

# THE PHENOMENON OF LIFE

Toward a  
Philosophical Biology

Hans Jonas

With a foreword by Lawrence Vogel

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## EIGHTH ESSAY

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# The Practical Uses of Theory

### I

In his commentary to Aristotle's *On the Soul*, Thomas Aquinas wrote as follows:

"All knowledge is obviously good because the good of any thing is that which belongs to the fulness of being which all things seek after and desire; and man as man reaches fulness of being through knowledge. Now of good things some are just valuable, namely, those which are useful in view of some end—as we value a good horse because it runs well; whilst other good things are also honourable: namely, those that exist for their own sake, for we give honour to ends, not to means. Of the sciences some are practical, others speculative; the difference being that the former are for the sake of some work to be done, while the latter are for their own sake. The speculative sciences are therefore honourable as well as good, but the practical are only valuable."<sup>1</sup>

About three and a half centuries later, Francis Bacon wrote in *The Great Instauration* as follows:

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1. A. M. Pirotta, ed., *Sancti Thomae Aquinatis in Aristotelis Librum de Anima Commentarium, Lectio I*, 3. The above English quotation is from the translation by K. Foster and S. Humphries, *Aristotle's De Anima in the Version of William of Moerbeke and the Commentary of St. Thomas Aquinas*, p. 45.

"I would address one general admonition to all: that they consider what are the true ends of knowledge, and that they seek it not either for pleasure of the mind, or for contention, or for superiority to others . . . but for the benefit and use of life, and that they perfect and govern it in charity. . . . [From the marriage of the Mind and the Universe] there may spring helps to man, and a line and race of inventions that may in some degree subdue and overcome the necessities and miseries of humanity. . . . For the matter in hand is no mere felicity of speculation, but the real business and fortunes of the human race, and all power of operation. . . . And so those twin objects, *human knowledge* and *human power*, do really meet in one."<sup>2</sup>

Here are two opposing statements of the aim and very meaning of knowledge and, consequently, of its relation to possible use, or to "works." On this old theme the present discourse attempts to offer some comments unavailable to the original contestants but available to us in the light of the new "necessities and miseries of humanity," which are besetting us, so it seems, precisely as a concomitant of that use of knowledge which Bacon envisaged as the remedy for humanity's old necessities and miseries.

Aquinas and Bacon obviously speak of two different things. In assigning different ends to knowledge, they speak in fact of different kinds of knowledge, having also different kinds of things for their subject. Taking Aquinas first, who of course speaks for Aristotle, the "speculative" (that is, theoretical) sciences of his statement are about things unchangeable and eternal—the first causes and intelligible forms of Being—which, being unchangeable, *can* be contemplated only, not involved in action: theirs is *theoria* in the strict Aristotelian sense. The "practical sciences," on the other hand, are "arts," not "theory"—a knowledge concerning the planned changing of the changeable. Such knowledge springs from experience, not from theory or speculative reason. The guidance that theory *can* provide

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2. From the Preface of Francis Bacon to *The Great Instauration*. The four sentences of the quotation occur in the text in that order, but widely scattered. An additional quotation from the Preface may instance Bacon's direct criticism of classical theory: "And for its value and utility it must be plainly avowed that that wisdom which we have derived principally from the Greeks is but the boyhood of knowledge, and has the characteristic property of boys: it can talk, but it cannot generate; for it is fruitful of controversies but barren of works."

with regard to the arts consists not in promoting their invention and informing their procedures, but in informing their user (if he partakes in the theoretical life) with the wisdom to use those arts, like all things, wisely, that is, in proper measure and for proper ends. This may be called a practical benefit of theory through the enlightening effect which it has on the whole person of its votaries beyond its immediate actuality. But this benefit is not in the nature of a "use" made of theory as a means, and is anyway a second best in response to the necessities of man: the best is the sustained activity of pure thought itself, where man is most free.

So far Aristotle and Aquinas. It is the "necessities of humanity" which assume first place in Bacon's scheme: and since art is man's way of meeting and conquering necessity, but has not hitherto enjoyed the benefit of speculative reason (mainly by the latter's fault), Bacon urges that the two be brought into a new relationship in which their former separation is overcome. This involves a revision of both, but first, in causal order, of speculative science, which has so long been "barren of works." Theory must be so revised that it yields "designations and directions for works," even has "the invention of arts" for its very end, and thus becomes itself an art of invention. Theory it is nonetheless, as it is discovery and rational account of first causes and universal laws (forms). It thus agrees with classical theory in that it has the nature of things and the totality of nature for its object; but it is such a science of causes and laws, or a science of such causes and laws, as then makes it possible "to command nature in action." It makes this possible because from the outset it looks at nature *qua* acting, and achieves knowledge of nature's laws of action by itself engaging nature in action—that is, in experiment, and therefore on terms set by man himself. It yields directions for works because it first catches nature "at work."

A science of "nature at work" is a mechanics, or dynamics, of nature. For such a science Galileo and Descartes provided the speculative premises and the method of analysis and synthesis. Giving birth to a theory with inherently technological potential, they set on its actual course that fusion of theory and practice which Bacon was dreaming of. Before I say something more of that kind of theory which lends itself to technical application, and indeed has intrinsic reference to this kind of use, I must say something about use as such.

