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Man as an Object of Science

To what extent can the social sciences be expected to explain and help solve the problems of man?

Ernest van den Haag

The influence of science has mounted at a steadily accelerating rate over the last few centuries as scientists have annexed more and more realms to their dominion, and scientific methods are applied to almost all human activity. As it grew, science became self-conscious: an elaborate philosophy of science, a metascience, now analyzes the methods science uses as well as its scope, the meaning of its theories, and the kind and degree of certainty it can yield.

The self-consciousness of science was increased when scientific study was extended vigorously to human behavior itself, and the social sciences (including psychology) posed anew questions about the range and the effects of science which had lingered since its beginnings. These questions are of two types. The first is, can science deal with human beings as it can with the rest of nature? That is, is the behavior of people as predictable (and by analogous methods) as the behavior of other physical bodies and organisms? Are the social sciences, then, as scientific as, say, physics? (This question, of course, requires an answer, at least by implication, to the question: what makes science scientific?) The second type of question is, can the social sciences solve the problems besetting humanity in the same way in which chemistry solves a chemical problem? Or, what, precisely, is the potential role of the social sciences in the direction of human behavior, particularly in controlling the social changes which the progress of the natural sciences has made more necessary than ever?

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Objectivity

Just as the scientific purpose and method of the natural sciences were thought at first to be impious and immoral, so were those of the social sciences. With regard to the social sciences, however, this objection is still with us, though usually in disguised form.

As soon as political science was refounded in the Renaissance, moralists asked whether it is permissible to do what Machiavelli did—in Bacon's words, "to describe frankly and without dissimilation what men do, and not what they ought to do." (Actually, Machiavelli generalized too much from his specific surroundings; yet many of his observations remain applicable.) *The Prince* describes how power is achieved, held, and lost. This is what politics *qua* politics is about (whatever the ends for which power is desired or used), and, therefore, what political science must be concerned with. Yet the thought is still repugnant to many, as witness Machiavelli's reputation through the ages, and such truisms as "power politics," which are as sensible, Jacques Barzun rightly remarks, as "food nutrition" would be.

Machiavelli was particularly vulnerable to moral objections because his description of political behavior was cast into the prescriptive form of advice to a ruler. His critics thought he must approve of the prince's goal—power at any price—and of all the means for the achievement of this goal which he recommended as effective. Whether or not he did and, if so, for what ulterior reason, should be irrelevant to the political scientist. What matters to him is whether the means recommended are as effective as Machiavelli thought—whether he correctly observed the relation between cause and effect in politics.

Somewhat later, when economists studied how a man would have to act to maximize his income, the same question was raised: should men act that way? The misunderstanding of the nature of science on which such questions are based, far from being confined to outsiders, is shared by many social scientists. Yet, approval or disapproval of the behavior he studies is as irrelevant to the task of the economist as it is to the task of the political scientist. In this respect, social scientists do not differ from meteorologists, though people are usually more resigned about the weather than they are about themselves. Perhaps we can do more about human behavior (and we certainly feel more responsible for it) than about the weather. But we will succeed only if we first study it, without ignoring undesirable aspects and possibilities.

Nonetheless, there is one consideration to which not enough attention has been paid, and which might lend some force to the view that the study of social behavior cannot be quite neutral morally: such a study may have automatic effects, desirable or undesirable, apart from increasing our knowledge. Something analogous to the Heisenberg effect in physics may occur in the social sciences; the observation, the attendant requirements, and the publication of results may unavoidably influence that which is being observed (for better or for worse). So far this effect has been minor. But to the extent to which it does occur, it modifies the assumption of neutrality. Observation, to the extent to which it is likely to influence what is being observed, is

not neutral in its effects, and possibly it does not record what would have occurred had there been no observation. Social scientists have accorded but fitful recognition to this fact, perhaps because they do have a vested interest in recognizing it whenever the anticipated effects of their activity are beneficial, and in ignoring it otherwise.

Models

Uneasiness about the moral aspects of behavioral studies probably also prompts the questions about "economic man" which appear to be based on modern psychology: do men really act to maximize their income? and do they do so as rationally as economists assume? Actually, economists, in building a model of man as income maximizer, need not assert anything about the psychology or the nature of man, or even about his ordinary behavior; they need to explore only how a man would have to act, if (all other things being equal) he wanted to maximize his income. Nor does such a model assume anything about the rationality with which we actually pursue the fulfillment of our desires.

