the decisions they do and take the actions they do.[70]

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[69] Stockton, "Creating Computers That Think," p. 41

> . . . There is the fear that machines could come to possess all the capabilities that have set humans apart. Will there be machines that will intrude into-- or supplant-- the province of real intellect, a province of knowledge, intelligence, value judgments, decision making, aesthetics and, most of all, emotions. If a computer could ultimately be programmed to exhibit them all, would we then be in danger of programming ourselves out of existence? By permitting the creation of intelligent machines, would we assure the immortality of machines and unwittingly sow the seeds of our own extinction?[71]

On a different track from these possibilities lurks the serious "technetronic-big brother" dystopia; where the computer really becomes used to control people--a totalitarianism by computer, since information is power and computers now have a huge volume of information on virtually every person in this country.

> Central files having extensive data on every individual exist throughout the society. At the national level extensive dossiers are held by the Federal Bureau of Investigation, the Internal Revenue Service, the military services, the Bureau of the Census, the Labor Department and the National Science Foundation; by schools and colleges, the Educational Testing Service and similar agencies, insurance companies (auto, life, medical), medical data centers, banks and credit agencies, professional associations. Biography publishers like Marquis also have extensive dossiers. Apparently data is often exchanged among such agencies, and is, of course, potentially available to persons in agencies that process or do computer work for such repositories.[72]

Would the authorities be people or computers, all hooked up, by their own decision, into a single matrix? This possibility

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[71]Ibid.

[72]Dechert in Technology, Power and Social Change, ed. Thrall and Starr, pp. 126-127.

is chilling, and its consideration is no longer the stuff of science fiction, as reality outstrips prediction.

> . . . If the new computer technology could be subverted, enormous evil could result. Computers taught to interpret speech could be programmed to listen in on virtually every human conversation, learn to ignore the trivia, report to the authorities on what would be considered objectionable and take action. The ultimate fear is that the computers themselves will take over.[73]

There is no timetable that any scientist studying computer intelligence would be able to say is a reliable estimate for such developments. All that can be said is that events are moving fast. IC and subminiature memory techniques are leapfrogging. The computers we have today could barely have been dreamed of fifteen years ago and may well be obsolete five years from now.

> Given the astonishing pace of scientific development, who can say how quickly these questions about artificial intelligence will cease to be future abstractions?[74]

An area where computers and contemporary electronics technology is making tremendous strides is in the field of medicine. One of the important recent technical developments has been the CAT Scan machine. Short for Computerized Axial Tomography, it is used to take low-intensity x-ray photographs of the brain at many levels, with the images being created by the computer. It

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[73]Stockton, "Creating Computers That Think," p. 42

[74]Ibid.

has enabled neurologists to find abnormalities in the brain previously undiscoverable or diagnosable only through other, painful diagnostic procedures. The CAT Scan has the potential of being able to similarly "see" the whole body. Computers are now used in analyzing case histories and symptoms, helping physicians to diagnose many diseases.

Not only computers, but the whole field of electronics is making inroads into diagnostic and curative medicine. Lasers are being used in opthalmological surgery to reimplant detached retinas. Infra-red sensing devices enable doctors to record the different heat levels of various areas of the body by computer generated color photographs. These images help to find early signs of malignancies not otherwise detectable. Sonar is being used to "look" at babies while still in the womb, check the position before delivery, and let parents see their baby before it is born. The same device lets a heart specialist see a patient's beating heart.

There have also been strong advances in the treatment end of medicine. Smallpox has been totally eradicated. Using microsurgery, successful reimplantation of severed limbs is becoming a "normal" procedure. The first artificial heart, powered by air pressure, has recently been developed. Many tropical and infectious diseases are becoming controllable. Around the world, more people are living longer.

Not unpredictably, one of the principal results of mod-

ern medical technology is the further acceleration of world population growth, particularly in the poorer, less developed regions of the world. In many of these areas, food production is not anywhere near adequate to handle the population pressures. These countries do not have the technologies or the energy to mechanize farming and increase their agricultural yields to an adequate level to feed their populace. This is a serious problem, for it is the poorest countries that have the highest birth rates. It is an old and proven axiom that as a nation industrializes and gains in wealth, its birth rate declines. The matter of improved medicine in many poor countries, then, becomes a paradox: lives are saved from infant mortality and infectious diseases only to have many people live the slow death of starvation.

This paradox is at the heart of the contradiction that sometimes arises in contemporary humanism. The Hippocratic Oath, that most humanistic of all documents, implores physicians to save lives. So, they deploy all of the knowledge and technology at their disposal, only to create more suffering from the plague of too many people: endemic starvation.

The answer to this problem must take two directions. It is safe to assume that world population growth will continue. While encouraging birth control and family planning, we must help these countries to create for themselves the socio-economic technological conditions that lead, in an organic manner, to

lower birth rates. We also must create the energy and "hardware" to enable these areas to produce more food for themselves.

In many respects, the American society in the late twentieth century can be defined by its transportation and communications systems. Rapid and easy communication and transportation characterize the American scene.

During the period of relative prosperity and low fuel prices in the twenty-five years following the Second World War, the "right" to personal, discretionary automobile transportation became an assumption in this country. The effect of the automobile (and jet airliners) has been to make it possible to get anywhere in the country quickly and easily. The last thirty-five years has seen massive roadbuilding take place, including the entire Interstate Highway System. It has become a truism that the largest sector, if not the entire, American economy is based around the automobile and its ancillary industries.

The automobile, since around 1945, has transformed the American society. People have moved out to the suburbs, creating urban sprawl and the decay of downtown areas. Its exhaust is a major pollutant, resulting in thousands of deaths from lung cancer, emphysema, heart disease and other ailments. The excessive demand for fuel has made the United States subservient to the Middle Eastern nations. Because people drive to work and drive to shop, neighborhoods and communities break

down. People become alienated from each other, increasing the psychic and emotional demands on family and home life, and perhaps thus contributing to increased divorce rates.[75]

These are all second order consequences, unintentional effects of the automotive technology. The principal effect--the ability to travel "rapidly, easily, cheaply, privately door-to-door"[76] has been a benefit to a large proportion of the American population. The second order effects, however, have reduced the quality of life for almost all Americans.

The electronic communications revolution has changed the entire world. Largely due to television and communications satellites, no longer can a major event anywhere go unnoticed or unseen. Television, in the words of Marshall McLuhan, has made the world a "Global Village". At any point in time, any one part of the world can be in touch with and see any other part of the world. The informational power of television is awesome. It brought the Vietnam War into American living rooms, the first time a war has been "viewed". Its social and political power was illustrated by one incident. One of the final contributing factors in President Lyndon Johnson's decision not to seek a second term was Walter Cronkite's decision to oppose the War

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[75]Edward Cornish, The Study of the Future (Washington, D.C.: World Future Society), pp. 7-8.

[76]Ibid., p. 8.

on the CBS Evening News. The shooting deaths of John Kennedy and John Lennon were worldwide events due to the impact of the television media.

People are being presented with an unprecedented quality of cultural events, such as live opera, that at one time were reserved for an elite. Never, before Luciano Pavarotti, has an opera star become a media star, recognizable around the world. When Roots was first shown in the United States, an entire nation stopped every night for a week. A single sporting event, the Super Bowl, has virtually become a national holiday. Public Television regularly airs drama and documentary material of very high value. Yet, a result of all this is the tendency for culture to become homogenized. Everyone watches basically the same thing. The question, "Who shot J.R.?" became national, if not international news.

However, while we are all watching the same shows, receiving the same information, we are doing it in the comfort of our own living rooms. People tend to stay home, going out less, meeting and getting to know people in their communities less. People rely less on themselves and peer groups for entertainment; become spectators rather than participants. Leisure time is taken up by watching rather than doing. As with the automobile, by reducing social contact, the television acts to increase the atomization and fragmentation of our society.[77]

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[77]Ibid., p. 9.

New developments such as the home video decks and video disks will create the potential for home video libraries, much the same way people today collect records. Movies, opera and drama will be made expressly for video disks, with the potential of a sound quality better than today's best stereo equipment, via the digital laser scanner system. The new communications satellites will facilitate the proliferation of television networks--scores, if not hundreds of stations will go on the air, breaking down the hegemony of the major networks. There will be television to suit any taste. These developments, while providing undeniable services, will only exacerbate the tendency for people to center their lives in home--in the television-entertainment-computer center, further breaking down communal social contact. Television may make us all a Global Village, but it will likely make us urban and suburban strangers.

