IF MATTER COULD TALK
Fritz Machlup

The differences between the natural and the social sciences have been both exaggerated and minimized. To some, especially Anglo-American writers, the differences have seemed so categorical that they decided to appropriate the designation "science" for the natural sciences and to deny it to the study of social phenomena. Others, especially German writers, insisted on the scientific character of the study of cultural phenomena but still held that natural and "cultural" sciences were so fundamentally different that they required "contrary" methodological approaches.

These extreme positions had to be countered; it was important to show that in most respects, especially regarding the logic of inquiry, cognition, generalization, verification, and application, there were no fundamental differences between natural and social sciences. Philosophers of science who applied themselves to this task have, however, in their zeal to correct the errors of the exaggerators of contrast, sometimes gone too far in minimizing genuine differences. To recognize these differences may do a great deal for the comprehension of both the unity and the departmentalization of science.

This essay is intended to present an issue which has an important bearing on the difference between the natural and the social sciences. Following my inclination to dramatize ideas when I want the reader to share my appraisal of their importance, I shall introduce the issue by means of a short story or parable.

A PARABLE

They had debated the proposal to telephone the physical laboratories at Harvard, Princeton, and Chicago and notify their counterparts in these institutions of their exciting observations; but then they felt unsure and decided to call a psychiatrist.

"Doctor, please come to the physics laboratory, Columbia University. A group of seven men—three professors and four assistants—apparently are suffering from strange hallucinations, although none of us has taken alcohol, LSD, or any other drugs. We all hear voices. They seem to come from inside our machines and apparatuses, in clear English. If we are not crazy, we are going crazy. Please come immediately."

When the psychiatrist arrived, he found the physicists engrossed in conversation, not with one another but each with some persons hidden in all sorts of containers, cabinets, and machines.

"Are you making fun of us? Is this a hoax, or what?" Professor R. spoke into an apparatus of stainless steel, cylindrical in shape.

"Nothing of the sort," a voice answered from the inside of the apparatus. "We simply have decided to end our silence and cooperate with you in your research work by telling you all we know."

The professor greeted the psychiatrist and introduced him to his colleagues and assistants. At this point he was called to the telephone. He returned after several minutes.

"The same thing happened in Princeton. Professor W. was on the phone. Apparently it started there at the same time as here. At the Forrestal Laboratory the people panicked after the stellarator started talking . . . ."

He was interrupted by a newcomer. "Someone from the New York Times called. He wants you to comment on a dispatch from Moscow. There are two strange headlines in Tass. One says: 'New Elementary Particles Are Russian'; the other says: 'Genes Pass Resolution Siding with Lysenko'."

Before Professor R. was able to answer, Dr. M., an instructor, entered. He was excited and, without waiting for his chief's nod or question, he began to report on his lab section. He had been talking to a group of undergraduates, demonstrating various cases of Brownian motion. As he spoke about the random walk of molecules and about molecular collisions at various pressures, someone shouted, "Stop that nonsense!" When he looked around to see which student had made this impertinent remark, the voice continued. It was obviously coming from the protective chamber with the suspended mirror, whose movements were being tracked by the fluctuations of a reflected light beam. This is what he heard: "It is time that you cease and desist from misleading your students. What you teach about us molecules is simply not true. This is no random walk and we are not pushing one another all over the place. We know where we are going and why. If you will listen, we shall be glad to tell you." He had not waited for more, but had rushed here to report and get Professor R. to witness the event and to hear what the molecules were about to tell.

"Oh," said Professor R., "you mean they are going to tell us what they think they are doing. By all means, let them go ahead."

A SKETCH OF THE HISTORY OF THE THEME

I shall resist the temptation to spin this yarn further. To do so might be fun—but each of us can do it in his spare time and make a short story
long. The parable has served to pose the issue, that is, to ask what problems would arise in the natural sciences if inanimate matter began to talk. It is a fantastic idea, to be sure, but an idea worth exploring. Before I proceed, however, I shall acknowledge how it came to me.