The economic model depicts the behavior that would be rational if a given end—income maximization—is assumed. But, in essence, economic calculation is simply rational calculation: how to achieve *any* goal with the least expenditure of whatever is to be economized. Hence, if we replace the goal of income with some other goal, or, better, add some other goals, economic analysis still needs to be applied. In this respect, economics may serve as a paradigm for all social sciences, as was pointed out by the political sociologist Gaetano Mosca.

The importance of the economic model in predicting human behavior (as distinguished from indicating the implications of assumed behavior) depends on the actual strength of the income-maximizing tendency and the influence of the excluded variables. This is so with any theoretical model: its relevance to reality depends on the importance of the included variables in reality; and models become models by excluding some variables, to concentrate on others.

The exclusion is not a defect or sin but a virtue—which becomes a vice only if the model builder is unaware of his exclusions or forgets about them, and attempts to apply conclusions drawn from the model directly to human behavior. This, of course, has happened often, but is no more reason for throwing out models in the social sciences than anywhere else. On the contrary, it is a good reason for constructing models which include the variables excluded before, whether separately or together. Sociology, anthropology, and other sciences are attempting, however haltingly, to do so.

Methodological Problems

It is possible to abandon the assumption of rational behavior altogether. We need retain only the assumption that we can find regularities of behavior—for without that assumption no study could bear fruit. But the assumption of rationality is useful inasmuch as it can guide our search for regularities and help make these regularities intelligible. Finally, if we wish to apply the social sciences to the control of human behavior, we have to postulate ends and calculate the most rational ways of attaining them. And to assume that people behave rationally is simply to assume that they have ends and strive to use suitable means to attain them—effective and economic means—means that are justified by the end (for nothing else can ever justify means, though, of course, no end can justify all means).

To say that people act rationally, then, is to make a judgment about how suitable the means used are to the ends pursued. Such a judgment requires us to know not only what people do, but also what they want to achieve. We will be misled if the true objective of the behavior studied is not what it is assumed to be. And much apparent irrationality may occur because people are vague or ambivalent about their objectives. Yet, not much would be gained if we were to drop the teleological model altogether in the social sciences. The real difficulties lie in empirically establishing regularities of human behavior, regardless of the form—purposive or not—in which they are described. And, as mentioned, the heuristic value of the teleological model is considerable. Above all, if we are to apply our knowledge of the regularities of human behavior for its control, we will have to investigate actual human ends anyway, and decide among possible ones.

Before we turn to the problems connected with application, some further problems of attaining knowledge about human behavior must be mentioned. Though not peculiar to the social sciences, these problems characterize them more than other disciplines. In studying individuals or societies, we deal with historical streams of events, which, unlike the models abstracted from them, take place in nonrecurrent situations. Wars, and economic depressions, and the institution of the family are classes of events which permit the classification signified by the words *war, depression,* and *family*. But, one war, one depression, one family, differs immensely from another, if only because each develops in unique historical circumstances. Strictly speaking, this is true as well for the events studied by the natural sciences. But in the natural sciences the most relevant features appear to be repetitive, whereas in the social sciences repetitiveness can be postulated only by abstracting from relevant and often decisive features, which, though not themselves unique, combine into unique situations. What is worse for the social sciences is that it is impossible to *reproduce* any of the situations that concern them. Because of this impossibility, we cannot actually isolate variables from one another so as to ascertain which are necessary and sufficient to produce the effects of which we suspect them to be the cause. We can do so only in our analytical models.

As for reality, we must rely on observation, without the basic advantage, offered by experiment, of keeping constant the actual environment of the phenomena under observation, and thus testing our hypotheses. The evidence for the theories of the social sciences is therefore unlikely to be ever as conclusive as the evidence for propositions in physics can be: the propositions of the social sciences are unlikely ever to be definitively tested. If a prediction which follows from a theory does not come true it may be that the theory is wrong. It may be as well that it would have come true were it not that some of the circumstances presumed to remain unchanged —*ceteris paribus*—did *not* remain unchanged. And we cannot ascertain empirically which was the case.

Moreover, for the sake of simplicity, we often must presume circumstances to remain constant which we know will actually change (though we do not know which way). Further, these circumstances are known to be relevant to what we study—for example, political developments are relevant to economic ones. Yet, the major attempts to create a uni-

fied social science—from Comte, to Marx, to Spengler or Toynbee—have proved to be without scientific value themselves, though they have served as sources for manifold inspirations, and are sometimes admirable as works of art or metaphysics.