In looking at the ecological morass that man, essentially technological man, has created, there are basically three paths we can follow. One is the romantic notion which, individually or collectively, advocates a return to a pastoral life and a Luddite rejection of technology as being the main cause of our problems. Looking at current world realities, this is not a very realistic solution.

> . . . Sharp limits on food, energy, and materials confront us at a time when most of the human race is still poor, and when much of it is on the edge of starvation. We cannot solve that problem by a retreat to a

> pastoral, machine-free society: There are too many of us to be supported by preindustrial agriculture. . . .[78]

> At times, spirit beckons falsely . . . moves into blind channels from which it must retreat in order to go forward once again. Its false beckonings in certain forms of romanticism can be found in the nostalgia of our times, urging us to return to the "natural life" of the Indian in the wilderness. . . .[79]

> Maybe it would be nice to go back to a time when each of us had our own green field and our untouched spring and our own little house somewhere off in the wilderness. For better or worse, however, there are already three and a half billion of us on this planet and there are going to be a lot more before we stop the population explosion. We are not going to feed, clothe, and shelter that number of people without science and technology.[80]

The second is to keep on going as we have been, using resources and disposing of wastes more-or-less in the haphazard and often careless manner of the recent past. This too, is not a tenable solution. We are now able to see, in the relatively near future, the total depletion of certain essential resources.[81] We also endanger the ability of the biosphere to support life. Ecological catastrophe is a real threat. The continued growth of energy production and consumption of burnable or nuclear (fission or fast breeder) fuels poses one more problem, that of raising the surface temperature

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[78]O'Neill, The High Frontier, p. 15.

[79]Kreyche, "The Meaning of Humanness", pp. 43-44.

[80]Robert Theobald in Technology, Power and Social Change, ed. Thrall and Starr, p. 18.

[81]Malcolm Ross-Macdonald, Life in the Future, (Garden City, New York: Doubleday and Company, Inc., 1977), pp. 60-61.

of this planet.

> . . . Within about eighty-five years the power we will be putting into the biosphere will be enough to raise the average temperature of Earth's surface by one degree centigrade. That is enough to cause profound changes in climate, rainfall, and in the water level of the oceans. Some geologists feel that the ice ages of the past were brought on by temperature changes no larger than that.[82]

The third is to accept the conditions we exist in right now as real and as givens. We need to recognize that there are serious problems in the world that require positive action by man to be ameliorated. Using the technological capabilities we have and are developing, a healthy imagination and the humanistic spirit of creating a better life for the people of this planet, we must go on from here and exercise our true power.

> _Fictitious_ power, as Rebecca West has told us, is the power to order and be obeyed. But _real_ power is _the power to direct one's environment toward a harmonious end_.[83]

A harmonious end must mean dealing with the real needs of the world's population without despoiling it at the same time. To accomplish this end, novel solutions may be needed.

The problem that is today and in the foreseeable future most acutely tied in with environmental questions is that of energy. There are a limited number of sources of it, and there is a virtually unlimited need for it. The energy con-

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[82] O'Neill, _The High Frontier_, p. 24.

[83] Albert William Levi, _Humanism and Politics_ (Bloomington, Indiana: Indiana University Press, 1969), p. 14.

sumption of the developed and industrial nations is enormous and the potential need of the underdeveloped Third World may be even greater, as energy is the key to their development, if not their very survival.

> In the wealthier areas of the world, we depend on mechanized farming to produce great quantities of food with relatively little human effort; but in much of the world, only backbreaking labor through every daylight hour yeilds enough food for bare survival. About two-thirds of the human population is in underdeveloped countries. In these nations only a fifth of the people are adequately fed, while another fifth are "only" undernourished--all the rest suffer from malnutrition in various forms.
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> In these countries the need to increase the food supply is desperate. When the land cannot support the population, and starvation is general, disease strikes at the old and even harder at the young. Small children of a family contract the crippling diseases of malnutrition; parents must watch their children die, and be powerless to save them. In such areas some degree of industrialization is not a luxury but a desperate need; it is a great tragedy of the late twentieth century that the satisfaction of such a need is being denied or delayed in part because of the energy and material limits of Earth.[84]

These countries see the level of living standards possessed by the wealthy and advanced nations--and the contrast with their low level of development and their relative impoverishment. They can see what they do not have and feel they are being denied, setting up extreme political-economic divisions. They aspire to the level achieved by the developed nations, but it is unattainable.

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[84] O'Neill, The High Frontier, pp. 15-16

> Knowledge, once given, can never be taken away. That is the essence of the Revolution of Rising Expectations--the awareness everywhere in the world that the problems of mankind can be solved by the wit of man. And at the root of much of the disenchantment with impoverished "freedom" and of the disturbances all over the world is the sense of being deprived of the advantages which the technologically endowed countries so consistently boast and of being denied their basic wants.[85]

The key to attaining these advances and satisfying those basic wants and needs is adequate energy, a commodity that in our era of "energy crisis" in is very limited supply.

The energy crisis that we face today is a double-edged sword, and it can hurt us with either edge. On one side, the source of most of the energy we use is fossil fuels--petroleum and coal. There is a finite amount left in the earth of both of these fuels, and their cost is high. Our other consumable fuel is uranium, which also is in limited supply. If these fuels are to be relied upon to power our technology and heat our homes, our future, too, becomes limited. The other side of the problem is the environmental price to be paid for this energy. Burning fossil fuels foul the atmosphere. Coal is a prime contributor to the creation of acid rain. Mining coal, particularly strip mining, can irrevocably ravage the land. Oil spills, becoming all too common, cause tremendous known damage to fish, mammals and birds living in, on or from the oceans. They also cause unknown levels of long-term

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[85]Ritchie-Calder, "Putting Ethics to Work," pp. 154-155.

harm to the oceanic ecosystem. The most serious problem with fission reactors is the as yet unsolved problem of safe disposal of nuclear waste, let alone the unknown dangers of the nuclear generating plants themselves. One response to the short supply of uranium is to design and build fast breeder reactors, which produce more fuel than they use. They also produce explosives grade plutonium, the stuff of which nuclear bombs are made. Such devices are not very hard to build, and the more breeder reactors that are built, the more plutonium there is, the easier it would be for some terrorist to steal some. . . .

Energy and food production are tied together. The countries that lack enough food also lack energy. These are the underdeveloped nations in the Third World. The situation can become, no pun intended, explosive. It pits the "haves" against the "have-nots"; the industrial and post-industrial technological societies against the agricultural societies. The ultimate potential is total war.

> . . . As we plunge deeper into the energy-food crisis--we approach a world society governed by mutual threat; deprive me with oil, and I deprive you with food; threaten me enough with deprivation, and when I have nothing left to lose I will risk life itself in a last desperate gamble; provide for me, or I burn you to death with hydrogen bombs.[86]

This does not paint an optimistic future for man. From current trends, the more we develop, the more energy we use, the worse we bury ourselves in our own effluents and poisons.

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[86] O'Neill, The High Frontier, pp. 38-39.

Yet, we cannot stop consuming energy. For the survival of the human race at any level of prosperity, we must develop affordable, non-polluting sources of energy.

> To summarize, our hopes for improvement of the standard of living in our own country, and for the spread of wealth to the underdeveloped nations, depend on our finding a cheap, inexhaustible, universally available energy source. If we continue to care about the environment in which we live, the energy source should be pollution-free and should be attainable without stripping the Earth.[87]

Ultimately we cannot, for the sake of energy, retreat into zero growth. That is like saying we have found our ecological, evolutionary niche. The oyster, the horseshoe crab and the cockroach all found their niches hundred of millions of years ago. Man must either develop and grow or retreat into oblivion. We cannot stand still.

Where, then, can we look for energy? There are many relatively small sources that can add up to a large amount of electricity. Wind power, geothermal (Iceland, a volcanic island, heats this way), ocean wave power, hydroelectric power (which aside from previously discussed problems, also destroys much wild or wilderness land and rivers) are all drops in the bucket, some even steady drips. The bucket, though, seems to get bigger and bigger. Controlled heavy water fusion is a potential future source of non-polluting power, but it is a long way off and still bears the problem

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[87]Ibid., p. 23.

of waste heat.