## II

What is use for? The ultimate end of all use is the same as the end of all activity, and this is twofold: preservation of life, and betterment of life, that is, promotion of the good life. Put negatively, as suggested by Bacon's pair "necessities and miseries," the twofold end is to ward off extinction and to overcome misery. We note the emergency aspect that Bacon gives to human endeavor, and thus to knowledge as part of that endeavor. He speaks of lifting or lessening an adverse and pressing condition, whereas Thomas, with Aristotle, speaks positively of attaining "fulness of being," or perfection. Bacon's negative emphasis invests the task of knowledge with a kind of physical and moral urgency altogether strange and novel in the history of theory, but increasingly familiar since his time.

The difference in emphasis admits, however, of common ground: assuming mere preservation (which takes precedence in both cases) to be assured in its basic conditions, misery means denial of a good life; its removal then means betterment, and therefore by both accounts, that of Aristotle and that of Bacon, the ultimate aim of all doing beyond that minimum necessary for survival is the good life or human happiness. Leaving the term "happiness" in all the ambiguity it must have until we determine what happiness may consist in, we may thus state as the ground common to Bacon and Aristotle that the "what for" of all use, including that of knowledge, is happiness.

Whose happiness? If, as Bacon holds, knowledge is to do away with the miseries of mankind, it is the happiness of mankind which the pursuit of knowledge has for its aim. If, as Aristotle holds, man as man reaches fullness of being through, or rather in, knowledge, it is the happiness of the knower which the pursuit of pure knowledge achieves. In both cases there is, then, a supreme "use" to theoretical knowledge. To Aristotle it consists in the good that knowledge works in the soul of the knower, that is, in the condition of knowing itself as the perfection of the knower's being.

Now, to claim this ennobling effect for knowledge makes sense only when theory is knowledge of the noblest, that is, most perfect, objects. There being such objects is indeed the condition of there being "theory" in the classical sense of the word; and conversely, failing such objects the contemplative ideal of classical philosophy becomes pointless. Assuming the condition as given, then theory, as

intellectual communion with those objects—and through such communion modifying the subject's own condition—does not merely promote but in its actuality constitute happiness: a happiness termed “divine,” and therefore but briefly obtainable in the lives of mortals. Hence in this case possession and use of theory are the same. If there is a further “use” of it beyond its own activity—and therefore a contribution to happiness of a more “human” (as distinct from “divine”) kind—it consists, as we have seen, in the wisdom it confers on the person for the conduct of his life in general, and in the comprehension which, from the summit of speculation, transfuses his understanding of all things, including common things. But although theory through wisdom may deliver its possessor from the spell of common things, and thereby increase his moral freedom from their necessity, it does not increase his physical control over and use of them (rather tends to limit the latter), and leaves the realm of necessity itself unaffected.

Since Bacon's time it has been the other alternative that matters. To him and those after him, the use of knowledge consists in the “fruits” it bears in our dealing with the common things. To bear that fruit the knowledge itself must be knowledge of common things—not derivatively so, as was classical theory, but primarily and even before becoming practical. This is indeed the case: the theory that is thus to be fruitful is knowledge of a universe which, in the absence of a hierarchy of being, consists of common things entirely. Since freedom can then no longer be located in a cognitive relation to the “noblest objects,” knowledge must deliver man from the yoke of necessity by meeting necessity on its own ground, and achieves freedom for him by delivering the things into his power. A new vision of nature, not only of knowledge, is implied in Bacon's insistence that “the mind may exercise over the nature of things the authority which properly belongs to it.” The nature of things is left with no dignity of its own.<sup>3</sup>

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3. “For as all works do show forth the power and skill of the workman, and not his image; so it is of the works of God, which do show the omnipotency and wisdom of the maker, but not his image: and therefore therein the heathen opinion differeth from the sacred truth; for they supposed the world to be the image of God, and man to be an extract or compendious image of the world; but the Scriptures never vouchsafe to attribute to the world that honour, as to be the image of God, but only *the*

All dignity belongs to man: what commands no reverence can be commanded, and all things are for use. To be the master of nature is the right of man as the sole possessor of mind, and knowledge, by fitting him to exercise this right, will at last bring man into his own. His own is "the kingdom of man," and it consists in his sovereign use of things. Sovereign use means more use—not merely potential but actual and, strange to say, even necessary use. Control, by making ever more things available for more kinds of uses, enmeshes the user's life in ever more dependencies on external objects. There is no other way of exercising the power than by making oneself available to the use of the things as they become available. Where use is forgone the power must lapse, but there is no limit to the extension of either. And so one master is exchanged for another.

Even the laying hold of power in the first place is not quite so free as the appeal to man's legitimate authority suggests. For not only is man's relation to nature one of power, but nature herself is conceived in terms of power. Thus it is a question of either ruling or being ruled; and to be ruled by a nature not noble or kindred or wise means slavery and hence misery. The exercise of man's inherent right is therefore also the response to a basic and continuous emergency: the emergency of a contest decreed by man's condition. The attack of knowledge, being a defense against necessity, is itself a function of necessity and retains this aspect throughout its career, which is a continuous response to the new necessities created by its very progress.

