PHILOSOPHICAL AND ETHICAL PROBLEMS OF TECHNICISM AND GENETIC ENGINEERING

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Our culture has more than once been called a technological or scientific-technological culture. Technology or technological thinking is today the basis, the motor, and the mark of nearly every cultural activity or field. This culture has many advantages in comparison with the past. But the reverse is also true; we are more and more confronted with major problems and threats. Through all this the responsibility of humankind grows as well. At the same time it is clear that in our culture there is no common ground regarding the direction in which we have to go. The main reason for this is that there is no general agreement about the - spiritual-historical background of Technological Culture.

This shows up in disagreements about the new possibilities of genetic engineering. No one will deny that this new development has promise, but there are also risks which no one knows exactly, and, moreover, there is no agreement about our responsibilities with respect to this new technology. So the novel ethical problems associated with it are not addressed on the same terms.

My contribution to the discussion will start with the spiritual background and roots of our scientific-technological culture. It is this background which manifests itself in the development of genetic manipulations and modifications and their problems. The discussion, in my view, must focus not on science and technology themselves, but on people's religious and ethical evaluations.

TECHNICISM

In many publications I have claimed that the spiritual background of modern technology and of our technological culture is *technicism*. Technicism reflects a fundamental attitude which seeks to control reality, to resolve all problems with the use of scientific-technological methods and tools. Technicism entails the pretense of human autonomy to control the whole of reality. Human mastery seeks victory over the future. Humans are to have everything their way.

We want to solve all problems, including the new problems caused by technicism; and to guarantee, whenever possible, material progress. Technicism obeys two fundamental norms, as if they are the two main commandments: technical perfection (or effectiveness) and efficiency.

Technicism can be interpreted as just one view of the spiritual history of the West. Moreover, the feeling that Western philosophy is technicist is not generally accepted. Mostly people point to the supreme position of autonomous, self-sufficient thought. This particular interpretation certainly warrants recognition, but we can still ask whether the spiritual background of this autonomous thought is not itself technicist. If so, gaps in earlier interpretations disappear. If, however, we first recognize that the idea of technical control has been the fundamental dynamic of Western philosophy, of scientific thought, and of our cultural actions, we gain a more profound and broader perspective.

This interpretation is more profound because it addresses the fundamental intention of autonomous thought as it seeks to determine the origin, existence, and destiny of all things. The intent of autonomous thought is to structure everything according to human thought and action. And this intent includes attempts to reduce reality as given to its smallest components in order to recombine them in agreement with the insights of autonomous humanity.

The revised interpretation of technicism is also broader because it attempts to present the problem of scientific knowledge and human society—currently a very real issue—within a broader spiritual-historical context. The new version shows that, rather than modern technology being applied science, the modern natural sciences have always been dominated by the spirit of technicism. In other words, modern technology and technological society are not in the grip of scientism; instead, both science and society are dominated by technicism, by an absolutization of the method of scientific-technological control.

Here I would like to make a side remark. More than once it has been said that modern society is dominated by a capitalist economy. That is surely right. But to understand the characteristics and consequences of capitalism, our vision will become much clearer if we see that the background of liberal capitalism is also technicist. Modern economics is molded according to technological models.

Mutual relationships are much more complex than may at first appear. The development of the modern natural sciences has reinforced, intensified, and broadened the scope of technicism immensely—so much so that since the rise of the classical natural sciences we can speak of *scientistic technicism.* In other words the construction of a technological model of culture also implies the construction of a scientific model. In brief, *technicism is the absolutization of scientific-technological control.*

Once we know what technicism is, we see it everywhere. For example, concerning the successful moon landing in 1969, U.S. President Richard Nixon said: "This is the greatest week in the history of the world since the creation." Earlier, technicism had appeared as a doctrine of redemption in the Soviet Union, where certain technical accomplishments were commemorated as if they were redemptive events. Furthermore, I recently read about a scheduled symposium on recombinant DNA—the technology of genetic manipulation; it was announced under the title, "The Eighth Day of Creation." The same intent can be found in ideas about procreation technologies, with their eugenics implications. Technicism gives humanity the pretention that it has become a creator, a redeemer, and a giver of meaning. One last example: at a special general assembly of the United Nations in New York, June 1997, President Clinton—in a speech about our global environmental problems—stressed technology as if it could and should solve all our problems.

This technicism deeply influences the spiritual climate in the West. Technicism is an ethos, the fundamental attitude we have introjected in our knowledge of and dealings with science and technology. This ethos promises to solve all global problems and to assure progress through technology and scientific-technological control.

HISTORY OF TECHNICISM

To assess and evaluate this spirit and its effects, we have to turn back to spiritual decisions made several centuries ago. Technicist control of reality really began to burgeon during the Renaissance, a movement which then bequeathed its version of technicism to modern philosophy (rationalism) and to the Enlightenment, then later to Positivism, Marxism, and especially Pragmatism. Today's cultural manifestations of technicism trace back through these modern

philosophical movements. From the first proclamation of human autonomy, it should be clear that technicism contains a religious conviction whose nature should not escape our attention.

The religious motivation of technicism first became clear among Renaissance thinkers and then again at the beginning of modern philosophy. Christian terminology was still used, but with a new anthropocentric content. Humanity was declared to be the center of reality. Thus creation was no longer recognized as the handiwork of God, but rather as the handiwork of men. Reality was not accepted any more as given to humans by God, but as a reality which humanity itself should give meaning to through such activities as philosophy, science, and technology. The biblical fall of man was not a loss of faith in God, but rather men's loss of faith in themselves. Hence redemption was not the confession that Christ restores communion with God, but rather the pretention that a man can stand on his own two feet. Faith is not belief in God through Christ; it is reliance on oneself. Finally, the future is not given to us by God, but rather a course plotted by men.

This spirit permeated the thinking of philosophers and scientists. As time went on, the ideals of the Renaissance became increasingly integrated with the development of science and technology.