There is one more source of power, and that is solar. It is already starting to demonstrate its efficacy in heating buildings, even in cold, northern areas such as Rochester, New York. It has been used in Maine, Minnesota, Idaho, even Canada. For heating water or passive building heating systems, it works quite well. The greatest need, however, is the generation of electricity.

There are a number of inherent problems in using solar energy to generate electricity with photovoltaic cells. The most serious is that they need sun to work, and lots of it. Even in the best locations, they only get it part of the day. The land area that would be needed to be covered with such cells is enormous, hundreds, if not thousands, of square miles. They could only be used, with even a minimal efficiency, in areas that receive steady reliable sunlight, such as our Southwestern deserts. The earth's atmosphere filters out a large part of the sun's energy, further limiting its potential effectiveness. At best, they could provide some of the power for a small part of the country.

There is one place where solar generation of electricity faces none of these problems. That is in outer space. It has been proposed by a number of people, most notably the Princeton University astrophysicist Gerard K. O'Neill, that the best long-term answer to our energy problems is the building of Satellite Solar Power Stations (SSPS) in geosyn-

chronous orbits around the earth."[88]

In fact, O'Neill is saying much more than that. He is proposing the colonization and industrialization of space in large, permanent stations in high earth orbit. The first station, to be a self-supporting system, he calls Island One. It would have, when completed, a population of about ten thousand people. That is, by his estimate, the minimum number needed to reach 'ignition point'--the level where they will be generating new wealth fast enough so that further growth won't require subsidy from earth.[89]

Once an initial construction base is set up, materials to build Island One need not come from the earth. As the surface of the moon has been shown to be composed mostly of oxides of iron, aluminum and silicon, most of the materials required for construction (including breathable oxygen as a by-product) is available right there. With no atmosphere and a gravity pool much shallower than the earth's, lifting construction materials presents no problem. In fact, a device has been developed, called a "mass driver", which would use solar generated electricity to drive an electromagnetic accelerator to lift ores off the moon to the station.[90]

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[88]A geosynchronous orbit is an orbit in space about 22,500 miles above the earth, where the satellite is always over the same point. Such orbits are presently used by communications satellites.

[89]O'Neill, The High Frontier, p. 116.

[90]Ibid., p. 140.

A giant nuclear fusion reactor, a safe but usable 93 million miles away, provides all the heat that will be needed for the refining and smelting of metallic ores and local electric generation.

The first large project for the colonists, after the completion of Island One could well be the construction of Satellite Solar Power Stations.

> The plan consistsof locating a geosynchronous orbit above a fixed point on Earth's surface, a large solar power station. At the station solar-electric power would be converted to microwave energy, which would then be directed in a narrow beam to a fixed antenna on the ground.
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> . . . Research on high-power microwave transmission has demonstrated experimentally that power can be transmitted at an overall efficiency of at least 55 percent. The target figure for economic viability is not much higher than that, so with moderate development one would expect the target to be attained. The environmental problems of microwave power transmission will have to be much less severe than those of radioactive waste generation from fission of fusion nuclear plants. The microwave beam would arrive at Earth with a beam width of about seven kilometers. Its intensity would be modest, less than half that of sunlight. In contrast to sunlight, though, it would be there all the time, even at night or in clouds or rain, and it would be in a form ready for conversion to DC current with a loss of only 18 percent. The antenna region on Earth would be fenced, and outside the fence the intensity of microwave radiation would be no higher than outside a microwave oven with the door closed. . . .
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> Satellite solar power would have significant advantages over its possible competitors, beside the fundamental one of generating no radioactive wastes. Because the conversion of microwave energy to direct current could be done with such high efficiency, only a very small fraction of the total power would be released as waste heat into the biosphere from such an installation.

> In contrast, generator stations using fossil or nuclear fuels deposit as waste heat in the biosphere about one and a half times as much energy as they put into the power grid.[91]

The land area needed for the antenna would be much smaller than that needed to generate the same amount of power with ground-based photovoltaic cells.

> In the extreme case (certainly not realizable in practice) that SSPS power were to become the sole source of electric energy in the United States in the year 2000, the land area necessary for the SSPS antennas would still be only 0.2 percent of that of the continental United States; that is, about one-fifth of the area already devoted to roads. Unlike the roads, SSPS antennas could be located in remote areas where they would not be visually obtrusive. They would be almost fully transparent to sunlight, and would block out microwaves from the land below them, so the areas below them should be usable as protected grazing land.
>
> By contrast, if solar cells at Earth's surface were to be used to supply all our electric power, we would have to cover about forty times as much area, or 8 percent of the continental United States, with opaque solar arrays.[92]

As satellite solar electricity begins to fill a larger part of our energy needs, it frees petroleum from a great deal of the need to use it as a fuel. That is not to say we will not consume petroleum--airplanes will still need it, automobiles (as long as they last) will probably need it. Its consumption as a fuel will, though, drastically decrease. We will then be

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[91]Ibid., pp. 172-173.

[92]Ibid., p. 174.

able to put it more fully to perhaps its best use--the manufacture of fabrics and plastics.[93]

At the time of this writing, 1981, projects such as massive SSPS, if they are to happen, may still be twenty years away. Other, more immediate uses by industry of the potential opened by the space shuttle are closer at hand. It is expected the American business and technological concerns will take advantage of the shuttle to develop processes that could not be done on earth or only at low efficiency. What space provides is a sterile, total vacuum, and controlled gravity capabilities down toward zero gravity. The possibilities are just beginning.

> Joseph P. Loftus, Jr., chief of technical planning at NASA's Johnson Space Center, believes that the advent of the shuttle could do for the economic development of space what the transcontinental railroad did for the American West. . . .
>
> . . . NASA sees a day when dozens of shuttles will be commuting to and from earth carrying enormous payloads. Crews aboard the shuttles could build and maintain gigantic orbiting communications satellites, solar power stations that would transmit energy to earth, and highly automated factories where industry could use the unique environment of space to make things that cannot be made as well, if at all, on earth . . .
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> . . . Based on theory and several experiments on earlier space flights, the crystals that are the raw materials of the electronics industry could be made purer and more reliable in space. New alloys and new

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[93]Ibid., p. 58.

> types of glass should also be possible, and, for the pharmaceutical industry, biological substances could be separated more cleanly and efficiently. By the mid-1980's, according to NASA, some special products sold on earth, probably pharmaceuticals and crystals for microelectronics, will bear the made-in-space label.[94]

One such pharmaceutical process is already being planned. In an experiment conducted in 1975 during the Appolo-Soyuz mission, the rare and costly enzyme urokinase was separated from human kidney cell cultures at six times the efficiency that could be done on earth. Urokinase, a drug which dissolves blood clots, is so difficult to produce here that a single dose now costs up to $1,500.00. It is estimated that made in space, the cost could drop to $100.00. In the United States, urokinase could prevent 50,000 blood clot deaths a year.[95]

Glass and crystals that can be produced without needing containers, because of the microgravity environment, will be far purer than anything producible on earth, with tremendous implications for fiber optics, lasers, and the electronics industry. Processes will be developed that cannot now even be imagined, until we start working up there. Gradually, more and more work will start to be conducted in space. People will start to live there at least semi-permanently. Eventually, large colonies will happen. Then, many industries

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[94] John Noble Wilford, "The Industrialization of Space: Why Business is Wary", New York Times, 22 March 1981, sec. 3, p. 1.

[95] Ibid., p. 22.

now working on earth, lured by cheap, non-polluting energy and plentiful resources on the moon or in the asteroid belt, will move their operations into space.

> Each time the balance is tipped for a particular industry, so that production in space becomes cheaper than on Earth, we will be relieving Earth in two ways: we will be removing the burden of energy usage and materials mining for that industry, and we will be generating an additional force to draw away population: the work force of that industry, and the families of the work force.[96]

If these ideas seem not visionary but harebrained, impractical, or even ridiculous, a look back into history might be appropriate. In examining new developments that may be harbingers of major growth and change, it is healthy to keep skepticism restrained. How many people in 1910 saw much future in the airplane? People frequently scoff at new ideas.