The theme—that animals, trees, and inanimate objects could be endowed with the gift of human speech—is, of course, as old as literature. Legends, fables, and fairy tales are the best-known sources; in Homer's *Iliad* we encounter a talking horse, that of Achilles; Aesop's fables and the tales by the Grimm brothers and by Hans Christian Andersen are full of talking and chatting foxes and wolves, trees and flowers, storks and ducks, the sun and the wind, and teakettles, mirrors, and street lamps. In addition, there are the stories of Orpheus, who moved rocks and rivers by his songs; and there have been many anthropomorphistic parts in epic and lyric poetry, in tragedy and in comedy.

As a youngster I delighted in reading books by Carl Ewald; among them was one with beautiful *Tales Told by Mother Nature* about talking animals and objects. There was one in which earth and a comet had a discussion, joined in by the moon; another featured a chat between a spider and a mouse. A conversation between the sea and various plants and birds occurred in one tale, and another had a talk, with interesting implications of conscious cooperation, between a soldier-crab and a sea-anemone. There was also a most informative debate among five germs: tuberculosis, cholera, and diphtheria complaining about man’s warfare against them, mold bragging about its great power, and yeast defending man as its best friend.

Much later I became acquainted with the writings of E. B. White and I fell in love with *Charlotte’s Web*. But the most philosophical stories of this genre are in the poems by Christian Morgenstern. The manifesto of the “West Coasts,” protesting the semantic willfulness of man and declaring their semantic independence, belongs in the notebook of every language philosopher. But none of the human talk of these nonhuman beings and things included, to my knowledge, any allusions to the problem of scientific procedure.

In methodological and epistemological discussions of the social sciences, references to a cognate, though inverted, theme can be found: Several writers have mentioned that the natural sciences lacked two sources of information—inner experience and verbal communication—which were of essence in the social sciences. We are familiar with statements by social scientists reflecting about their advantage—in some measure compensating for several disadvantages—in having access to data of inner experience unavailable to natural sciences. Thus Friedrich von Wieser wrote: “We can observe nature from the outside only, but ourselves also from within. And since we can do it, why should we not make use of it?”

The emphasis here was on the scientific observer’s ignorance of how it feels to be a molecule, an electron, or a gene, contrasted with his knowledge of how it feels to be a human being, suffering pain, enjoying pleasures, and making decisions. There was little emphasis, as far as I know, on the scientific observer’s inability to interrogate, and receive communications from, inanimate objects, in contrast with his ability to interrogate, and listen to verbal reports from, large samples of the members of human society.

Some philosophers of science, to be sure, have likened the controlled experiments in the physical, chemical, or biological laboratories to “interrogations” and “cross-examinations.” But, notwithstanding the cleverness of such metaphors, the observation of physical (chemical, biological) changes in response to controlled variations in conditions is essentially different from verbal replies to verbal questions. To watch the change in the speed with which molecules move as temperature is increased is not the same thing as to ask them why they are moving faster, and then to listen to the introspective explanations they might offer in reply—if they were able to talk.

Whether the fact that the natural scientist does not have to bother with verbal communications from observed objects was ever emphasized, or even mentioned, by early writers on the philosophy of science—this I must leave to the historian of ideas. I do know, however, where I encountered the idea. It came to me through Alfred Schütz, who in turn gave credit to Hans Kelsen.

In his theory of law, Kelsen discussed the problem of contradiction between self-interpretation and the analyst’s interpretation of the written constitution of a state. What should we make of the contentions, stated in such a document, that the particular state was a federation, a democracy, a republic, if we find these contentions contradicted by our “objective” interpretation of many of its substantive provisions? Should we disbelieve and discard the self-characterization? The same problem appears frequently in connection with statutory law. Several statutes in the United States, for example, tell in their preambles that they are enacted to preserve competition and reduce monopoly, while their actual effect—intended or unwitting—is to reduce competition and increase monopoly.

It was this type of contradiction that prompted Kelsen to make a general observation about the “considerable difference between the subjects of cognition in juridical science, and indeed in all social sciences, and the subjects of cognition in the natural sciences. A rock does not say: I am an animal.”