Value Judgements

Even if the social sciences could predict with the degree of probability which characterizes the natural sciences, there are difficulties in applying such knowledge for purposes of control, which, though not altogether peculiar to them, are harder to overcome in the social sciences than in the natural ones. In physics, for instance, controlling energy means to utilize our knowledge so as to arrange matters in such a way as to produce the energy wanted. But in the social sciences we would have to arrange, not matters, but ourselves, so as to produce the desired result: we are not only the manipulators but also the manipulated. To some extent the natural sciences, when applied, also involve the manipulation of human beings, for instance in medicine. Uusually, however, the individual is free to take the physician's prescription or pour it down the drain. Moreover, people are fairly agreed on what they wish to achieve with the physician's help. In contrast, in the social sciences, the measures needed to change social phenomena require collective, rather than individual, acquiescence. And we are not agreed on what changes are worthwhile.

This last point is, perhaps, most serious. For the disagreement on what changes are worthwhile—on what ends we *should* strive for, individually and collectively—is not amenable to resolution by scientific means. Hence, to the extent to which social problems are rooted in divergent values, they are not likely to be solved by the social sciences. If collective decisions have to be taken, disagreements are not necessarily soluble, then, by any factual study such as science can undertake. (Actually this may be as true for individual decisions, if we regard the individual, not as a monolithic structure, but as composed of not necessarily integrated parts. There are then, perhaps, a number of equally possible and —in terms of the individual's values— equally successful bases for integration, and the decisions on the right one would not rest with the psychologist.)

This is not to say that the social sciences can be of no assistance. Divergent ends may be attained by different persons without conflict, and it is for scientific analysis to establish where this can or cannot be done. Further, ends may be pursued in ignorance of the means actually required to achieve them, or in ignorance of their unattainability or of their incompatibility with other ends simultaneously pursued. Knowledge of means and of effects may influence the ends people wish to pursue; and the social sciences yield such knowledge.

Some American philosophers even feel that most conflicts which appear to be about ultimate ends can be eliminated by increased knowledge. And some social scientists believe that a philosophical anthropology (or psychology) could establish the needs of human nature, and therewith the ends we should strive for. These views have the merit of calling attention to the fact that agreement on ultimate values is often greater than it appears to be, that many apparent conflicts about ends are due to ignorance of the precise implications of each end— the means needed and the effects achieved by it. Nonetheless, I think that those views are false if they are interpreted to assert that perfect knowledge would eliminate conflicts about values— about what is good, or right, about what should be done, about the ends that people should pursue in preference to others.

James Madison went too far when he wrote "if men were angels, no government would be necessary," if he meant that perfect knowledge, goodness and wisdom, such as may be attributed to angels, would lead to agreement on ends and means and thus make a government superfluous. Not so. If the angels do not all come from the same mold (and to assume that they do is to define away the problem and not to solve it), they may have different preferences. Some, for instance, may wish to leave nature unspoiled; others, in concrete circumstances, might want to give up some natural beauty in favor of, say, electric power or housing developments. No social sciences, indeed no knowledge at all, can decide which should be done, which is better, or even by what means the decision should be made; for the process by which the decision is to be made assumes criteria for decision making which ultimately must be based on values. Yet, decisions must be made all the time and we are not angels.

"Happiness" No Help

It is well known that Bentham's famous formula, which is still popularly accepted—the greatest happiness of the greatest number—is unfortunately of little help; the greatest happiness (if measurable at all) is not necessarily the happiness of the greatest number; which means that the greatest happiness possible may be achieved by enslavement of some to others. Bentham was a benevolent utilitarian. The Marquis de Sade, who fantasied just that, was a malevolent one; the premises are really the same; the ultimate values differ, but though one may prefer one set to the other, one cannot prove it right on the basis of the "felicific calculus" (or any other). Note how this kind of problem crops up in any decision made. Is the "happiness" of Southern Negroes or that of Southern whites, of Algerian *colons* or Arabs, to be preferred? Should local majorities or over-all majorities decide, or the interpretation of the will of a generation long dead?

On the other hand, the happiness of the greatest number when each counts equally, as Bentham intended, might be the least possible happiness in sum and surely less than the maximum one. All this is on the assumption that there is a homogeneous and measurable quantity called happiness. But that Benthamian assumption seems wrong for each person and, of course, interpersonally. The feelings that spring from eating a peach, defeating an enemy, reading a poem, smelling a flower, winning a gamble, making love, solving a problem, and so forth, cannot be quantified and added up so that after negative feelings are subtracted a net amount of happiness remains. Can one really say that a life replete with joys and sorrows yields the same net happiness as one that has little of either? Surely the quantities are not homogeneous enough to make even ordinal measurement meaningful.

Preferences can be observed; happiness is hard to observe, impossible to calculate. Anyone who thinks otherwise ought to read some of the great novels which describe man's career on earth. Yet we act—and must act—as though we knew what action will lead to a net increase of happiness. From the building of a highway to the imposition of a tax, such an assumption, though perhaps not causing the action, is used to justify it.