Leonardo da Vinci was one of the most celebrated representatives of the Renaissance. Remembered by most people as an artist, he is known to technology as the inventor of airplanes and submarines. He suggested that the world of mechanics is the paradise of geometry. Both Galileo and Descartes were inspired by da Vinci. But where Leonardo da Vinci limited the relevance of geometry to the world of machinery, Galileo applied it to all of nature. He believed that the book of nature is written in mathematical laws. Descartes went even further when he claimed that the rules and laws of mechanics are the same as those for nature. Basic to his natural philosophy is the paradigm of the automaton, the model of the machine. This conclusion introduced the mechanical view of the world. "Nature is a machine," wrote Descartes, "as easy to understand as clocks and automatons, if only we investigate her carefully." This means, according to Descartes, that nature can be analyzed completely and thus controlled, for man is "master and owner of nature."

Such is the technicist pivot of the Cartesian natural philosophy, a philosophy that resulted from Descartes's effort to make philosophy independent from the Christian religion. Eventually his image of God conformed to his own philosophy. Descartes's god was a perfect technician whose construction of nature was incomparably better than any machine made by humans.

Descartes laid the foundations of both modern natural science and technological thinking because he, as mathematician, recognized only quantitative characteristics as real. What counted, according to Descartes, was the extention of things. Qualities, such as form, consistency, durability, structure, color, smell, and taste did not really exist. Descartes saw plants and animals as things to be manipulated and in that way to be made useful.

It is not hard to see that such a worldview resulted simultaneously in the rise of modern natural science and technology *and* in the impoverishment and reduction of the world of experience. It led to an extremely utilitarian worldview, for in denying things quality one also removes intrinsic value from things. Things are functionalized. This constitutes the reductionism in Descartes's philosophy which would later become destructive to nature. And this is the spiritual background of our current environmental or pollution problem.

Cartesian thinking can also be found in Descartes's somewhat older contemporary, Francis Bacon. Bacon's declarations that "knowledge is power" and "in order to conquer nature we must obey her laws" anticipated later technological developments in which knowledge of the natural sciences was to be used to control the realm of nature. Bacon was encouraged in his views by the new discoveries of his time. Extrapolating from his reductionist world and life view, he anticipated that relationships among natural objects could be established chemically, that we would be able to change the species of plants and animals, that we would discover new metals, and that we would one day be able to intervene in the climate. Though Bacon couched his theories in Christian terms, it cannot be denied that he was motivated by apostate pride. In his utopian*New Atlantis* he suggests that the development of science and technology must be interpreted as simulations of the divine works of creation. He changes biblically eschatological perspectives into the idea of progress. According to Bacon, the application of science and technology would materially remove the effects of human sin. He saw in his plans for the progress of science and technology the

restoration of the power that Adam and Eve enjoyed before the Fall. This redemptive fervor is characteristic of technicism.

It is again important to stress that this technicism has, since the Industrial Revolution, influenced economic development a great deal.

Despite later criticisms and modifications of Cartesian philosophy, technicism came to dominate Western philosophic and scientific thinking. The celebrated natural scientists, Pascal and Newton, despite their biblical view of responsibility in the natural sciences, were unable to resist the tide of technicism. Pascal realized that the god of the philosophers was not the living God of Abraham, Isaac, and Jacob. Newton clearly realized that the reality he investigated was still God's creation. He was convinced that redemption could not be achieved through scientific research, primarily because all scientific research is relative. The inscrutable secrecy of creation repeatedly creates new possibilities for further scientific research. But shortly after Newton, his conviction faded, replaced by the idea that the natural sciences are instruments for the construction and control of reality.

The seventeenth-century philosopher Thomas Hobbes was the first to apply—also under the guidance of technicism—the scientific thinking of Descartes and Galileo to the state. That is to say, he structured his analysis of the state using mechanical models and methods. Hobbes saw the whole of reality through the spectacles of mechanics. He even saw God as the great architect who had built a machine and set it in motion, leaving its operation to the mechanical laws of nature. The world can be compared, according to him, to a clock slowly running down.

Because Hobbes recognized God as creator, he is called a *deist*—in contrast to a *theist* who believes that God constantly maintains His creation. Hobbes thought that his deistic view was consonant with the revelation of God. For him God was the perfect and almighty architect who made a technically flawless world that no longer needed maintenance. His view, however, reduces God to a meaningless entity beyond time. If everything operates according to an iron law of nature, prayer becomes pointless. Rather than pray, we need to know reality better in order to recreate it in line with our own wishes. This task, as perceived by Hobbes, is what is meant by the claim that man is the image of God.

Like God, man is an architect or an engineer.

Consonant with this philosophy, humans must construct the state as they construct a machine. The state apparatus, which Hobbes called Leviathan or "the earthly god," is the result of human creative efforts. However, Hobbes's model turns the state into an idol. It functions as a religious center in which people place their trust and from which they may expect everything. Technicism and the secularization of culture go hand in hand. Technicism creates a materialistic culture which is spiritually empty. Although Hobbes did not consciously and deliberately reject revelation's truths, in a certain sense his deism was a big step toward later atheism.

Bacon and Hobbes aside, philosophical developments after Descartes may appear not to be dominated by technicism. But those appearances are deceiving, for in reality technicism has reinforced all of modern philosophical thought. Even Kant's philosophy can be called technicist because his philosophy was governed by a constructionist spirit. Kant even transforms the moral order according to the spirit of technicism. In Kant's philosophy, man becomes a *homo faber*, the technical man, of whom Fichte, Kant's rogue student, wrote: "That includes everyone who can say 'I am human.' Should he not have holy respect for himself and shudder and quake before his own majesty?" In Feuerbach we encounter the summit of technicist thinking as it transformed into fulfillment the technicist word become incarnate. Technicist philosophy becomes the all-encompassing principle for organizing practical deeds. With it comes a technicist reorganization and control of all reality, including nature, society, economics, and even human nature itself.

Since the middle of the nineteenth century the practical realization of technicist thinking has run in two main courses, those of Positivism and of Marxism. For both, technical man not only governs nature, but also holds society and the future in its hand. Principal spokesmen for these movements were Auguste Comte and Karl Marx.

Around 1840 Auguste Comte dismissed deism, judging it unproductive to search for the meaning and origin of all things. To Comte only research into the relationships found in the natural sciences mattered. Along with promoting atheism, he also prepared the way for a world that would be ruled exclusively by

science and technology. Social processes, according to Comte, could be understood and controlled just as inanimate matter could be analyzed by physics and controlled by technology.