> In 1876 the inventor of the telephone, Alexander Graham Bell, offered exclusive rights to the new invention to Western Union, then the largest communications network in the United States. WU President William Orton was unimpressed. "What use could this company make of an electrical toy?" Orton asked. Later, Western Union officials watched helplessly as the "electrical toy" gobbled up most of its market.
>
> In 1878 gas company securities dropped because an American inventor named Thomas A. Edison had announced he was working on an incadescent lamp that would use electricity. The British Parliament named a committee to look into the matter, and to the relief of the gas companies witnesses testified that Edison's ideas were "good enough for our transatlantic friends . . . but unworthy of the attention of practical scientific men."

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[96]O'Neill, <u>The High Frontier</u>, p. 57.

> Chester Carlson, who invented the Xerox machine, tried for years to get U.S. companies to invest in his invention. The IBM Corporation looked over the contraption twice and turned it down both times. Finally the Haloid Corporation, an ailing firm desperate enough for a wild flyer, gambled on the machine's development. Sales of Carlson's machine boomed and the Haloid Corporation metamorphosed into the Xerox Corporation.[97]

The importance of moving into space is more than a mere technological and industrial matter. The colonization of space has profound practical political and sociological implications for man. Since the beginning of human history, our species has learned to live in a wider and wider set of conditions, often very different from those in which we were evolved.[98] Space is another jump in that direction. At a time not too far into the twenty-first century, there may well be not one but many space colonies or permanent communities. These will offer the opportunity for diverse social experimentation.

That experimentation will be not a luxury but a necessity. It will be an organic outgrowth of the experience of man living in totally new conditions. Old social formulas will not work and new ones will have to be devised and evolved. A new branch of the race will be formed, as children will grow up who are born in space, for whom earth may be a place to visit, but not a home.

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[97]Cornish, The Study of the Future, p. 189.

[98]Feinberg, Consequences of Growth, p. 23.

In years and centuries past, the "malcontents" of society have had new, sparsely populated areas to move to (sometimes taking land from people who already lived there). This, today, is no longer possible. Space colonies again open this up as a human option. It could become a safety valve, much as the Massachusetts Bay Colony was over 350 years ago for the Pilgrims. We would again have places to migrate to.[99]

The experimentation in new ways of living could have profound feedback on ways of life and patterns of society back on earth.

> . . . It [the colonization of space] would allow a much greater amount of social experimentation than is possible in organized societies, in which almost all activities must meet with the acceptance or toleration of the whole society. Many of these social experiments would probably fail, but some might be successful enough that they would serve as models for the rest of humanity. Such indeed was what happened as a consequence of the colonization of North America, whose most important contribution to human life has been not the technologies that have been developed here, but rather the social and political innovations developed in the various colonies, and summarized in the U.S. Declaration of Independence and Constitution.[100]

The colonization of space may be the beginning of man's reach out into the universe, moving out in an evolutionary leap. We would be, for the first time in our history, totally designing our environments to suit our needs and desires.

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[99] Ibid., p. 32.

[100] Ibid,

We would, in a sense, be starting from scratch, where the conditions of life are ours to define.

> . . . We are at present parasitic passengers on a minor planet. Through space colonization, we could create a new situation, in which we inhabit environments designed by and for ourselves, and in which the domain of life eventually becomes comparable to the extent of the matter in the universe. This is a goal worthy of our consideration.[101]

When Apollo 11 landed on the moon in July, 1969, and Neil Armstrong took that "small step" onto the lunar surface, the whole world stopped and watched. For that moment, perhaps, all differences were forgotten. We all looked up at the moon and realized that there were people up there on it. That body in the sky that had been the center of fantasy and dreams for untold thousands of years was no longer an alien planet. On that day, Armstrong may have personified all humanity--and we may all have been one.

Today, the key to man's future in space, to permanent colonies, to factories in space, to energy satellites is the space shuttle. As this is being written, the first shuttle, the Columbia, is weeks away from its initial flight. In the long run, this may be an event more significant for the future of humanity than landing on the moon. It is the beginning of man leaving the planet for more than just an excursion. It is

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[101]Ibid., p. 40.

the beginning of men and women moving into and living in space. That may be the true next "step for Mankind."

As we take that step, the practical matters already discussed--technological, social, economic and political--are all important. Yet, there may be a reason more important for man to venture into space to stay. We have no real frontier left on earth. It is in the nature of the human race to push, to strive, to risk the unknown. The challenge of the frontier may be necessary for the psychic survival of the human race, a challenge so great we can never master and conquer it, an unlimited goal. Mankind is a restless creature; that striving, that discontent is in our very nature. We now, finally, are on the verge of a frontier without limits.

> This divine discontent is part of our destiny. It is one more, and perhaps the greatest, of the gifts we inherited from the sea that rolls so relentlessly around the world.
>
> It will be driving our descendents on toward a myriad unimaginable goals when the sea is stilled forever, and Earth itself a fading legend lost among the stars.[102]

That struggle for ideals or goals beyond our abilities, at any point in time, is the greatness of mankind. It is the risk-takers--the "do-ers" and "try-ers"--who have made the

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[102] Arthur C. Clarke, The Challenge of the Spaceship, (New York: Pocket Books, 1958), p. 140.

history of man. It is also those who sometimes gave their all and found it not enough--they did not fail for not trying. There will be many failures as we move into space--and it may be as much by the failures as the successes that we mark our progress. For people to fail when extended beyond known limits is no shame--and there will be many unknown limits to discover in space.

> It makes a great difference in human life what men try to achieve, even if they fail. Indeed it might be said that men's failures are more important than their successes; for the successes usually lie in the line of least resistance, whereas the failures imply that the goal is high and that the effort is rightly directed. It is the essence of ideals that they should be unattainable. They define not what men possess but what they seek.[103]

What we are looking toward is the most exciting leap in our history. In the three billion years (give or take a little) that life has existed on earth, and the three million that man, in some form, has evolved, we have lived off and been nurtured by this bountiful planet. It is only six thousand years since the invention of the plough. Mankind, as a race, is just moving out of its infancy. This may be the time to leave that stage and start to grow into our destiny. We are ready to begin our move out into the universe.

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[103]Perry, The Humanity of Man, p. 99.

> The earth is the cradle of Mankind--but you cannot live in a cradle forever.[104]

> For a man, "home" is the place of his birth and childhood--whether that be the Siberian steppe, coral island, Alpine valley, Brooklyn tenement, Martian desert, lunar crater, or mile-long interstellar ark. But for Man, home can never be a single country, a single world, a single solar system, a single star cluster. While the race endures in recognizable human form, it can have no one abiding place short of the Universe itself.[105]

> . . . The freedom of the Universe is the greatest prize which human hands have ever reached out to grasp.[106]

It is this sense of freedom, of ability to move and go anywhere, to achieve to and beyond our limits--in space and on unknown worlds, as well as on earth--that is the untimate promise for man of the exploration of space.

For perhaps, the final quality that makes man different from other life on this planet is not merely the ability to make tools, nor the technological achievements, nor the facility in adapting environments to suit human conditions. It is the ability to dream, to look beyond what is and see other realities, to see what can be.

> . . .Our civilization is no more than the sum of all the dreams that earlier ages have brought to fulfillment. And so it must always be, for if men cease to dream, if they turn their back upon the wonder of the Universe, the story of our race will be coming to an end.[107]

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[104]Clarke, quoting the early 20th century Russion astronautics pioner, Tsiolkovsky, in <u>The Challenge of the Spaceship</u>, p. 175.

[105]Ibid., p. 139.

[106]Ibid., p. 178.

[107]Ibid., p. 27.

CONCLUSION

> . . . Events are moving so rapidly that what is now at stake is the very survival of the human species itself. Science has emancipated man from the bondage of dogmatic religious mythology and it has provided him with the instruments for remaking and reordering his life, improving and enhancing it immeasurably. But whether he will be able to create a new and better world with vision and daring, or will destroy himself in the process is the real option that he now faces. . . .[108]

We are, unquestionably, facing a serious crisis in the world today. We are in a period of upheaval and historical transitions: agricultural to industrial and industrial to technological. The tensions, worldwide, that these clashes create are enormous. There are also tremendous pressures created by and within the technological order itself that threaten destruction--military or ecological--and are the root cause of profound dehumanization. There is also a tremendous potential for the good of man contained in technological possibility.