### III

For knowledge to be beneficial to man's estate it must be "perfected and governed in charity." This is to say that whoever administers the course and the use of theory must take the necessities and miseries of

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*work of his hands*; neither do they speak of any other image of God, but man" (Bacon, *The Advancement of Learning*, Book II: *Works*, ed. J. Spedding and R. L. Ellis, III, pp. 349 f. [= *The Philosophical Works*, ed. J. M. Robertson, p. 91]). Leo Strauss adduces this passage in support of the statement: "The division of philosophy into natural and human philosophy is based on the systematic distinction between man and world, which Bacon makes in express controversy against ancient philosophy" (*The Political Philosophy of Hobbes*, p. 91, n. 1).



humanity to heart. The blessings of knowledge are not in the first place for the knower but for his not-knowing fellow men—and for himself only insofar as he is one of them. Unlike the magician, the scientist does not acquire in his own person the power that springs from his art. He hardly even acquires, and certainly does not own, the knowledge itself in his own person: since this knowledge is a collective enterprise, his fractional contribution goes into the common stock, of which the scientific community is the depository and society as a whole should be the beneficiary. Among the benefits that knowledge grants through power over things is relief from toil: leisure then, but not the scientist's own, is here a fruit of knowledge. The classical pattern was the opposite: leisure was a condition of theory, antecedently assured to make theory possible, not something to be achieved by its exertions. Modern theoretical activity, far from being use of leisure, is itself a toil and part of the common toil of humanity, however gratifying to the toiler. This alone shows that modern theory does not, in human terms, take the place of classical theory.

Furthermore, the need for charity or benevolence in the use of theory stems from the fact that power can be for evil as well as for good. Now, charity is not itself among the fruits of theory in the modern sense. As a qualifying condition of its use—which use theory itself does not specify, let alone assure—it must spring from a source transcendent to the knowledge that the theory supplies.

Here a comparison with the classical case is instructive. Though Plato does not call it by that name, the responsibility that compels the philosopher to return to the "cave" and help his fellow men imprisoned there is an analogue to Bacon's charity or pity. But also how different! In the first place, since of theory in the Platonic sense the activity as well as the object is noble, it will itself be the source of benevolence in its adepts for whatever part they may take in the active life. Nonbenevolent action would be inconsistent with the light they partake of through the highest knowledge. No such contradiction obtains between the insights of science and their potential nonbenevolent use. Second, though in Plato's scheme the "descent" into the active life is not by inclination but by duty, and this duty is proximately enforced by the state, its ultimate sanction emanates from the object of contemplation itself, namely, "the good," which is not envious and impels its own communication; thus no additional and

heterogenic principle is required to provide the ground of responsibility. Finally, the returning philosopher's action in the cave is concerned, not with the managing of things, but with the ordering of lives; in other words, it is not technical but political, informed by the vision of order in the intelligible world. Thus it is an "application" that derives its motive, its model, and its standard of what is beneficial from the one and self-sufficient theory. Such "application" can be exercised only in person by the authentic adepts of theory; it cannot be delegated, as can and must be the application of the "know-how" of technical science.

By contrast, modern theory is not self-sufficiently the source of the human quality that makes it beneficial. That its results are detachable from it and handed over for use to those who had no part in the theoretical process is only one aspect of the matter. The scientist himself is by his science no more qualified than others to discern, nor even is he more disposed to care for, the good of mankind. Benevolence must be called in from the outside to supplement the knowledge acquired through theory: it does not flow from theory itself.

Why is this so? One answer is commonly expressed in the statement that science is "value-free" (*wertfrei*), with the corollary that values are not objects of knowledge, or at any rate of scientific knowledge. But why is science divorced from value, and value considered nonrational? Can it be because the validation of value requires a transcendence whence to derive it? Relation to an objective transcendence lies today outside theory by its rules of evidence, whereas formerly it was the very life of theory.

"Transcendence" (whatever else the term comprises) implies objects higher than man, and about such was classical theory. Modern theory is about objects lower than man: even stars, being common things, are lower than man. No guidance as to ends can be derived from them. The phrase "lower than man," implying a valuation, seems to contradict the asserted "value-freedom" of science. But this value-freedom means a neutrality as much of the objects as of the science: of the objects, their neutrality (indifference) toward whatever value may be "given" them. And that which lacks intrinsic value of its own is lower than that by reference to which alone it may receive value, namely, man and human life, the only remaining source and referent of value.

What then about the sciences of man, like psychology or sociology? Surely it cannot be said of them that the objects of science are lower than man? Their object *is* man. Is it not true that with them value re-enters the universe of science? And can there not spring from them, as dealing with source and reference of all value, a valid theory of value? But here we have to distinguish: Valuation as a fact of human behavior indeed becomes known in the human sciences—but not value itself. And facetious as it may sound: insofar as they are *sciences* their object too is “lower than man.” How so? For a scientific theory of him to be possible, man, including his habits of valuation, has to be taken as determined by causal laws, as an instance and part of nature. The scientist does take him so—but not himself while he assumes and exercises his freedom of inquiry and his openness to reason, evidence, and truth. Thus man-the-knower apprehends man-*qua*-lower-than-himself and in doing so achieves knowledge of man-*qua*-lower-than-man, since all scientific theory is of things lower than man the knower. It is on that condition that they can be subjected to “theory,” hence to control, hence to use. Then man-lower-than-man explained by the human sciences—man reified—can by the instructions of these sciences be controlled (even “engineered”) and thus used.