THE ISSUE CLEARLY POSED

The implication is clear: If a rock said of itself that it was an animal, the geologist could not be content with a statement on its chemical composition, physical form and structure, and geological origin; he would also
have to explain why the rock was telling something that contradicted the geologist's finding. He would have to explain why the rock was wrong, did not know what it was talking about, or was trying to confuse those who listened to it.

It is one of the characteristics of the natural sciences that their subjects of investigation do not talk about themselves. Moreover, the facts and events [studied by natural scientists] are neither preselected nor preinterpreted; they do not reveal intrinsic relevance structures. . . . The facts, data, and events with which the natural scientist has to deal are just facts, data, and events within his observational field, but this field does not "mean" anything to the molecules, atoms, and electrons therein.

But the facts, events, and data before the social scientist are of an entirely different structure. His observational field, the social world, . . . has a particular meaning and relevance structure for the human beings living, thinking, and acting therein. They have preselected and preinterpreted this world by a series of common-sense constructs of the reality of daily life, and it is these thought objects which determine their behavior, define the goal of their action, the means available for attainment there. . . . The thought objects constructed by the social scientists refer to and are founded upon the thought objects constructed by the common-sense thought of man living his everyday life among his fellows. Thus, the constructs used by the social scientist are, so to speak, constructs of the second order, namely, constructs of the constructs made by the actors on the social scene whose behavior the [social] scientist observes and tries to explain in accordance with the procedural rules of his science.

THE NATURE OF THE DIFFERENCE

Nagel believes that the differences which the Weber school stresses between the explanation of social phenomena and that of natural phenomena lie chiefly in the "personal experience," "sympathetic imagination," and "empathic identification" that are possible for the social scientist and may aid him in his efforts "to invent suitable hypotheses." But Nagel denies that these differences are essential as far as the validity of explanatory hypotheses is concerned. He explicates his position by the following illustration:

. . . we can know that a man fleeing from a pursuing crowd that is animated by hatred toward him is in a state of fear, without our having experienced such violent fears and hatred or without imaginatively recreating such emotions in ourselves—just as we can know that the temperature of a piece of wire is rising because the velocities of its constituent molecules are increasing, without having to imagine what it is like to be a rapidly moving molecule. In both instances "internal states" that are not directly observable are imputed to the objects mentioned in explanation of their behaviors. Accordingly, if we can rightly claim to know that the individuals do possess the states imputed to them and that possession of such states tends to produce the specified forms of behavior, we can do so only on the basis of evidence obtained by observations of "objective" occurrences—in one case, by observation of overt human behavior (including men's verbal responses), in the other case, by observation of purely physical changes. To be sure, there are important differences between the specific characters of the states imputed in the two cases; in the case of the human actors the states are psychological or "subjective," and the social scientist making the imputation may indeed have first-hand personal experience of them, but in the case of the wire and other inanimate objects they are not.

I should like to raise some questions about four points in Nagel's formulation:

(1) Our knowledge of the state of "fear" of the fleeing man and of the
It. It merely requires the construction of at least one model of the actor or of the type of actor, that is, an imaginative construction of perceptions, memories, and preferences that is adequate for explaining (and for predicting) the observed behavior or the observed consequences of presumed behavior.

**Tales Told by Molecules**

Let us go back to the end of our parable, where the molecules, after denying the story told by the physicist, offered to tell all they knew about themselves. The lesson of the parable was not that the physicist had never been a molecule and thus had no introspective knowledge about molecules but that the tales told by the molecules would become data and problems for the physicist to deal with. The self-interpretations of the molecules and their interpretations of the actions and reactions of their fellow molecules would become integral parts of the scientists' observational field.