Comte's formula of control conflicted with Christianity. He realized that State control of society would subject every individual to that control. He also realized that Christians would resist his version of control, if simply because Christians historically have placed great value on the individual. Thus Comte's reorganized society had to exclude God. Anyone resisting societal control would be denied any form of political influence. This would apply especially to Christians, whom Comte called slaves of God. To him Christianity was an obstacle to technicism and technocracy. (We should note here that, unlike Comte, some modern thinkers have made Christianity responsible for the problems and perils presented by modern technology.)

This all-dominating role of scientific-technicist thinking means rejection of every non-scientific authority. Here occurs the break with God as the origin of all that is. To gain a correct understanding of the historical development, it is necessary to see that a definitive break with God is included in the so-called "methodological atheism" of science, which involves the notion that the development of science is possible "as if God is not there."

Methodological atheism in science led ultimately, via the scientific-technical control of culture, to an atheistic culture. This is to say that the greater the influence of secularized science and technology, the more the whole of reality comes to be regarded as materialist through and through.

Initially the consequences of this development were impressive. Many are fascinated by it to this very day, so that this development is regarded as a path to unprecedented progress and material prosperity. Yet it is important to discover that from the very outset of this development there was an underlying lack of direction, although this became apparent only later.

Comte's Positivism has been continued and reinforced throughout the twentieth century. There are many examples, but I will mention only one. The English philosopher Bertrand Russell once said that the Christian religion has become superfluous, or, worse yet, an evil. According to Russell, religion merely

signifies men's lack of maturity. Only mature people are capable of solving all problems. His vision also focused on modern technology; society, according to Russell, is to be organized with the same precision as a steam engine.

Though different from Positivism, Marxism is even more strongly influenced by the spirit of technicism. Marx was an avowed atheist who saw the dissolution of religion as the beginning of genuine bliss. This atheism has been reinforced so often in the development of Marxism that we can safely say that atheism has become the official state religion of every Communist country.

The dynamic center of this religion is the conviction, rooted in technicist power, that reality in its entirety must be reorganized and renewed through human power. Unlike other thinkers of his day, Marx was quick to see the suffering, problems, and evils of the Industrial Revolution. He paid particular attention to the many-sided alienation of man in the process of industrial technology. At the same time, he sought to eliminate this alienation by espousing a revolutionary overthrow of existing society, to be replaced by a classless society. Thus, according to Marx, technology would no longer be an instrument of oppression but a means for liberation. In Marx's realm of freedom, technology would do the work now performed by workers and each person would share equally in ever-increasing material prosperity.

For Marx, the meaning of history consists in humanity's rule, first over nature, thereafter over human society, its relationships, and its future. The meaning of history is progress, seen as the progress of technology. Marx's thinking was dominated by a technical *eros.* Armed with the technological objective of control, Marx designed a Communist society in which technology would bring redemption and freedom instead of the oppression and slavery found in the Industrial Revolution.

Marx's concept was adopted, modified, and applied by Lenin who, in 1918, said: "Society has to be reconstructed on the model of a machine in order that hundreds of millions of people will adjust themselves to its (uniform) operation." History has shown us that Russia tried to implement the idea of "perfection of technology," and the result was a centrally guided, totalitarian technocracy, in which alienation, suppression, and coercion were not elimininated but reinforced.

The development of the West after Positivism came under the special influence of pragmatism. The characteristic of pragmatism is a more individualistic technicism. The individual should use science and technology for a better life, for more utility. Pragmatism's technicism is related to the liberal market economy. It is this spirit of technicism which marks our daily life and all sectors of culture, like science, the economy, politics, agriculture, and health care. Technicism is the main spiritual climate of the West.

To understand the development and problems of Western, technological culture—and therefore of genetic engineering—we need to confront the technicist mind. The method of technicism is that of deconstruction and reconstruction: with the utmost consistency, we break everything down into its smallest components in order to build reality up again with the help of the elements thus obtained. In thinking about genetic manipulation this technicist mind is dominant. Living organisms are interpreted according to technological models. The origin, integrity, and coherence of living organisms are mostly unrecognized.

PROBLEMS AND THREATS OF TECHNICISM

The application of technicism will result in a society built on a technological model. This process is aided by powerful materialistic inclinations. And as this process intensifies, its perils will become more ominous.

It is also true that technicism's definition of reality is really alien to reality. Reality is an entity with an origin, existence, and destiny given to it by God. But modern man's technical world has no relation to meaningful creation. In other words, modernity pretends that the technical world is identical to all of reality, reducing everything to components of a great technical whole. However, created reality does not allow such a reduction. Creation coheres meaningfully. If this meaningful coherence is denied, distortions and destruction ensue. This may not be the case immediately; as the technological process intensifies, these side effects will become both prominent and perilous. Actually, the technical world cannot be made independent from creation. As technical development continues, it becomes even clearer that it is restricted by the limited potential present in creation.

Making the technical world independent by means of potentialities

available to modern science also reduces and dehumanizes personal relationships, and thus fragments society. The commandments of love are replaced by the commandments of effectiveness and efficiency. That means that a utilitarian ethos lies hidden in technicism. In utilitarianism those goals of science and technology are considered good which are useful to as many people as possible. Utilitarianism has an eye only for material prosperity, long life, happiness and the like. Again, to avoid any misunderstanding, these goals in themselves are certainly valuable. The ethical problem concealed by utilitarianism as technicism is that these aspirations are converted into absolutes, and that these absolutized goals have become defined by scientific and technological activity. That is to say, the *manner* in which and the *means* by which these ends are achieved through scientific-technological control are not given enough attention. At the same time, it is these ends that sanction the means of scientific-technological control.

Utilitarianism's narrow vision of a "good" and "responsible" technology has led to many problems. Everything that does not fit the parameters of technicism is misjudged or disregarded. Technicism has drawn nature into a reduction, and so destroyed it. Environmental problems, the pollution of living nature, acid rain, the contamination of oceans and seas, the decrease of the ozone layer, the pollution of soil, water, and air clearly show that technicism means exploitation. Attempts to make the technical world independent clash with the limited availability of energy and mineral resources.