Charity then, or even love (as love of mankind rather than person), in trying to make such use a charitable or beneficent one, does not correct but rather confirm the lower status. And as the use of what is lower-than-man can only be for what is lower and not for what is higher in the user himself, the knower and user becomes in such use, if made all-inclusive, himself lower than man. And all-inclusive it becomes when it extends over the being of one's fellow men and swallows up the island-kingdom of the person. Inevitably the manipulator comes to see himself in the same light as those his theory has made manipulable; and in the self-inclusive solidarity with the general human lowliness amidst the splendor of human power his charity is but self-compassion and that tolerance which springs from self-contempt: we are all poor puppets and cannot help being what we are. Benevolence then degenerates to condoning and conniving.

Even when of a purer and less ambiguous kind, benevolence alone is insufficient to insure beneficial use of science. As a disposition to refrain from harming, it is of course as indispensable in this context

as it is in the fellowship of men in general. But in its positive aspect good will is *for* the good and must therefore be informed by a conception of what is the good. Whence such a conception can derive and whether it can be raised to the rank of "knowledge" must here be left undecided. If there is a knowledge of it, not science can supply it. Mere benevolence cannot replace it—nor even love, if love without reverence; and whence can reverence come except from a knowledge of what is to be revered? But even if a guiding knowledge of the good, that is, true philosophy were available, it might well find its counsel to be of no avail against the self-generated dynamics of science in use. To this theme I shall return at the end. Now I must say something more about the specifically modern practice-theory relation itself and the ways it works, rather than what it works for.

## IV

We speak of *using* when we apply something as a means toward an end. As the end is distinct from the means, so normally is the means distinct from its application. That is to say, the means has a prior existence of its own and would continue to be what it is even if never so applied at all. Whether this holds fully for theory too, or for every theory, we have reason to doubt. But in speaking of uses of theory that much is conceded that theory, however used, is also something by itself.

Being something by itself is not necessarily to be neutral to possible use. Use may be essential, or it may be accidental, to that which can serve as a means. Some things, though having a substantive being of their own once they exist, do so *as* means from the outset. A tool, for example, owes its very being to the purpose beyond itself for which it was designed. If not put to such service it misses its *raison d'être*. To other things use comes as it were as an afterthought on the part of a user: for them, being used is accidental, extraneous to the being they have in their own independent right. In the first category are mainly man-made things, like hammers or chairs, in the second mainly natural ones, like horses or rivers. Theory is certainly man-made, and it has uses; but whether use is essential or accidental to it may well depend on the kind of theory one considers, as also on the kind of use. Mathematics, for example, differs in this respect from

physics. My thesis is that to modern theory in general, practical use is no accident but is integral to it, or that "science" is technological by its nature.

Practical is a use which involves external action, resulting in a change in the environment (or preventing a change). External action requires the use of external, physical means, and moreover some degree of information, which is an internal, nonphysical thing. But all action which is not strictly routine, and not purely intuitive, requires more than that, namely, deliberation, and this can be as to ends and as to means: as to ends—for example, whether desirable, and whether generally possible; as to means—for example, which as such suitable, and which here and now available. In all these respects, *knowledge* (if not necessarily theory) enters into the conditions and conduct of action and is made use of.

Obviously it is a different kind of knowledge that has to do with the desirability of ends, and a different kind that has to do with feasibility, means, and execution. Again, within the latter kind, the knowledge which pronounces on possibility in principle is different from the one which maps, still in the abstract, possible ways of realization, and this from the discernment of the course of action most practicable in the given circumstances. We have here a scale descending from the general to the particular, from the simple to the complex, and at the same time from theory to practice, which is complexity itself. The knowledge of possibility rests on the universal principles of the field, its constitutive laws (the terminal points of what Galileo called the "resolutive method"); that of typical ways of coming-to-be on more complex and more specific causal patterns, embodying the first principles and providing models for rules of action ("compositive method"); the knowledge, finally, of what to do now is entirely particular, placing the task within the context of the whole, concrete situation. The first two steps are both within theory, or rather, they each *can* have their developed theory. The theory in the first case we may call science proper, such as theoretical physics; the theory in the second case, derivative from it in logic, if not always in fact, we may call technological or applied science—which, it must be remembered, is still "theory" in respect to action itself, as it offers the specific rules of action as parts of a reasoned whole and without making a decision. The particular execution itself has no theory of its

own and can have none. Though applying the theory, it is not simply derivative of it but involves decision based on *judgment*; and there is no science of judgment (as little as there is one of decision)—that is, judgment cannot be replaced by, or transformed into, science, much as it can avail itself of the findings and even of the intellectual discipline of science and is itself a kind of knowledge, a cognitive faculty. Judgment, says Kant, is the faculty of subsuming the particular under the universal; and since reason is the faculty of the universal, and science the operation of that faculty, judgment as concerned with particulars is necessarily outside science and strictly the bridge between the abstractions of the understanding and the concreteness of life.

In the first stage, that of pure science, the form of propositions is categorical: A is P, B is P, . . . In the applied stage, the form is hypothetical: if P is to be, then either A or B . . . must be provided. In the deliberations of practical judgment, the propositional form is problematical: particulars f, g, . . . available in the situation, do perhaps (not, partially) fit the demands of universal A, or B, . . . ; may therefore be (not, more, less) suitable for bringing about P. Invention is typically such a combination of concrete judgment with abstract science.