Technology does not make decisions, people do. Governments do not make decisions. People in the governments do. The final questions, then, is whether the people who make decisions can be controlled and made responsive to real human needs; whether they make decisions for the "right reasons"

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[108] Kurtz, ed., The Humanist Alternative, p. 5.

becomes idealistic and probably not reasonable. It rarely has happened on a large scale in human history, and there is no real reason to expect any change now. There are no utopias.

Perhaps the most reasonable, realistic and optimistic hope we can afford is that through the efforts of women and men of good will, we will, as a race, continue to muddle along as we always have--with some bright successes, some failures, and the most dire possibilities being avoided. We must hope that some level of rationality in the world can prevent a re-enactment in the future of a Holocaust with the destructive capability we now possess.

It is possible, that as we begin to leave the planet in larger numbers, on a long term basis, the daring and excitement of the project and the metaphorical view of earth from space will stir the awareness in people of our commonality, and the smallness and finiteness of earth, and of our need to work together to solve and share our problems.

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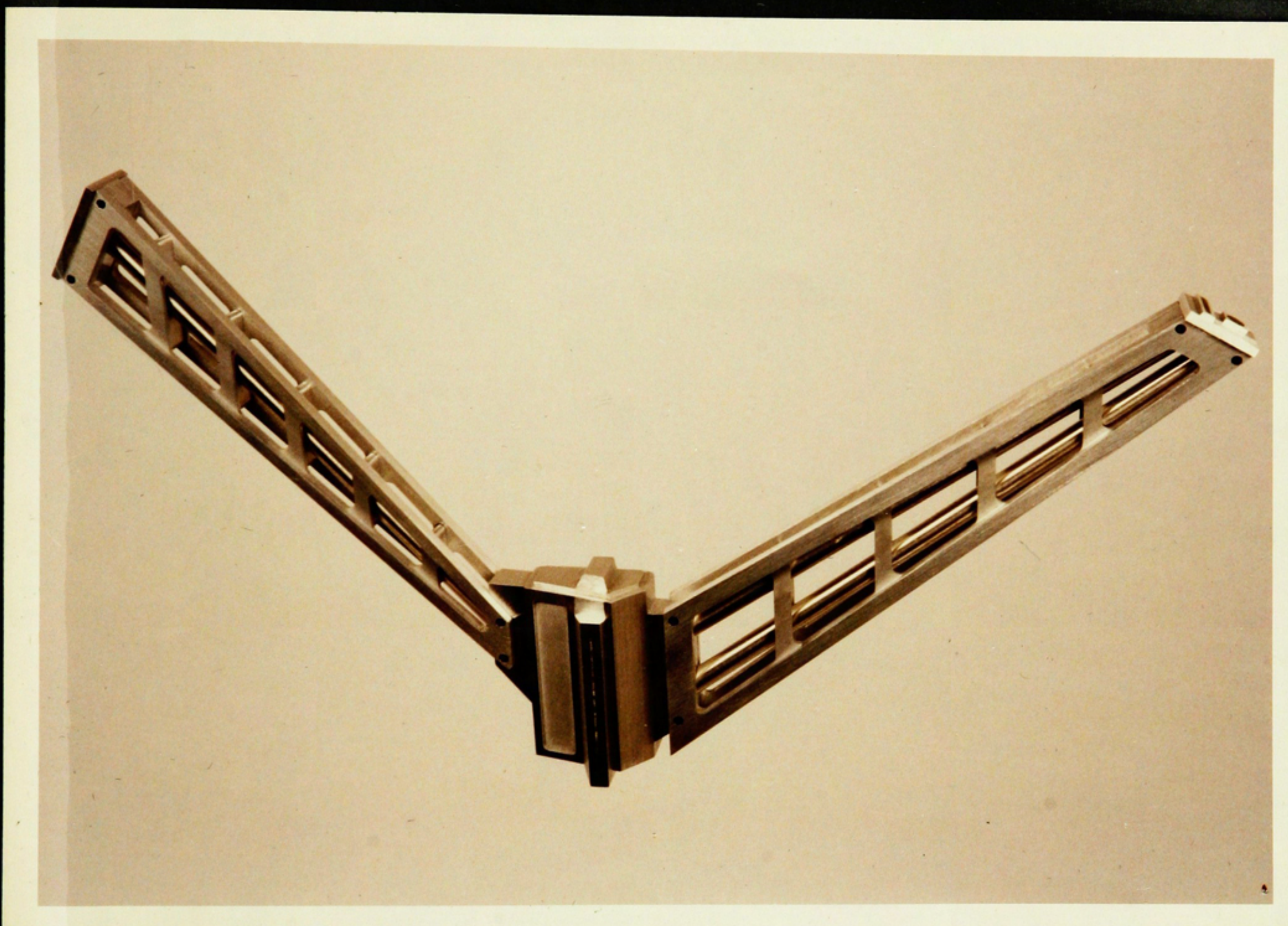

FOSO-801. Sculpture. Machined aluminum, stainless steel, fiber optics.
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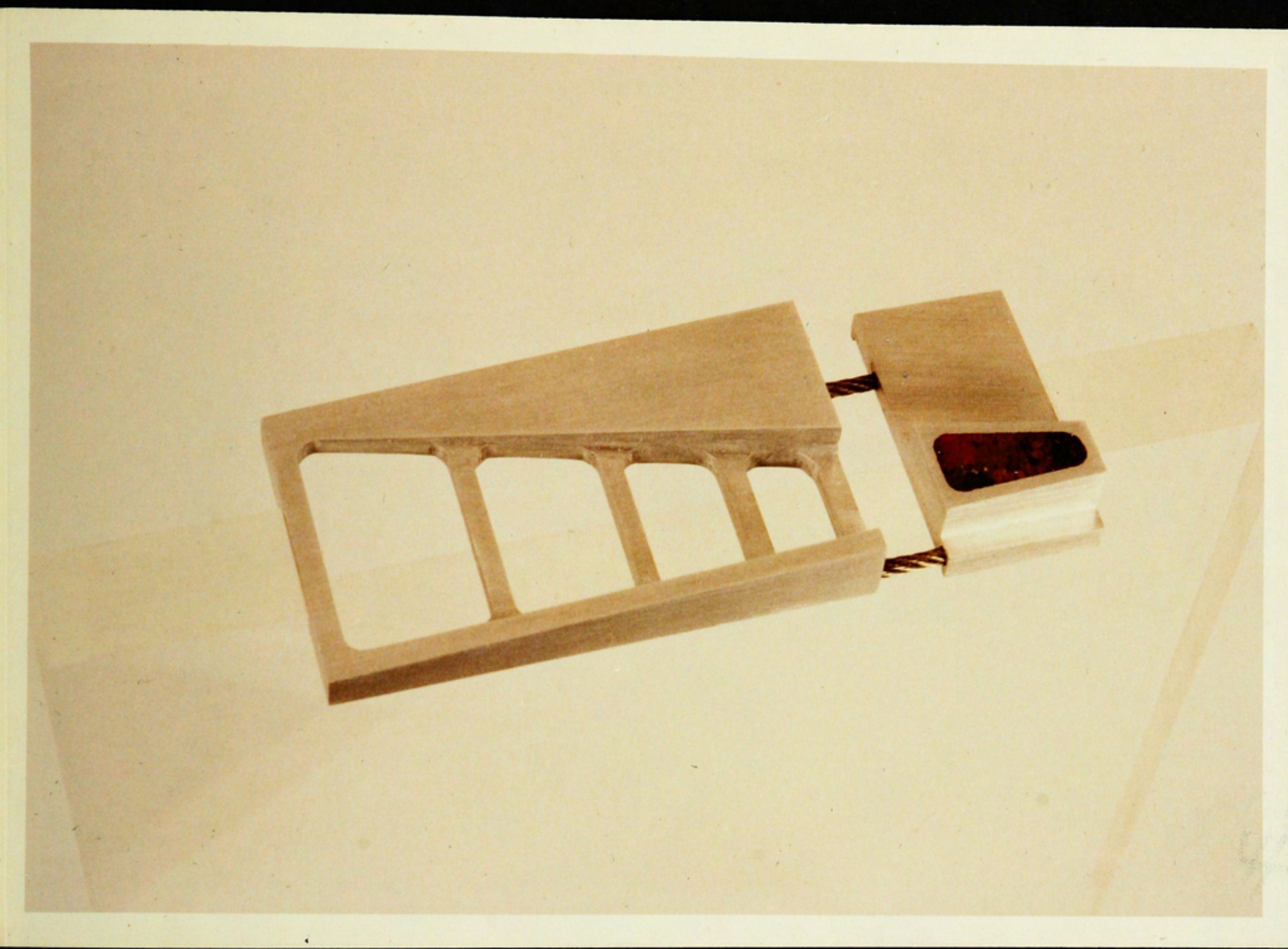