The technological process betrays internal tension as well: the dangerous development of nuclear arms, nuclear energy, the paradox of information and communication technology—namely, the more we have such technologies the less real information and real communication there will be—and the problems of bio-technology or genetic manipulation, the development of industrial agriculture, are but a few examples. Increasing use of computers accelerates dehumanization, unemployment, isolation, and alienation among human beings. The uniqueness of human beings and the individual and creative responsibility of humankind are eliminated in that process. As culture is defined by scientific-technological integration, it is torn asunder, fragmented, made abstract, uniform, and homogeneous.

The most consistent example of this deterioration could be found in the totalitarian technocracies of (earlier) Communist societies. The promised freedom

through the development of technology turned into unfreedom and oppression. But even people in Western countries today are trying to free themselves from the tyranny of technocracy as we can see in various modern philosophies, various social actions, and protests. Think, for instance, of existentialism, neo-Marxism, the counter culture, New Age thinkers, postmodernists. But although these philosophies and movements have had some influence, the process of technicism continues to develop unabated.

The gravity of the problem can best be illustrated by comparing the everyday world of experience and the world of science and technology— especially as it is reinforced by liberal economics. It is increasing attempts to make the scientific-technological world independent of everyday experience that best illustrate the tensions, problems, and perils of our technological culture.

THE WORLD OF EXPERIENCE AND THE SCIENTIFIC-TECHNICAL WORLD

What is meant by the "world of experience"? It is the world in which we live, hope, suffer and struggle; it is the world in which we see things, in which we feel and love; it is also the world of faith and trust; in fact faith and trust form the nucleus of the world of experience. This world is original and primary; it is incomprehensible, complex, concrete, diverse, highly differentiated and profoundly inscrutable. Every human activity, together with its meaning, belong to that world. Even science and technology, together with their meanings, are part of the world of our everyday experience.

Within this original, primary world of experience, there is knowledge, but no scientific knowledge. Primary knowledge means being involved, being integrated with, in the sense of "acknowledging" and " confessing." This knowledge precedes and transcends scientific knowledge.

The so-called second world is that of philosophy, of science and its applications. This is the world of scientific-technical control thinking. In theory, it is possible to have this second world supersede the first. This is what happens when people make scientific-technological models of reality. In that case, the world of everyday experience is subordinated to that of science and technology and every detail of reality is subjected to the dominance of scientific and techno-

logical control.

Since the Enlightenment, philosophers and scientists have indeed tried to subject reality to such scientific and technical control. On this course, much has been won, but at the same time much has been lost, for such reduction eventually destroys those things that were not intended to be subjected to scientific and technological controls. Much of created reality does not fit the scientific and technical models. The reality of our world of existence or experience resists such model building, but still the attempts continue, as we can see in urban growth, industrial policy, agriculture, housing, health care, social work, the economy, politics. Nowhere is this attempt more evident than in the increasing concentration of power in the technocratic society and in the disappearance of love, which cannot survive inside such uniform and universal models. The egotism of power keeps defeating the love through which people are drawn to each other. For love addresses itself primarily to the specific and the unique. It is no wonder that many people in a technocratic society feel that no one cares for them or loves them. No amount of "welfare" can remedy this situation. In a tech-nicized culture essential human relationships are severed and replaced by artificial ones. Love dies, compassion and empathy vanish, alienation and loneliness increase and cries of protest, demanding love and compassion, are heard everyw-here. From these protests much can be learned.

ABSTRACTIONS IN SCIENCE

To arrive at a better insight into the problems caused by the unlimited application of technicist science, of science as an instrument of control, we need to know more about the abstractions that characterize scientific knowledge. In an irresponsible application of scientific knowledge, these abstractions are projected wholesale onto reality, on the assumption that scientific reality is identical to real reality.

The process used to arrive at scientific knowledge is often called analysis or abstraction. Analysis and abstraction are the most symptomatic ways of arriving at scientific knowledge. The scientist analyzes one aspect or function of the many sides of reality. His research properly involves removing, or abstracting, one of these functions or aspects from its coherence with other aspects or functions. For example, the physical aspect, for analytical purposes,

may be temporarily removed from its relationship to the biotic or the economic.

A second step in the abstraction process involves discarding the concrete, the specific and unique, and focusing only on the general and universal.

The third step in abstraction is sometimes known as the abstraction of objectivity. Here the scientist removes himself from the visible, objective reality and consults the laws that govern this reality.

Finally, in the fourth step of abstraction the scientist disregards the interests of both himself and his fellow humans. It is this step which represents the "impartiality" of science.

It is primarily the last of these four forms of abstraction, namely impartiality, that has recently come under fire. Can an ethical norm for science be set aside so easily? Political, social, or economic interests often direct and stimulate scientific research. If this is the case, then there is little point in talking about objective, impartial science.

Moreover, our prescientific and trans-scientific visions of scientific knowledge cannot allow us to speak of objective, impartial science. This becomes clear when we discuss possible applications of scientific knowledge. Generally people presuppose that science will not only provide insight but will also afford control over concrete reality. For this reason modern philosophers of science have paid little attention to the problem of abstraction. By contrast, the Reformational Philosophy, which I represent, has made this a central problem because this philosophy correctly realizes that science increasingly alienates itself from the visible, integrated, and concrete reality, and it does so on the basis of its own pre-theoretic presuppositions.

Every scientist must observe the four abstractions outlined above if he or she expects to arrive at reliable scientific results. Through the process of abstraction, science removes itself from full reality and full meaning. Let me illustrate. In theory we know how to divide four apples among four children. In reality, it is not that easy. No two apples are the same and children's preferences change constantly. In our calculations we disregard the size and color of the apples, but in reality it is precisely those factors that determine the children's choices.

The illustration is simple. But when functional science as applied by modern industrial technology and economic interests comes into open conflict with reality, the problem is highly significant. Using natural science as an instrument of control marks everything with the abstractions of science. That means reduction of reality, and when it is done on a large scale it means destruction of reality.