Whether the tales told by inanimate matter would help or hinder the scientists' work is difficult to say. New discoveries will sometimes complicate, mess up, or even destroy the nicest and most widely accepted scientific models of natural phenomena, and thus increase the "mystery" of nature for the time being. Yet, in the long run such discoveries may prove to have been significant steps in the search for "truth." On the other hand, the newly discovered facts may turn out to be errors of observation, and the scientists' efforts to accommodate them in their theoretical system may have been sheer waste. In the same sense, any verbal reports mysteriously made by inanimate matter—on the witness stand, on the psychoanalyst's couch, on questionnaires, or in informal interviews—would certainly mess up the scientists' systems of ordered knowledge; in the long run, the value of such reports may prove to be positive or negative. Undoubtedly, most scientists would prefer not to be bothered by any confessions, true or false, of their now conveniently silent subjects of observation.

The most irritating disturbances would come from contradictory communications. They would raise, among other problems, the question of who, if anyone, is right, or "more credible." Assume, for example, that some molecules explained their movements as part of a well-designed plan of action, others as emotional reactions to irritations from their fellow molecules, while a few molecules admitted that they had been pushed around in random collisions with others. The scientist would probably regard the few respondents who had the "correct" story as particularly honest and intelligent molecules. But he would still be confronted with the problem of explaining why the others were liars or, at least, confused and unreliable witnesses.
bankers who failed to grasp the implications of their actions and often misinterpreted their own intentions. Writers on the theory of the business firm have repeatedly been criticized by businessmen who disliked the fundamental hypotheses of the theorists and offered contradictory explanations of business conduct.

SILENT NATURE VERSUS TALKING MAN: ONLY ONE OF THE DIFFERENCES

How fortunate, in contrast, are the physicists, say, those in particle theory: They do not have to put up with denials or contradictions of their propositions by verbal communications from electrons and positrons. Imagine how a physicist would react to positrons protesting that they have unjustly been called “antiparticles,” or to photons denying that they were “carriers” of the electromagnetic field.

Think of the long faces of biologists if the Tass headline, featured in my parable, became true and genes really passed a resolution siding with Lysenko! Or if cells divided in an opinion poll about the differences between viruses and microbes. And how disturbing to microbiologists it would be if a society of cells endorsed the selection of a scientist for the Nobel Prize and cited with approval his use of an anthropomorphic analogy: “. . . a cell consists of molecules which must work in harmony. Each molecule must know what the others are doing.” Some microbiologists might then take heart when they learned that a minority of the cells had dissented, protesting against anthropomorphism as inappropriate in the explanation of their interactions.

To be sure, these events—the message received from particles, genes, cells, etc.—need not at all change any predicted outcomes of actual movements observed by the scientist. The trouble caused by the messages might consist only in the extension of the scientist’s task: He would have to explain the processes behind the misleading messages. On the other hand, some of the messages might give clues useful in the modification of existing theories.

Perhaps I am giving too much play to the contrast between silent nature and talking man. Claims for recognition of several other issues in the discussion of differences between natural and social sciences have been made. Without deciding the relevance and relative importance of the various issues, and fully recognizing that some of them are closely related and partly overlapping, I propose to offer a list designed to point up some notable distinctions. The list will include the question of introspection, although Schütz preferred to have it put aside. All the issues refer to the relationship of the investigator to his subject matter, that is, in the social sciences, to man, human action, or the effects of human action.
know whether Mars still qualifies for this designation)—a scholar with a
great gift for observation but without any knowledge of human institutions,
practices, or languages. He sets himself the task of explaining the working
and the function of the stock market. He might observe the traders, jobbers,
messengers, brokers, and customers, their movements, their gestures, and
their shouts for any length of time, but he would not even come close to a
superficial description of the actual process, not to speak of the function
of the institution.

Now endow him with the ability to speak and to understand the language,
and permit him to interview every one of the people engaged in the ac-
tivities of the stock market. He would end up with information, but he
would not understand enough of what goes on to know the economic func-
tions of the stock market, particularly its role in the utilization of investible
funds and in the formation of capital. Since probably 999 out of 1000
persons working on the stock market do not really know what it does and how
it does it, the most diligent observer-plus-interviewer would remain largely
ignorant. Alas, economics cannot be learned either by watching or by inter-
viewing the people engaged in economic activities. It takes a good deal of
theorizing before one can grasp the complex interrelations in an economic
system. And this theorizing consists mainly in constructing ideal types of
motivated conduct of idealized decision-makers and combining them in
abstract models of interactions.