FOSO-802. Sculpture. Machined aluminum, stainless steel, fiber optics, colored paper.
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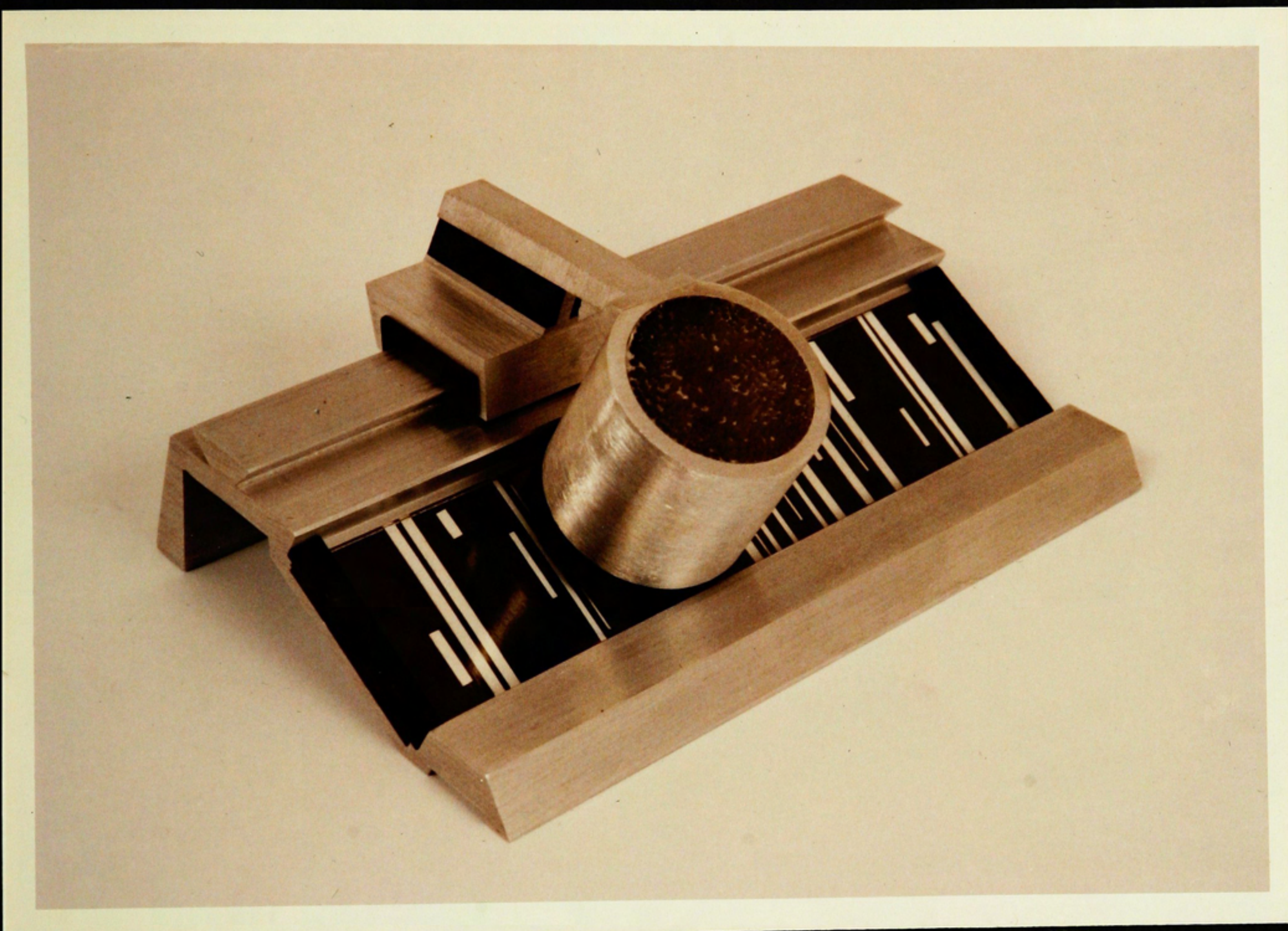

FOSO-803. Sculpture. Machined aluminum, Delrin, Kydex, acrylic, fiber optics, Geotape. 4¼" x 2-7/8" x 1¾".

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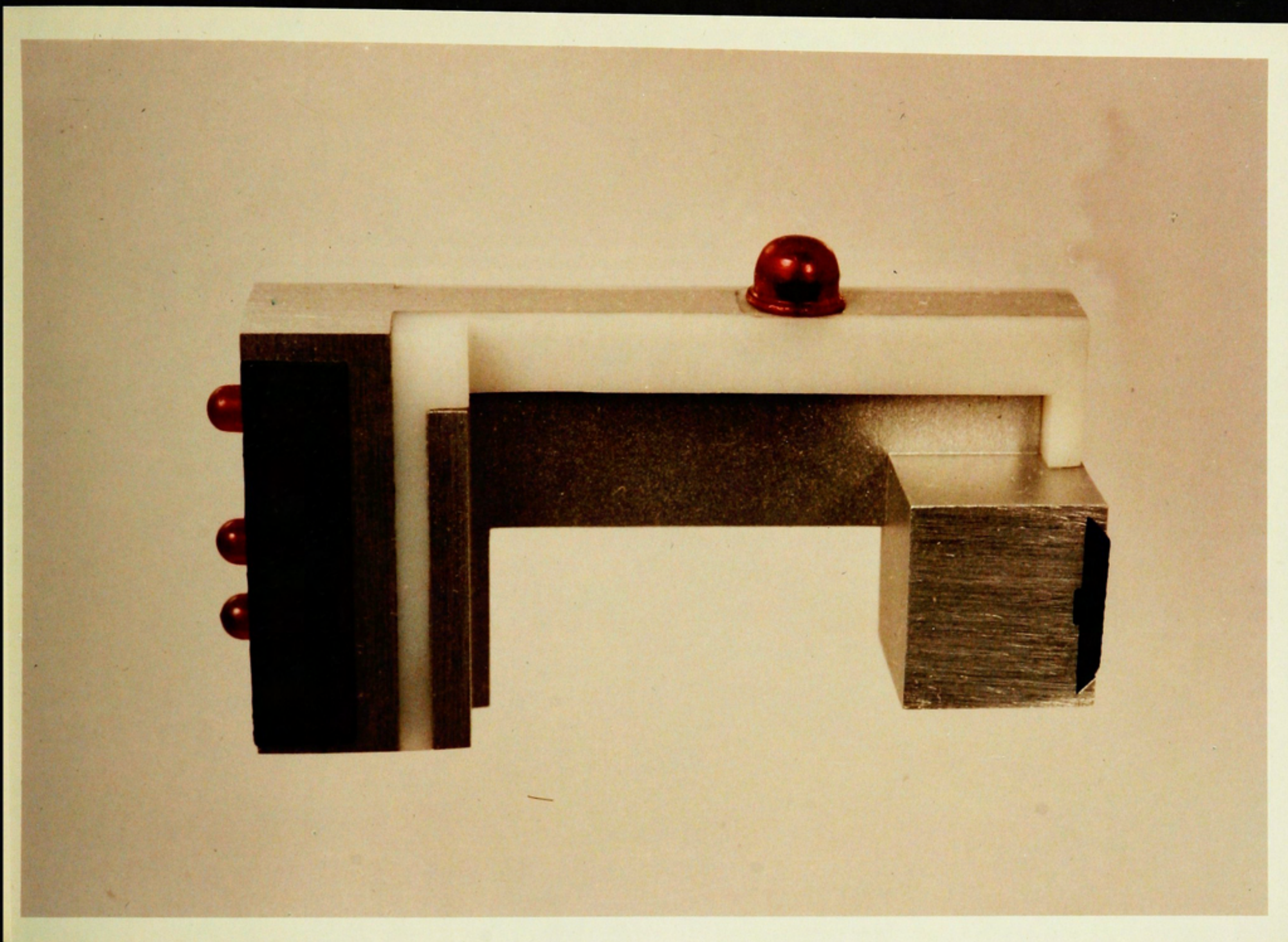