Something else must be added to our analysis. Since abstraction disregards the origin, meaning, and coherence of things, scientific findings are at best merely correct even though scientists often claim not merely correctness for their findings and theories but absolute truth. In reality, however, scientific findings confuse rather than clarify the truth. For example, from a strictly scientific point of view, man is a composition of fats, carbohydrates, and proteins. This may be correct, but it not true. After all, the statement says nothing about the true nature of man as responsible, or as free, or that he is made in the image of God. In technicism, an individual is usually seen as a cog functioning in a society interpreted as a big machine. There everyone is the same, interchangeable, calculable, and manipulable. A true view of human nature is missing.

Within the context of abstractions we can arrive only at a correct view of things. There are various aspects of correctness. Scientific knowledge is first of all *functional*, in that it concerns knowledge of an abstracted function or an abstracted aspect of an interrelated reality. Furthermore, scientific knowledge is *universal* in that it disregards the specific, unique, and individual. In addition, recognition of the laws valid for reality gives to scientific knowledge awareness of *lawfulness*, which is valuable, though this awareness is often incorrectly called objectivity. Finally, scientific knowledge should be *independent* of subjective, social, economic, or political interests. If this is not the case, scientific knowledge tends to favor, safeguard, or reinforce existing interests.

Before discussing the problems associated with applying scientific knowledge, I should also point out that all scientific knowledge is integrated into a *system.* Such integration is performed through logic, and we can also say that scientific knowledge is a *logically integrated* knowledge, otherwise known as *rational* knowledge.

The conclusion should be that science is always abstract knowledge. But if we abstract from God, the origin of everything, and from the meaning of everything as dependent upon and directed toward God, then science is absolutized, the abstractions are forgotten, and under the influence of technicism, we get the technicization of reality that brings with it so many problems and perils.

TECHNICISM, AGRICULTURE, AND GENETIC ENGINEERING

I want to illustrate everything I have said so far by the consequences of instrumentalization of science in agriculture. When the instrumentalization, the scientic-technological control of agriculture, took place on a small scale, the negative consequences were not serious. In the short run, success even prodominated. That is what made it so attractive. The construction of a kind of "counter-creation" in which humans would be lords and masters of everything and be assured of unprecedented material prosperity blinded them to what they were actually doing. As the process of scientization and technicization increased in intensity and scope, the negative aspects became apparent—and even preponderant. Reality has come to be modeled according to a reductive, logically-coherent network. Abstract frameworks have become so predominant that the fullness of reality is broken up atomistically and functionally. This is the deep background of our contemporary dislocation of nature and pollution of the environment. The result of an unlimited scientific-technical control of nature, inorganic and organic, can lead ultimately to the destruction of nature. For the biosphere in which we all live is a supremely complex, unique whole. Steady reduction of plant species produces an unstable and thus ever more difficult situation to control. The need for technical control becomes greater. This gives rise to a dangerous vicious circle.

In this light it is clear that human beings, animals, and plants have come to be seen through the spectacles of the technological model. Given the influence of technicism, they can be disesteemed and misformed as technicization occurs.

Technicization becomes clear in the danger of creating crops with too great a uniformity in their genetic profile. Genetic uniformity means reduction of the variations in plants. The result, in other words, is genetic erosion and instability, because as a result of the uniform genetic profile and thus of its

restricted genetic diversity, resistance to unknown diseases has been lost. The seriousness of this development is illustrated by the attempts which are currently being made to compensate, via artificial gene banks, for the loss of many natural species of plants.

Intensive animal husbandry confronts us with similar problems. In bioindustry, scientific-technical control of the abstracted functions of animals have become so absolute that the animal itself, in its intrisic dignity, is no longer taken into account. The so-called procreative techniques are other models of technicization. The consequences of these techniques are that genetic uniformity and genetic erosion occur on a grand scale.

If the technicist mind also becomes dominant in the development of genetic engineering, we will be confronted with further technicization of living organisms. This includes a lot of ethical problems such as neglecting intrinsic dignity (and therefore suffering) of, for instance, non-human animals. The unlimited genetic engineering of farm crops would cause greater genetic erosion, because such plants are used on a large scale under the influence of economics. The result is a loss of biodiversity, as well as possible destruction of given natural diversity and stability. This last problem has been mostly neglected because the scientific-technical control of organic nature is not generally recognized in the scientific-technical control of inorganic nature, because the difference between physical laws (including entropy) and biological laws (ektropy) have been neglected.

In relation to the genetic manipulation of plants or crops, most interpreters abstract from the wholeness of the organism and from the complexity of context factors, which makes the consequences unpredictable. The delicate balance in nature can be distorted. And what possible dislocations can changes in genetic information have on an organism? Which unknown characteristics will be brought about by a new combination of genes? What is the effect of reinforcing a particular characteristic in terms of the overall balance in a species? And what happens when a genetic experiment fails? These ethical questions are a consequence of the growing technicization in genetic engineering.

We all know that, via *in vitro fertilization* and the results of the human genome project, there is also the possibility of a technicization of human

procreation. That means that genetic selection, genetic manipulation, and even cloning—in combination with genetic manipulation—opens the way for eugenics. The old objections against eugenics have become urgent again.

THE CHALLENGE OF SYSTEMS THEORY

The process of technicization continues unabated in various sectors of culture. The resulting problems are also clear, particularly when specializations become increasingly more abstract. Not that there is no resistance to this process; more and more philosophical currents and public movements protest against increasing specialization and technicization. Variegated and inexhaustible reality cannot be forced into the narrow mold of scientific abstractions. Many young scientists have come to this conclusion; many young doctors and young technicians demand alternatives. These protests are not without results: some innovations in technology promise to curtail the harmful side effects of developments in these fields. But even these positive results, important steps in the right direction, are really no more than a minor diversion from the mainstream. This mainstream has gathered strength through the recent development of systems theory and its parallel, computer technology. Representatives of systems thinking believe that their new scientific model can undo much damage caused by the old positivistic scientific model. They defend their new scientific approach as "holism" and in that sense as a fundamental correction of the consequences of abstractions in science.