It is in this realm of concrete judgment and choice that the practical use of theory comes about. Whence it follows that the use of theory does not itself permit of a theory: if it is enlightened use, it receives its light from deliberation, which may or may not enjoy the benefits of good sense. But this knowledge of use is different not only from the knowledge of the theory used in the case but from that of any theory whatsoever, and it is acquired or learned in ways different from those of theory. This is the reason why Aristotle denied there being a science of politics and practical ethics; the *where, when, to whom* . . . cannot be reduced to general principles. Thus there is theory and use of theory, but no theory of the use of theory.

At the opposite end of the scale is the knowledge concerning ends repeatedly alluded to—of which today we do not know whether it admits of theory, as once it was held eminently to do. This knowledge alone would permit the valid discrimination of worthy and unworthy, desirable and undesirable uses of science, whereas science itself only permits discrimination of its correct or incorrect, adequate or inade-

quate, effectual or ineffectual use. But it is with this very science which is not in doubt that we must now concern ourselves, asking what features intrinsically fit this type of theory for use in the world of things.

## V

Of theory formation one of its nineteenth-century masters, Heinrich Hertz, had this to say: "We form images or symbols of the external objects; the manner in which we form them is such that the *logically* necessary consequences of the images are invariably the images of the *materially* necessary consequences of the corresponding objects."<sup>4</sup>

This is an elliptic statement. For the "images or symbols" formed and used are not of the immediate external objects such as rocks and trees, or even of whole classes or general types of such, but symbols for the residual products of a speculative analysis of the given objects and their states and relations—residues which admit of none but symbolic representation, yet by hypothesis are presumed to underlie the objects and are thus treated as "external objects" themselves in substitution for the original objects.

The key term here is "analysis." Analysis has been the distinctive feature of physical inquiry since the seventeenth century: analysis of *working* nature into its simplest dynamic factors. These factors are framed in such identical quantitative terms as can be entered, combined, and transformed in equations. The analytical method thus implies a primary *ontological reduction* of nature, and this precedes mathematics or other symbolism in its application to nature. Once left to deal with the residual products of this reduction, or rather, with their measured values, mathematics proceeds to reconstruct from them the complexity of phenomena in a way which can lead beyond the data of the initial experience to facts unobserved, or still to come, or to be brought about. That nature lends itself to this kind of reduction was the fundamental discovery, actually the fundamental anticipation, at the outset of mechanical physics.

With this reduction, "substantial forms," that is, wholeness as an

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4. H. Hertz, *Prinzipien der Mechanik*, p. 1, taken from H. Weyl, *Philosophy of Mathematics and Natural Science*, p. 162.

autonomous cause with respect to its component parts, and therefore the ground of its own becoming, shared the fate of final causes. In Newtonian physics the integral wholeness of form, on which classical and medieval ontology was based, is broken up into elementary factors for which the parallelogram of forces is a fitting graphic symbol. The presence of the future, formerly conceived as potentiality of becoming, consists now in the calculability of the operation of the forces discernible in a given configuration. No longer something original in its own right, form is the current compromise among the basic actions of aggregate matter. The falling apple is not so much elevated to the rank of cosmic motion as the latter is brought down to the level of the falling apple. This establishes a new unity of the universe, but of a different complexion from the Greek one: the aristocracy of form is replaced by the democracy of matter.

If, according to this "democracy," wholes are mere sums, then their seemingly genuine qualities are due to the quantitatively more or less involved combination of some simple substrata and their dynamics. Generally complexity and degrees of complexity supplant all other ontological distinctions. Thus for purposes of explanation the parts are called upon to account for the whole, and that means that the primitive has to account for the more articulated, or, in older parlance, *the lower for the higher*.

With no hierarchy of being but only distributions of a uniform substratum, all explanation has to start from the bottom and in fact never leaves it. The higher is the lower in disguise, where the disguise is provided by complexity: with the latter's analysis, the disguise dissolves, and the appearance of the higher is reduced to the reality of the elemental. From physics this schema of explanation has penetrated all provinces of knowledge, and it is now as much at home in psychology and sociology as in the natural sciences where it originated. No longer is the realm of passion characterized by the absence of reason, but reason is characterized as a disguise and servant of passion. The transcendental philosophy of a society is but the ideological superstructure to (and thus a disguise of) its vital interests, which reflect organic needs, which depend on physical constitution. The rat in the maze tells us what we are. Always the lower explains the higher and in the course of analysis emerges as its truth.

Now this ontological analysis has *per se* technological implication



prior to any application in fact. The latter is possible only because of the manipulative aspect inherent in the theoretic constitution of modern science as such. If it is shown how things are made up of their elements, it is also shown, on principle, how they can be made up out of such elements. Making, as distinct from generating, is essentially putting together pre-existing materials or rearranging pre-existing parts. Similarly, scientific cognition is essentially analysis of distribution, that is, of the conditions in which elements are inter-related, and is not burdened with the task of comprehending the essence of those elements themselves. Not what they are but how they function under such specified conditions, that is, in such combinatorial relations, is the theme that science can and does pursue. This restriction is basic to the modern conception of knowledge; for, unlike substantial natures, distributions of conditions can be reconstructed, even freely constructed, in mental models and so allow of understanding. Again, unlike "natures," they may be actually repeated or modified in human imitation of nature, that is in technique, and so allow of manipulation. Both understanding and making are here concerned with relations and not with essences. In fact, understanding of this sort is itself a kind of imaginary making or remaking of its objects, and this is the deepest cause for the technological applicability of modern science.