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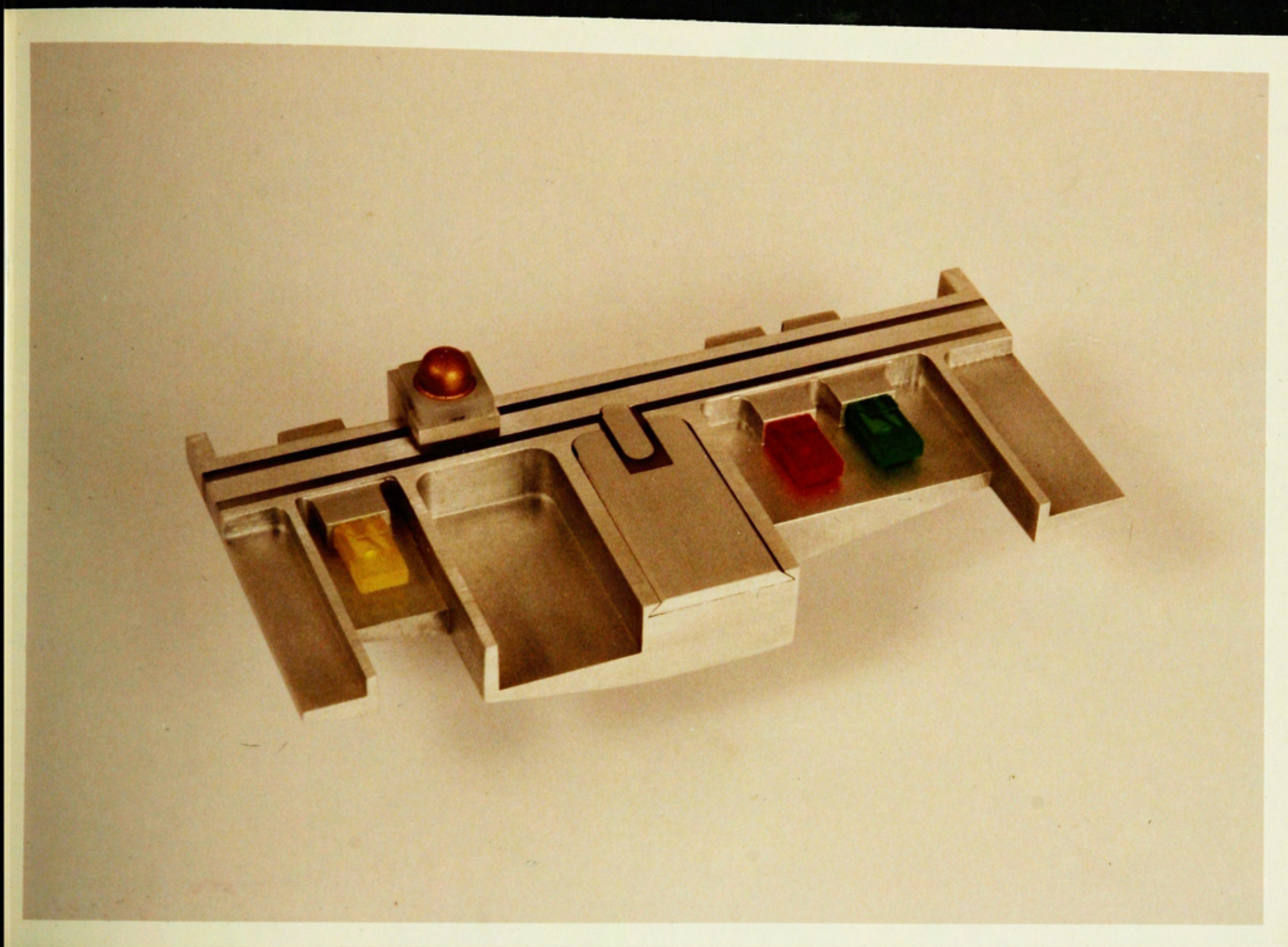

ESO-801. Sculpture. Machined aluminum, acrylic, electronics, 14K gold.
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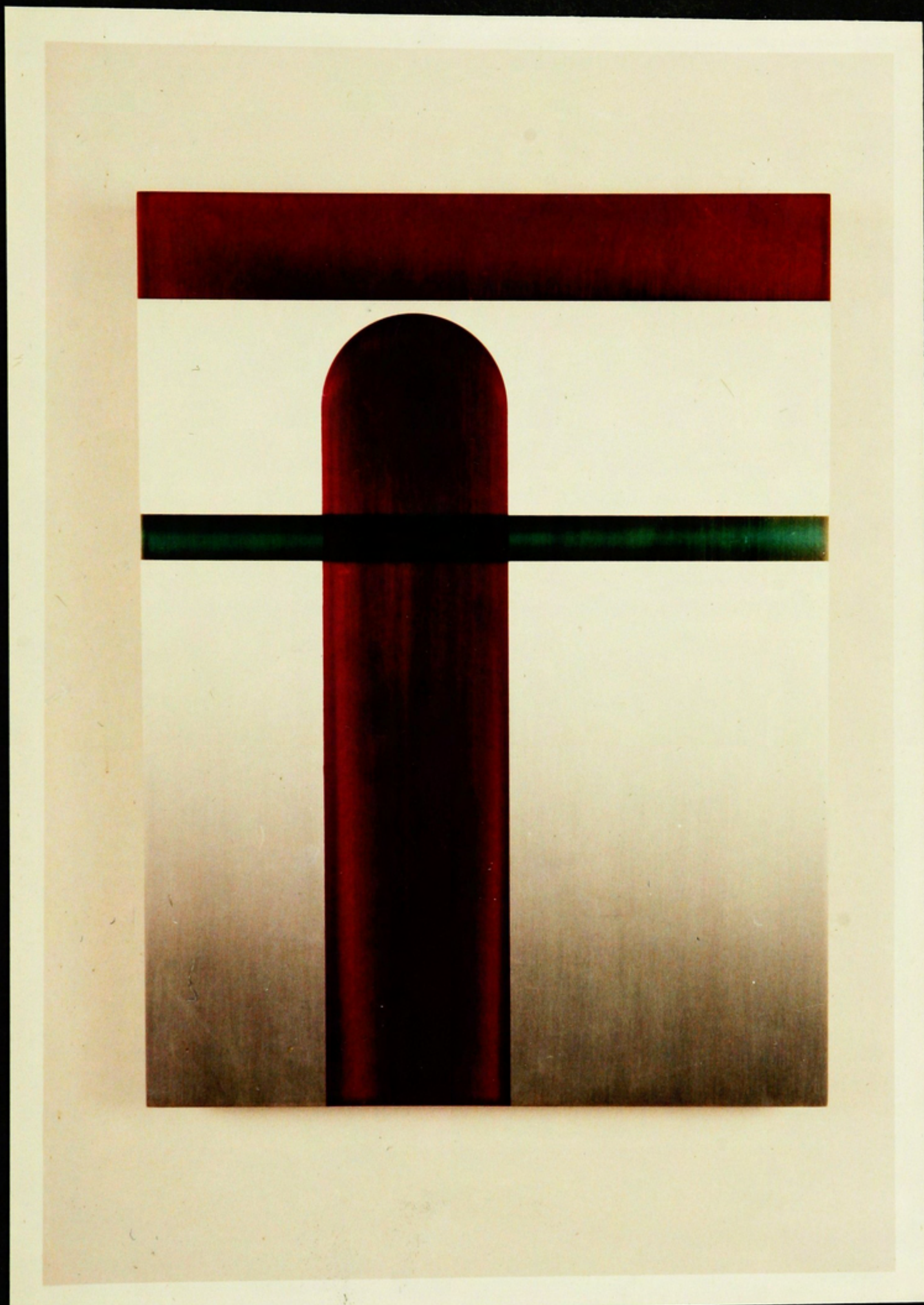