Finally, that happiness is desirable at the expense, possibly, of other things, is

to be shown, not to be assumed; and it cannot be shown by showing that it is desired. Moreover, unless we deprive "happiness" of meaning and assert that everything that is desired is desired because it is believed to lead to happiness—in which case we would not be helped much in choosing among desiderata, for we would be saying that we ought to strive for whatever we want to strive for—it seems that people do many things even though aware that they will not lead to happiness.

Finally, the social sciences have shown rather definitely that happiness as a goal for society is unhelpful for the simple reason that its contents are largely determined by society. In other words, what makes a group or individual happy is not, apparently, altogether dependent on biological or other inherent needs; it is decided largely by social conditioning. Inherent factors, at most, set a limit to the range of possibilities. Cultural conditioning influences individual personalities sufficiently to influence greatly, if not to decide, what will make them happy or unhappy. A native of New Guinea may be made happy by hunting heads successfully; an American, by making money; a medieval person, by becoming a martyr for his faith. Martial glory may make for happiness among some tribes; and peaceful, noncompetitive living, among others. If this is so, clearly it is meaningless to say that society should strive for the greatest happiness of its members. For, society in the first place appears to determine what the things (values) are that will make its members happy. In this decision—what social values shall we foster?—the rule "those conducive to happiness" (apart from all the other objections) is meaningless, for it is the choice of social values which determines what will be conducive to happiness.

Limits of Science

The social sciences can nonetheless assist in making social decisions. They can ascertain who wants what; they can ascertain what makes people want what they do want, and how their desires may be fulfilled, or changed. Such desires may arise from wrong beliefs—prejudices. If this is so, knowledge provided by science can change the desires. Unfortunately, the desire leads to the prejudice more often than conversely. And if this is so, the desire will not change with increased knowledge. On the contrary, though available, such knowledge is unlikely to be absorbed. Further, the desire itself—apart from its rationalization—cannot be proved to be right or wrong by any science. The one thing the social sciences cannot do—the one thing, indeed, no science can decide—is whether desires ought to be fulfilled or changed or frustrated.

If we could believe that people can pursue their aims independently, fewer social decisions would have to be made. But this is seldom so; worse, it is not at all certain that individual and group satisfaction do not require dissatisfaction of other individuals and groups. St. Thomas Aquinas might have been a good psychologist when he wrote that those who are in heaven will see the punishment inflicted on the damned "so that their ecstasy will be greatly heightened." Perhaps we ought to do without that ecstasy (though this "ought" cannot be proved to be "right"). But it might well be that such simpler things as the enjoyment of riches, of prestige, of power, are all predicated, not on having a certain quantity—which it might be possible to grant everyone—but on having more than others have, which obviously is something that cannot be granted to everybody. Surely that is the case with regard to prestige.

Even in simpler matters, valuation based on esthetic or moral decisions, and not on observation, is unavoidable, though the questions to be decided are largely framed by observation. Thus, economists may come to the conclusion that a certain degree of social mobility is required to achieve maximum social income. Sociologists, however, may conclude that the required degree of social mobility is detrimental to a person's relations with other people (and possibly with himself). In short, the social and the economic optimum may differ, and they may require inconsistent conditions. In analyzing the results of the industrial revolution, I have come to the conclusion that we bought economic advantages at a fairly high cultural and psychological price [see R. Ross and E. van den Haag, *The Fabric of Society* (Harcourt, Brace, New York, 1957), chap. 15]. Assuming that my analysis is correct, it fails to provide an answer to the question: was it worth our while? And, indeed, no scientific answer is possible to such a question, whether it regards irreversible past developments or the future.

If Not Science, What?

Are we then to despair? Not unless we assume that science is the only method of solving problems. And that assumption seems unwarranted, even though scientists often develop a faith in science which is no more justified by science than religious faith is. (Faith—belief in "the evidence of things not seen"—is far more justifiable in the religious than in the scientific context. Science is based on the evidence of things perceptible by all who are skilled. Not so religion, which admits divine grace, revelation, and providence not necessarily intelligible to the faithful.) To admit but scientific methods is to assume implicitly that the cosmos is so arranged that its total magnitude and contents cannot exceed the grasp of scientific method—that nothing can exist that cannot also be known intersubjectively and proved scientifically. Values, then, can be proved to be "right"—or the universe becomes valueless.