Because systems theory is an important new model for science in our culture, I will give it some attention, although I do not want to deal with specific details. Irvin Laszlo and Russell Ackhoff (leading systems thinkers) are of the opinion that the new science of systems theory makes the scientific control of reality definitely possible. Aided by systems technology they claim that humans will learn to control the development of culture. These thinkers are under the illusion that their holistic approach, when supported by political powers, can resolve existing cultural problems. This claim clarifies why philosophers and theoreticians of systems theory pay so much attention to politics. With systems technology (especially computer technology) it is possible to eliminate geographical barriers as parameters of national politics and to strengthen a global politics.

Generally speaking the new thinkers agree that the instrumentalism of old-

fashioned positivistic science caused many problems, including the environmental crisis, the resource and energy crisis, human alienation, the dehumanization of labor, the issue of war and peace, and the poverty dilemma. The old positivistic science, with its analytical approach, concentrated too much on one aspect of reality. And because it was an instrument designed to control culture (as well as nature), it necessarily resulted in reduction and fragmentation. Because of its dependence on the principle of causality, its view of the world was too mechanical and deterministic, and this resulted in our present dehumanization, disharmony, and disintegration.

By contrast, the new science concentrates on reality in its entirety: the world is the largest, all-comprehensive system. The most noticeable difference between old and new lies in the shift of emphasis: the old science concentrated on an aspect or function of reality, while the new systems theory focuses on reality as a complete system. That complete reality is no longer a mechanism or clock, but rather an entire system which is more than the sum of its parts. The method of the old science was analytic and abstractionist; the method of the new science would be synthetic or emergent. For that reason they speak, in contrast to the mechanistic view of the world, about an organic view of the world. This organic view of the world allows for human freedom, harmony, and integration.

The question which ought to answered is whether the new science and the new technology can solve the problems of the scientization and the technicization of culture, which we have discussed. They at least teach us about the disadvantages and evils of the mechanistic world view. Mechanistic thinking has denatured nature and culture and now must face the demand for restoration, harmony, and coherence. The question is whether the new organic view of the world is really organic. That would be very good in relation to the ethical problems of genetic engineering.

It is without any doubt that the new science and technology are wonderful possibilities in God's creation. But when the motive of scientific-technical control does not change, the mechanistic view of the world will not be changed in the cybernetic view of the world. The problems of both may differ, but because a new reductionism is involved we will be confronted with both old and new problems and perils. The cybernetic or information model of living organisms remains reductionistic. The new reductionism can best be understood if we see

that the whole of the new theory is always a constructed one, and therefore artifi-cal, and therefore also abstract, although this abstractness is different from the older one. The artificial whole is not identical to the given whole of reality. The system of systems philosophers is defined scientifically, while the whole given in creation has an entirely different qualification or definition. A plant has a biotic definition, a business has an economic definition, and man has a religious qualification. The pretense of an organic worldview is a pretense that cannot be realized. On the contrary, the pretense of systems philosophy leads to new forms of technicization. And because systems theory has also been introduced into biotechnology, technicization does not stop, but simply gets another direction.

RESPONSIBILITY IN TECHNOLOGY

Up till now we have seen that the development of technology and economics has been disrupted. When we turn to talking about responsibility in technology, it is worthwhile to warn against the opposite pole of technicism: that is, the cultural movement of the adoration of nature. This movement is against technology as such. The Norwegian philosopher Arne Naess, with his concept of "deep ecology," is fully ecocentric. This movement desires, in a certain sense, to see a rebirth of animism; nature is divine in character and hence cannot be violated without punishment.

A militant group within the movement of deep ecology is the Earth First! movement. They try to destroy the modern machinery used to control what the earth produces. Another group is guided by James Lovelock and Lynn Margulis. The earth is seen and accepted as an organismic whole: "Gaia." Gaia is hailed as a messiah. She can restore all that has been destroyed on earth, under the condition that humans accept themselves as a part of nature without a normative cultural calling to be stewards. We could say that, over against the technological paradise, these naturalistic thinkers are reclaiming the original paradise. This organicism or naturalism can not be a responsible answer to genetic engineering. It would mean that there is no responsible place for genetic engineering.

A THIRD WAY

But is there another, a third way? To answer that question we have to look again at the dialectic between technicism and naturalism. The dialectic has its

deepest roots in the religious claim to the absolute self-sufficiency and independence of human nature in terms of science and technology. Such human autonomy is, as I have said, a pretense. Reason is not founded upon itself nor can it be its own support. The dialectic works itself out in terms of unrestricted human power which turns humanity against nature. But such a tension cannot last indefinitely; the dialectical/cultural tensions remain tied to reality as God's creation. Man's pretention to build his own kingdom cannot be divorced from the meaning of creation. The kingdom of man is a parasite on the meaning of the creation as the Kingdom of God. God's Kingdom will remain dominant and inviolable to us, even in science and technology.

In other words, this dialectic parasitizes on God's creation. Unrestricted scientific-technical power eventually encounters limits. Current problems and threats demonstrate that.

From a Christian philosophical perspective we can say that the original dynamics of the creation are converted, through human pretensions of autonomy, into a dialectic within creation. Needed, before all else therefore, is attunement to the dynamics of the original creation. This does not mean rejection of science and technology as such (as is found in counter-culture movements). In the perversion of the creation in science and technology a great deal has been brought to light that is of lasting value. Recognition of the dynamics of creation requires reorientation and renewed reflection on the motive and norms for human activities involving science and technology within culture. Science and technology must be driven from their primary position so that they occupy a place, not of domination but of service.

Men must come to realize that they do not have the first and the last word about history. We may not aspire to be the meaning giver of history, for we are not self-sufficient or sovereign. When one proceeds from a recognition that humanity is meant to do its cultural work before God, and to be guided in doing so by the normative character of the dynamics of creation—and that humanity is not itself the center of reality—then the motives for the various cultural activities receive a different content. Instead of the central motive of power, in which everything men do revolves about themselves, we have the central motive of love, which allows diversity in human cultural activities. Thus, implicitly, what ought to matter is the growth of wisdom in science; building and preserving in technology;

harvesting and maintaining in agriculture; stewardship in the economy; and serving and advancing righteousness and public justice in politics. The variously qualified responsibilities and their irreducibility are safeguarded. Such diversity leads to a meaningful disclosure, a meaningful development, of cultural activities.