Early in the eighteenth century, Vico enunciated the principle that man can understand only what he has made himself. From this he reasoned that not nature, which as made by God stands over against man, but history, which is of man's own making, can be understood by man. Only a *factum*—what has been made—can be a *verum*. But in opposing this principle to Cartesian natural science, Vico overlooked the fact that, if only "has been made" is widened to "can be made," the principle applies to nature even better than to history (where in fact its validity is doubtful). For according to the mechanistic scheme the knowledge of a natural event deals, as we have seen, not with the God-created part of the situation—the intrinsic nature of the substances involved—but with the variable conditions which, given those substances, determine the event. By re-enacting those conditions, in thought or in actual manipulation, one can reproduce the event without producing the substratum. To understand the substratum itself is as much beyond man's powers as to produce

it. But the latter is beyond the powers even of nature, which, once created in its substantial entities, goes on "creating" only by manipulating them, that is, by the shift of relations. Conditions and relations are the vehicle for created nature's noncreative productions, just as they are the vehicle for created man's cognition of nature and also for his technical imitation of nature's ways of production. This was the meaning of Bacon's famous maxim that nature can be commanded only by being obeyed. Nature's quasi-technical modes of making—or nature as its own artificer and artifact—is the at once knowable and imitable aspect of it, whereas essences in themselves are unknowable because unmakeable. The metaphor of "nature's workshop," into which science is to pry in order to learn her procedures, popularly expresses the point that the distinction between natural and artificial, so basic to classical philosophy, has lost its meaning. "I do not," wrote Descartes, "recognize any difference between the machines made by craftsmen and the diverse bodies put together by nature alone . . . all the rules of mechanics belong to physics, so that all things which are artificial are thereby natural" (*Principles* IV, art. 203).<sup>5</sup> In the same vein, Descartes could say "Give me matter and motion, and I shall make the world once more"—a saying impossible in the mouth of a premodern thinker. To know a thing means to

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5. But do "all the rules of mechanics" equal "all the rules of physics"? The readily conceded truth that the former "belong to" physics may serve to cover the very different subreption that they exhaust the book of rules of physics (i.e., of nature). The complete passage in the *Principles*, from which the above quotation is taken, is of capital importance as the enunciation of a really new principle, which has since dominated natural science and natural philosophy. Its technological implications are obvious. The new doctrine of a uniform nature, here emerging from the ruins of the medieval edifice, naïvely assumes an identity of macro- and micro-modes of operation, which more recent physics has found wanting. But even apart from any later discoveries, one could have objected at the outset on logical grounds that from the fact of machines working by natural principles entirely it does not follow that they work by the entire natural principles, or, that nature has no other modes of operation than those which man can utilize in his constructions. But this very view of nature (not the innocent one of human mechanics) was Descartes' true conviction: its spirit alone, going far beyond a mere experiment with Occam's razor, accounts for the supreme confidence of the next statement quoted in the text.

know how it is or can be made and therefore means being able to repeat or vary or anticipate the process of making. It does not matter whether man can always actually, with the forces at his command, provide the factors making up the required conditions and, therefore, himself produce their result. Man cannot reproduce a cosmic nebula, but assuming he knows how it is produced in nature, he would on principle be able to produce one too if he were sufficiently large, powerful, and so on, and this is what to know a nebula means. To put it in the form of a slogan, the modern knowledge of nature, very unlike the classical one, is a "know-how" and not a "know-what," and on this basis it makes good Bacon's contention that knowledge is power.

This, however, is not the whole story of the technological aspect inherent in scientific theory. Theory is an internal fact and internal action. But its relation to external action may be not only that of means to end by way of application, but also the reverse: that is, action may be employed in the service of theory as theory may be employed in the service of action. Some complementarity of these two aspects suggests itself from the outset: it may be that only that theory which has grown out of active experience can be turned to the active changing of experience; or only that theory can become a means to practice which has practice among its own means. That this is the case becomes obvious when we consider the role of experiment in the scientific process.

The alliance contemplated by Bacon between knowing and changing the world is indeed much more intimate than the mere delegation of theoretical results to practical use, that is, the *post factum* application of science, would make it. The procedure of science itself, if it is to yield practically relevant results, has to be practical, namely, experimental. We must "close with nature" and do something to it in order to make it yield its secrets through the response we have elicited, "seeing," as Bacon says, "that the nature of things betrays itself more readily under the vexations of art than in its natural freedom." Thus in two different respects modern science is engaged in the active changing of things: on the small scale of the experiment its effects change as a necessary means of knowing nature, that is, it employs practice for the sake of theory; the kind of theory gained in this way lends itself to, and thus invites, the large-scale changes of its

technical application. The latter, in turn, becomes a source of theoretical insights not to be gained on the laboratory scale—in addition to furnishing the tools for more effective laboratory work itself, which again in turn yields new increments of knowledge, and so on in a continuous cycle. In this way the fusion of theory and practice becomes inseparable in a way which the mere terms “pure” and “applied” science fail to convey. Effecting changes in nature as a means and as a result of knowing it are inextricably interlocked, and once this combination is at work it no longer matters whether the pragmatic destination of theory is expressly accepted (for example by the “pure” scientist himself) or not. The very process of attaining knowledge leads through manipulation of the things to be known, and this origin fits of itself the theoretical results for an application whose possibility is irresistible—even to the theoretical interest, let alone the practical, whether or not it was contemplated in the first place.