Yet this seems an unnecessary dilemma, explainable by the psychological impact of science, but in no way inherent in its methods or results. Only science can make *testable* predictions, and thus prove scientific theories. But, if it is correct to say that only what is true can be proved to be so, it does not follow that only what is proved, or provable, can be true. Demonstrability and truth are not the same. And there are many matters which pose problems that will not yield to scientific methods. To ignore such problems surely is not to solve them; to pretend that science can solve them is to create pseudoscientific morals and to discredit science. Philosophical reasoning is needed here. Such reasoning takes account of what science tells us about the facts of the situation, and about the probable effects of any move we might make. But philosophical reasoning goes beyond that by offering an analysis of moral premises, and of whether the various solutions are compatible with them. Such analysis will not prove the premises, and, therefore, will not prove the solutions to be correct or incorrect. But it can clarify what, precisely, is implied, and thus help us choose in full awareness of both the factual and the moral implication of our choice.

As for the "truth" of such moral implications of values, of ends and purposes of life, though science cannot establish it, one may well allow that there is such a truth—even though people disagree on where and how to find it. A difference of

beliefs does not imply that there is no truth or that it cannot be found. It implies only that it has not been found. The situation is not very different from the situation in art: it is probably impossible to prove that one composer is a great musician and another is not, that one novelist is a great writer, and another is not. Yet, I shall continue to hold very strong convictions on the value of their respective works; and I shall not regard them as matters of taste but of esthetic truth. Analogously, I hold moral values to be matters of moral truth. Science will help somewhat—it will clear the underbrush—but reason and faith cannot be dispensed with, if we wish to map a transcendent road.

Peaceful Uses of Atomic Energy

A British scientist summarizes the results of the second Geneva Conference of the United Nations.

John Cockcroft

I have been given the difficult task of surveying the work of this conference, and using the wealth of new information, to look once again into the crystal ball and try to predict the course of peaceful development of atomic energy in the world. If we take as a yardstick the rapid progress during the last three years, I am sure you will not expect me to claim any great clarity of vision beyond the next five years.

The three years since the previous conference have been notable for the coming into operation of the world's first large-scale nuclear power stations at Calder Hall, Shippingport, and recently in Siberia. This has been of great importance, since we have thereby begun to acquire practical operating experience of nuclear power. This has provided us with experience on the operating characteristics of such stations, and much new information about their technology is being obtained to supplement the earlier small-scale experiments in research reactors.

Power Reactor Experience

Our first impressions have been that these nuclear power stations have been docile and well-behaved. They can generate electricity for months on end until some minor fault develops. The most usual faults have been the faults of conventional components which require the normal amount of maintenance. There has been a surprisingly small number of defective fuel elements. Fuel elements rely on their sheathing to prevent corrosion of the fissile material by the coolant, which can then lead to leakage of radioactive fission products into the coolant stream. Therefore a very high degree of integrity of the fuel elements is required.

The operators have reported good experience over the first two years of operation, with failure rates of only three or four per year in 10,000 fuel elements. Reactors using metallic fuel expect to achieve a burn-up of at least 3000 megawatt days per ton, so that 1 ton of uranium will do the work of 10,000 tons of coal. Reactors using uranium oxide fuel expect over three times longer burn-up (10,000 megawatt days per ton), and indeed good irradiation stability of small samples has been reported up to 25,000 megawatt days per ton. Our experience of burn-up of *full-scale* fuel elements is now nearly halfway towards the target. Accelerated experience will be gained in the future by increasing the enrichment of the fuel. A continuing large technological effort will need to be devoted to these problems.

The nuclear power stations so far built in the world have been either dual-purpose power stations or demonstration power stations, and they would not be economical as commercial power stations. Nevertheless the experience of their operation has been invaluable in preparing the way for the next generation, which in most cases will be fully commercial nuclear power stations, with credits for plutonium based on its real value for civil purposes.

Three Types of Stations

Three main types of second-generation full-scale power stations have been described to us: first, the graphite-moderated, gas-cooled reactors; second, the pressurized and boiling-water reactors; and third, the heavy-water-moderated reactors. The capital costs per kilowatt of the first of the commercial nuclear power stations have been very much reduced below those of Calder Hall and Shippingport but are still over twice those of coal- or oil-fired stations. The papers presented to the conference show, however, that capital costs are likely to continue to fall appreciably during the next decade. The capital costs of U.K. nuclear power stations will fall a further 20 percent by 1962 as the output goes up from 300 to 500 megawatts, and a further fall of at least 10 percent, resulting from straightforward engineering developments and increase of output, is forecast in a U.K. paper.

The boiling-water-reactor power stations seem to be growing in favor as a result of the good performance of the reactor experiments. Because of their low system pressure and small size and comparative simplicity, they may achieve very low capital costs in the next five years.

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