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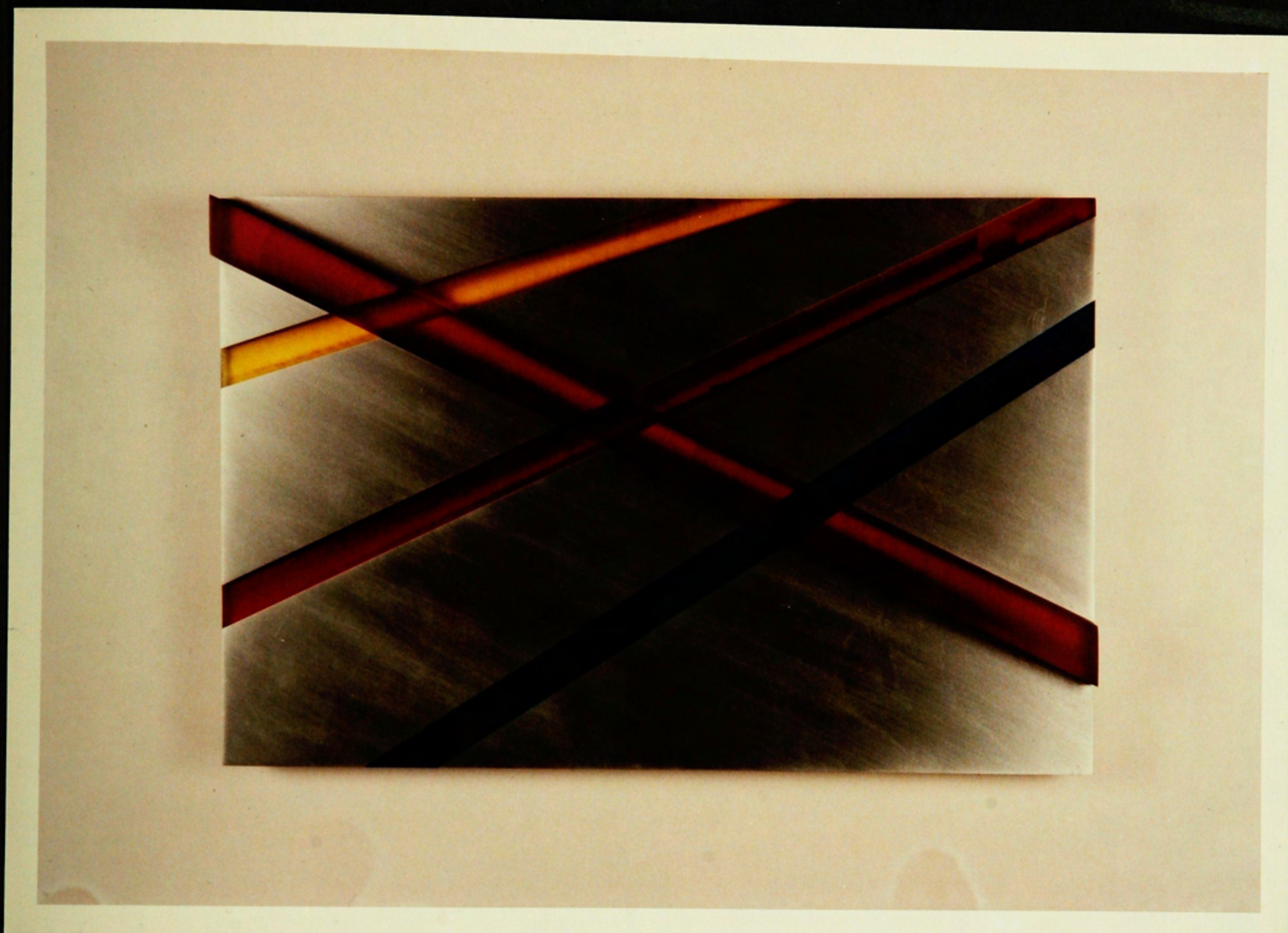

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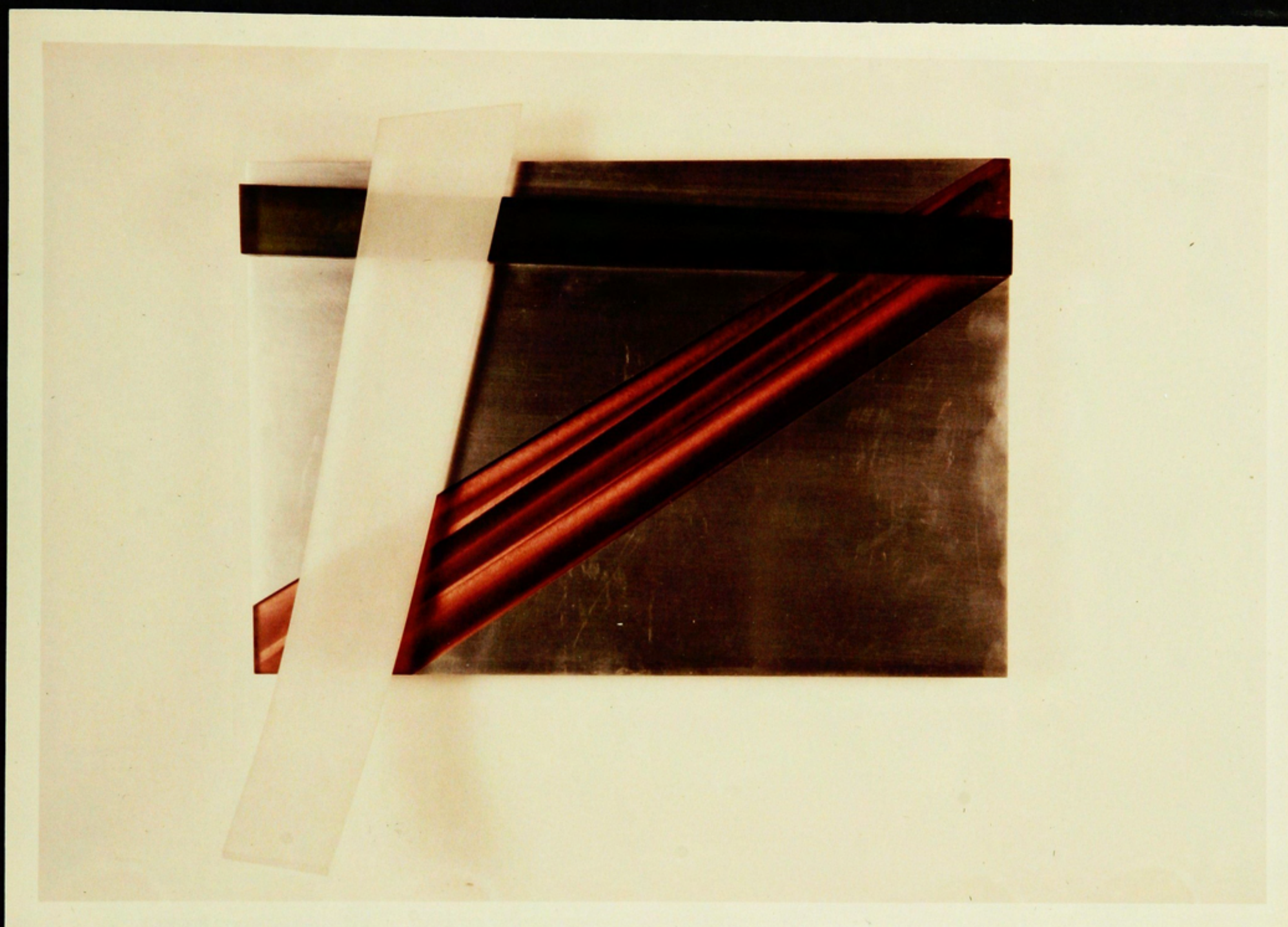

Wall Sculpture. Machined aluminum, colored epoxy resin, acrylic.
11¾'' x 3-7/8'' x 12''.