For instance, science needs to be integrated within the fullness of empirical reality; experience will be deepened in this way. If scientific knowledge serves growth in wisdom, then science can contribute to increasingly comprehensive insight. Reality is not abandoned to functionalism or to a meaning determined for it by men—as in utilitarianism as a functional reality oriented toward a materialistic society. Scientific-technical control, and technology itself are then no longer simply the result of science. Science must not function as the super-highway in cultural action. Enriched by science, a comprehensive insight which fosters responsibility—leading to creative, prudent action—grants science only the function of a useful service road for practical action, and thus also for the advancement of a diversity of cultural fields.

It is a fallacy to endeavor to find a solution for just one cultural problem. It is of fundamental importance to start from a basic, radical, and integrated approach to all cultural problems.

This brings us to the special question of what all of this means for responsible progress in technology. I wish to address that question by discussing the appropriate motive for technology. Building, preserving, healing—emphasize human creativity and responsibility. It may be possible to change the course of technology, to change the current one-track technology policy to a multi-track policy. This will offer new, creative opportunities for both large scale technology and small scale developments, as well as many in-between—such as certain appropiate or intermediate technologies. This would guarantee more stability in the relationship between technology and nature, greater social justice, and more equitable relations with the so-called Third World.

When technology is forced to change from the role of oppressor to the role of a liberator—without ascribing to technology a messianic role—the motive for technology also must change. The new motive is very old; this ancient motive holds that man is created in the image of God. It also affirms that God is the

source of human responsibility. It stands in direct contrast to the current dominant control motive which subordinates everything to humanity.

The motive of building, healing, and preserving makes clear that technology should be subordinated to a higher good. It means that one must adopt a different attitude toward the development of science and technology. Science and technology must not play a messianic role, but they ought to serve. Men should not adjust themselves uncritically to any and all prevailing trends in science and technology.

Science and technology, when not absolutized, can help to provide basic human needs. So the way to achieve at least part of the fulfillment of basic needs involves a struggle. We must struggle for normative limits to the development of science and technology because such limits keep this development within its proper channels. The struggle for normative limits implies that we can get part of the real meaning of science and technology. To see this as the nucleus of human responsibility has important consequences for the development of science and technology in general and for genetic engineering in particular.

A first requirement is that we should not accept science as an instrument of control. The world of science as world of abstract thinking must be relativized. The world of science, a secondary world, cannot become primary. It must be integrated responsibly into the world of experience, into our concrete, existential, and prescientific knowledge. The scientization of reality, which culminates in technization, must be brought to a halt. This implies a detoxification of technicism and technicization. Scientific-technical control will no longer be sought as the straightforward result of science. Science must not function as a superhighway in cultural action. Integrating scientific knowledge within prescientific knowledge will increase the human sense of responsibility, creativity, and stewardship. Scien-ce will no longer be abstracted from the origin and the full meaning of reality as God's creation. This means that we will accept reality as enriched by science and technology, as a meaningful whole, but as one that was created by God, is main-tained by Him, and is destined for His glory. Man has been called to disclose that meaning in historical development and in culture. In that light science and technology can make contributions when they are placed under the normative direction of creation's cultural development. Then our sense of responsibility can direct both science and technology. Only then can we avoid the pitfalls of our

relentless, arrogant, troubling, terminal rush toward the future. The human future will then no longer be determined by a compass whose needle points only toward humanity, as though it were the magnetic pole. The future approaches us, in unexpected ways, if we accept, obediently and responsibly, the direction of the normative cultural perspective. If we can also take into account existing conditions and allow ourselves to be led by insights created by that perspective, we need not fear the changes and surprises that the future will bring us.

Science in the service of wisdom can have a wholesome influence on culture if cultural activities are brought under the guidance of the supra-subjective and supra-arbitrary normative structure of created reality. Required of us is that we work these normative principles out in responsibility, in norms that function as guides or signposts for responsible cultural action. Effectiveness and efficiency are not most important; in the first place there ought to be love, righteousness, justice, service, readiness to make sacrifices, mercifulness, and thankfulness. Only by following the normative direction of creation can science and technology be enabled to make a meaningful contribution to all cultural sectors. The Reformational Philosophy, which I represent, has done much to discover this structural direction.

This future perspective is best seen as an old biblical view of a healthy culture and cultural development: it is the perspective of the garden, in which building and preserving are in balance. Technology and economics, in such a perspective, have a useful place. Everything is given to us. To develop technology and the economy, in the perspective of the garden, means that technology ought to be a means, not a Moloch, and the economy ought not to be materialistic but an economy of usufruct. Such a culture shows a harmony between technology and nature. We are living from the usufruct, and not destroying our God-given capital. In such a perspective we can speak of a renewed lifestyle, of recycling, of lighter-than-air-ships, of renewable energy, and so on.

At the moment there is much talk about a sustainable culture; but a technological culture can not be sustainable. Only if technology and economics are developed in the perspective of the garden will there be sustainability. Ecology and economy go hand in hand in such a perspective, because natural cyclical courses are not broken down, and the sources of raw materials are not exploited to the very end. We can use the technology of recycling, energy sources which

renew themselves—such as wind energy, solar energy, and so on. Or to use another image: we can learn to live on the fruits or profits or interests of creational capital, and not on that capital itself. Otherwise we squander or waste it. And that is what we are seeing today: depletion of the ozone layer, emissions of greenhouse gases, deforestation, desertification, and the end of raw materials.

A very good example of developing technology in the perspective of the garden can be found in biological or organic agriculture. In modern industrial agriculture we can see the destruction of technicization. We see overproduction. But the reverse side of this technical and economic success of industrial agriculture is the great insecurity and anxiousness of farmers about the future, the worsening of animal welfare, over-fertilization, impairment of the soil, the appearence of various diseases of the soil, serious disruption of landscapes, the deterioration and exhaustion of nature, pollution of the environment, and so on. Because of the scientific-technical outlook, animate nature has been seen as inanimate. Agriculture has been wrenched loose from its ecological biotic context, and the tension between agriculture and nature has increased.