## VI

At the same time the question as to what is the true human end, truth or use, is entirely left open by the fact of the union as such and is in essence not affected by the conspicuous preponderance of the practical element. The answer is determined by the image of man, of which we are uncertain. Certain it is from what we have learned that if “truth” be the end it cannot be the truth of pure contemplation. The modern discovery that knowing nature requires coming to grips with nature—a discovery bearing beyond the field of natural science—has permanently corrected Aristotle’s “contemplative” view of theory. More, of course, was involved in the ideal of the contemplative life than a conception merely of theoretical method: more than the latter’s correction must also be involved in a legitimate farewell to the ideal—a farewell the more bidden with a heavy heart the more understood in its necessity.

It was Aristotle’s contention that we act in order to intuit and not intuit in order to act—on which the favorite modern comment is that it reflects nothing but the attitude of a leisure class in a slave society. Rarely in our pragmatic climate is the trouble taken to ask whether Aristotle, socially biased or not, might not be right. He was, after all, not deaf to the demands of “reality.” That the necessities of life have

to be taken care of first he explicitly states, this being the task allotted to civilization; only he considered this task to be finite, not infinite, or interminable, as it is likely to appear to modern thought on the basis of different attitudes and experiences. Even with these it is well to consider the Greek reasoning in the matter, so as to put the contemporary dynamism of the active life in its proper perspective. Some simple considerations will still be found pertinent. Thus Aristotle's reasoning that we make war in order to have peace is unanswerable, and the generalization that we toil in order to find rest is at least eminently reasonable.<sup>6</sup> Clearly, then, the rest to be found must not consist in suspension of activity but must itself be a kind of life, that is, have its content in an activity of its own—which to Aristotle was "thought." Now, when full due is given to the sanity and appeal of this classical stance, it must be said that it implies views both of civilization and of thought which, rational as they are, have in the light of modern experience become questionable concerning civilization, and untenable concerning thought.

As to civilization, Aristotle takes for granted that once it has reached a working equilibrium between legitimate wants and means for their satisfaction it can devote its surplus to making possible the philosophical life, the life of thought, the true goal of man. Today we have good reason for disbelief in the very attainment of such an equilibrium. We therefore see no better use (in fact, no choice) for the "surplus" than to be fed back into the active process for that adjustment of its constantly generated disequilibrium which results in progress—a self-feeding automatism in which even theory is of necessity involved as factor and function at once, and to which we cannot see (let alone set) a limit. But, if infinite, then the process of civilization calls for the constant care of the best minds—that is: for their constant employment in the "cave."

And as for "thought" itself, the modern adventure of knowledge has corrected the Greek view of it in yet another respect than that of its possible detachment from practice, and for all we know as definitively. To the Greeks, be it Plato or Aristotle, the number of the truly knowable things is finite, and the apprehension of first principles, whenever obtained, is definitive—subject to intermittent renewal but

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6. *Nicomachean Ethics*, X, 7, 1177 b 4 f.

not to obsolescence through new discovery and better approximation. To the modern experience of knowledge it is inconceivable that any state of theory, including the conceptual system of first principles governing it, should be more than a temporary construct to be superseded by the next vista to which it opens itself the way when all its implications are matched against all the facts. In other words, the *hypothetical* character of modern science *ipso facto* qualifies each of its explanatory and integrating attainments as setting a new problem rather than granting the object for ultimate beholding.

At the root of this difference is, of course, the difference between modern nominalism, with its understanding of the tentative nature of symbolism, as against classical realism. To the latter, concepts reflect and match the self-existing forms of being, and these do not change; to the former, they are products of the human mind, the endeavor of a temporal entity and therefore subject to change. The element of infinity in Greek *theoria* concerned the potential infinity of satisfaction in beholding the eternal, that which never changes; the element of infinity in modern theory concerns the interminableness of the process by which its tentative hypotheses are revised and absorbed into higher symbolical integrations. Thus the idea of potentially infinite progress permeates the modern ideal of knowledge with the same necessity as it permeates the modern ideal of technical civilization;<sup>7</sup> and so, even apart from the mutual involvement of the two, the contemplative ideal has become invalid, nay, illogical, through the sheer lack of those presumed ultimates, the abiding "noblest objects," in whose apprehension knowledge would come to rest and turn from search into contemplation.

## VII

It seems, then, that practice and theory conspire to commit us to unceasing dynamism, and with no abiding present our life is ever into the future. What Nietzsche has called "sovereign becoming" is upon us, and theory, far from having where to stand beyond it, is

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7. And as it permeates the modern idea of nature or reality itself: the very doctrine of being, not merely that of knowledge and of man, has become engulfed in the symbolism of process and change.

chained to its chariot, in harness before it or dragged in its tracks—which, it is hard to tell in the dust of the race, and sure it is only that not theory is the charioteer.

There are those who cheer the surge that sweeps them along and disdain to question “whither?”; who hail change for its own sake, the endless forward thrust of life into the ever new, unknown, the dynamism as such. Yet, surely, for change to be valuable it is relevant *what* entity changes (if not toward what), and this underlying whatness must in some way be definable as that nature of “man as man” which qualifies the endless consummation of its possibilities in change as a worthwhile enterprise. Some image then is implied in the affirmation of change itself. But, if an image, then a norm, and if a norm, then also the freedom of negation, not only the surrender of affirmation; and this freedom itself transcends the flux and points to another sort of theory.

That theory would have to take up the question of ends which the radical vagueness of the term “happiness” leaves open, and on which science, committed to provide the means for happiness, cannot pronounce. The injunction to use it in the interest of man, and to the best of his interest, remains empty as long as it is not known what the best interest of man is.

Faced with the threat of catastrophe we may feel excused from inquiring into ends, since averting catastrophe is a nondebatable first end, suspending all discussion of ultimate ends. Perhaps we are destined to live for long with such pressing emergencies of our own making that what we can do is shoring-up and short-term remedy, not planning for the good life. The former surely needs no philosophy; to meet the recurrent emergency that kind of knowledge would seem competent which has helped to create it—technological science, for it did help create it in each instance by successfully meeting its predecessor.

But if ever we entrust or resign ourselves wholly to the self-corrective mechanics of the interplay of science and technology, we shall have lost the battle for man. For science, with its application governed solely by its own logic, does not really leave the meaning of happiness open: it has prejudged the issue, in spite of its own value-freedom. The automatism of its use—insofar as this use carries beyond the recurrent meeting of the recurrent emergency created by

itself—has set the goal of happiness in principle: indulgence in the use of things. Between the two poles of emergency and indulgence, of resourcefulness and hedonism, set up by the ever-expanding power over things, the direction of all effort and thereby the issue of the good tends to be predecided. But we must not let that issue be decided by default.

Thus even with the pressure of emergencies upon us we need a view beyond them to meet them on more than their own terms. Their very diagnosis (wherever it is not a case of extremity) implies at least an idea of what would not be an emergency, as that of sickness implies the idea of health; and the anticipation of success inherent in all struggle against danger, misery, and injustice must face the question of what life befits man when the emergency virtues of courage, charity, and justice have done their work.

## VIII

Whatever the insights of that "other" theory called philosophy, and whatever its counsels, there is no stopping the use of scientific theory which propels us into the flux, for stopping its use means stopping theory itself; and the course of knowledge must not be stopped—if not for its gains, then in spite of its costs.

Nor is a return to the classical position open to honesty and logic. Theory itself has become a process, and one, as we have seen, which continuously involves its own use; and it cannot be "possessed" otherwise. Science is, therefore, theory and art at once. But whereas in other arts having the skill and using it are different, so that its possessor is free to use it or not, and to decide when, the skill of science as a collective property begets its use by its own momentum, and so the hiatus between two stages, where judgment, wisdom, freedom can have their play, is here dangerously shrinking: the skill possesses its possessor.

Theory itself has become a function of use as much as use a function of theory. Tasks for theory are set by the practical results of its preceding use, their solutions to be turned again to use, and so on. Thus theory is thoroughly immersed in practice.

With this mutual feedback mechanism theory has set up a new realm of necessity, or what may be called a second nature in place of



the first nature from whose necessity theory was to liberate man. To this second nature, no less determinative for being artificial, man is as subject as he was to original nature, and theory itself is under it while constantly engaged in its further making.

If we equate the realm of necessity with Plato's "cave," then scientific theory leads not out of the cave; nor is its practical application a return to the cave: it never left it in the first place. It is entirely of the cave and therefore not "theory" at all in the Platonic sense.

Yet its very possibility implies, and its actuality testifies to, a "transcendence" in man himself as the condition for it. A freedom beyond the necessities of the cave is manifest in the relation to truth, without which science could not be. This relation—a capacity, a commitment, a quest, in short, that which makes science humanly possible—is itself an extrascientific fact. As much, therefore, as science is of the cave by its objects and its uses, by its originating cause "in the soul" it is not. There is still "pure theory" as dedication to the discovery of truth and as devotion to Being, the content of truth: of that dedication science is the modern form.

To philosophy as transscientific theory the human fact of science can provide a clue for a theory of man, so that we may know again about the essence of man—and through it, perhaps, even something of the essence of Being. Whenever such knowledge will again be with us, it can provide a basis for the supremely useful and much-needed knowledge of ends. Pending that event, unforeseeable today as to when and if, we have to live with our poverty—comforted perhaps by the recollection that once before the "I know that I know not" has proved as a beginning of philosophy.<sup>8</sup>

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8. Three comments, by professors Solomon E. Asch, Erich Hula, and Adolph Lowe, followed the delivery of this paper at the twenty-fifth anniversary celebration of the Graduate Faculty, New School for Social Research, in April, 1959. The comments were published with the paper in *Social Research*, 26/2 (1959), pp. 151-166, and reprinted in M. Natanson, *Philosophy of the Social Sciences: A Reader* (New York: Random House, 1963), pp. 142-157.