In biological (sometimes called ecological) agriculture or organic farming, the method of harvesting is not an exploiting one, but a biological method. Fertility or fruitfulness is not decreasing but increasing. Such a biological—thus truly scientific—method is in agreement with animate nature. In the Netherlands this kind of agriculture is rapidly increasing. It has many more advantages than industrial agriculture.

To make the perspective of the garden clearer in opposition to a Babel-culture, a technicized culture, I should give more specific attention to good normative directions for cultural development. They start with the acknowledgment that good technology is adaptable and ecologically responsible technology. Historical cultural norms, the norms of information and communication, of stewardship and harmony between technology, culture, and nature, the norms of justice and the ethical norms of care and love must be honored and applied.

GENETIC ENGINEERING

What does this view mean for a normative approach to genetic

engineering? Genetic manipulation is a technological method to transport one or more genes from one species to another species in order to get a new living organism with new properties.

Genetic engineering, as a part of technicism and technicization, shows much promise and it can fulfill several dreams. But because there is little reflection on the method and its consequences, we will be confronted with nightmares.

Under the guidance of technicism nature, plants, and animals are recognized only to the extent that they can be controlled and produced. If we accept the technological model for plants, animals, and human beings, we see them as technological artifacts which we can manipulate. And from the outset, we have conceived living wholes as composites of dead things. The consequence is a neglect of their dignity or integrity, in the end, even the destruction of life. In our scientific-technological view, we have abstracted from life and in cases of manipulation of living organisms their life is distorted and put in peril. In other words, technicism relates to living organisms as a dictator does to people. They are recognized only to the extent that they can be manipulated. Plants, animals, and nature become the victims of limitless genetic manipulation.

From the perspective of the garden we should look at animals and plants as living wholes which must be preserved, healed, cared for, and looked after. In using plants and animals as food, they should be respected right to the end as living organisms.

It is an important ethical issue whether, in the perspective of the garden, genetic engineering is really necessary. I think that we do not need it. The main question which ought to be answered is, Do we really need this new technology to solve our problems? Are not the risks too high? The general ethical assessment ought to be, "No, unless." The "unless" relates to the fact that we already have the new technology, that, in certain cases, it can be seen as inevitable.

But if we make use of genetic engineering in our technological culture, we have to recognize that technological models have their limits. The mechanical model should be relativized, integrated within our pre-scientific experience. Before starting genetic manipulation, we ought first to honor the dignity or

integrity of animals and plants. And for that reason we need a normative framework which limits the new technology. Generally speaking genetic engineering of animals can only be accepted if there is no other opportunity to produce medicines for sick people. That is the content of the "unless" in the ethical principle, "No, unless."

Moreover, I have come to the conviction that genetic manipulation of plants is especially dangerous for nature. The outcome of using a method of scientific-technical control on living creatures is very hazardous, especially in the long run. The reason is that the laws of biotic reality are different from the laws of physics; therefore, we can be confronted with unforeseeable effects in the far future. Besides, the introduction of genetically manipulated plants into the environment will decrease biodiversity; and genetic pollution is not excluded. From the point of view of preserving nature and biodiversity, this new technology thus offers more reasons for doubt.

Special attention ought to be given to the possible genetic engineering of human beings. The new technology enables the scientist to map our hereditary information. That information consists of roughly one hundred thousand genes. If such gene profiles are not protected, they can easily be abused, as, for example, through discrimination in the workplace and by prejudicial conditions placed on insurance policies if the gene profile shows that the insured poses a high risk to the company. Naturally, such ethical questions become even more crucial when a reading of parents' gene profiles, in combination with the prenatal investigation of the fetus's gene profile, shows that the child has an "unfavorable" gene structure. Such research could easily lead to a higher rate of abortions.

Besides, everyone feels that trifling with animals paves the way for trifling with human beings. Successful experiments conducted on animals open the way to similar experiments involving the genetic information of human beings. The very possibility requires us to deal with it now. Repairing genetic defects, infusing into people specific characteristics such as greater intelligence, for instance, no longer belongs to the area of science fiction. And we must confront head-on the associated ethical problems.

With the aid of so-called test-tube technology, it will be possible not only to point to hereditary defects in advance; it will also be possible to "construct" a

super-baby with a favorable genetic structure. That means a lot of experiments with a loss of many human embryos. And, besides, no one can be sure that gene-tic manipulation will ever succeed. As far as I can see, the only way it could succeed is by combining the genetic manipulation of a cell with the technological process of cloning. Is this permissible?

When a whole human being is at stake, under the guidance of the motive and norms of technicism, the being will be seen as a complicated machine, or a complex physical-chemical substance, or, more recently still, as an information programming system of complex DNA molecules. The result is a reductionist view of the human race, which implies dehumanization because the materialistic view has degraded human beings to things to be manipulated.

In the light of technicism, genetic manipulation will be judged as a successful technological process with a technological guarantee. Genetic engineering has to guarantee the quality of its product. Needless to say, a poor outcome is not acceptable and must therefore be destroyed. The result will be seen as a product better than what natural processes provide. The old ethical issue of eugenics is at stake again. Eugenics seeks to improve the human race and always implies discrimination against disabled people. Eugenics seeks to prevent human beings with diseases and handicaps, instead of preventing diseases and handicaps of human beings. It is my convinction that eugenics via genetic manipulation is not allowed. The rights of all human beings ought to be honored.

Does this mean that all genetic engineering of human beings must be rejected? No, not if scientific-technological control is turned to human service. The "no, unless" principle comes into play here again. Only then will there be an end to the scientistic and technicist approach to humanity and to a materialistic view of humanity. We can only appreciate genetic engineering if it is applied to remedying certain hereditary deficiencies and diseases, and only then if the approach zeroes in on limited genetic therapy at the organic level, rather than on a general treatment of the total genetic structure. In any case, all the ethical rules of medical treatment must be strictly observed.

In conclusion, to the extent that genetic engineering can be used at the organic level, it can be in accord with the old medical ethics. A repaired cell of a sick organ, after transplantation, can make a sick person become healthy again. In

that case the wholeness of human identity is respected and even recovered.

This position makes clear where the ethical boundaries lie; but, even then, much reflection is needed to prevent responsible technologies from degenerating into acts of unspeakable evil.