From time to time efforts have been made, in economic literature, to
do without the fundamental hypothesis of economic theory, that is, without
the assumption that households and firms pursue a definite objective, such
as maximization of satisfaction and profits. For example, it has been pro-
posed “to start with complete uncertainty and nonmotivation” and rely on
“the principles of biological evolution and natural selection” to explain and
predict the course of economic events. The principle of conscious “adapt-
ation” by firms seeking more profits was to be replaced by a principle of
“adoption” of successful firms by the environment. The survival of the
“viable” firms and the elimination of the nonviable ones were supposed
to be the result of “competition.”

This proposal depends on the assumption of competition; but competition
in markets depends on the desire of human decision-makers to make
profits. Competition among hungry animals for scarce food can be under-
stood without reference to any “thoughts” expressed by the animals. Com-
petition among well-nourished men cannot. Of course, competition among
athletes in a sport contest, competition among scholars in intellectual
endeavors, and competition among businessmen in trade and industry are
different matters, each presupposing different motivations. The point is that
the existence of the profit motive must be presupposed to explain com-
petition in business. If firms in particular lines of activity make good profits,
the emergence of newcomers trying to get a share in the market can be

The investigator in the social sciences

(1) can feel and think like the men whose actions he investigates;
(2) can talk with other men, learn about their experiences, thoughts, or
feelings, and ascertain that these are similar to his own;
(3) can listen to verbal communications, or read written communica-
tions, among persons whose actions he investigates, or among per-
sons of the same type;
(4) can receive verbal communications, solicited or unsolicited, directly
from the persons, or type of persons, whose actions he investigates;
(5) can make mental constructs and models of human thinking and act-
ing, and can construct theoretical systems involving relationship
among ideal-typical actions, counteractions, and interactions;
(6) can interpret, with the use of his abstract models and theories, par-
ticular (concrete) observations of human conduct;
(7) can interpret, with the use of his abstract models and theories, par-
ticular (concrete) data as results of certain types of action;
(8) cannot build useful constructs and theories in disregard of con-
structs and theories formed and communicated by men of the type
he observes;
(9) cannot obtain useful data (i.e., the “givens” he is supposed to ex-
plain) except through verbal (and often also numerical) reports
from men engaged in the activities he investigates.

Following Schütz, I regard point 8 as the most significant. But it is
obviously connected with several other points, especially with point 4. Since
point 4 is most easily comprehended, even by laymen and scientists with
an aphoristical or antiphilosophical orientation, I have chosen this point as
the one to emphasize and dramatize.

OBSERVATION AND EXPLANATION IN ECONOMICS

My emphasis on the importance, for the invention and acceptance of
theoretical models in the social sciences, of communicated interpretation
of human actions by the actors themselves may give a false impression.
For, alas, these “prescientific” or naïve interpretations may be very poor
clues to a satisfactory theory of the network of actions, reactions, and
interactions which the social scientist has to explain. This warning, how-
ever, should not support the opposite position, namely, that complete
absence of verbal communications from the participants in social actions
would facilitate the construction of a good theory. Indeed, certain institu-
tions and processes could never be satisfactorily explained by observers of
overt behavior exclusive of men’s verbal responses.

Assume an anthropologist arrives from a populated planet (I do not

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expected only if one assumes that there are men who prefer more money to less and, therefore, decide to enter the industry that seems to offer relatively large profits.28

One of the most important phenomena of the social world, inaction or "negative action" ("intentional refraining from action"), necessarily escapes sensory observations,29 other than the nonactor's verbal statement of his "reasons," that is, to say, a statement of his (perhaps wrong or misleading and certainly intuitive) theory about his way of thinking. Where inaction is a mass phenomenon, the construction of an ideal type of man who would "understandably" not react to a particular change in conditions is required.

UNIVERSAL AND PARTICULAR, THEORY AND HISTORY

One of the worst stumbling blocks in the methodological analysis of the social sciences was the insistence of many (chiefly German) philosophers of science on a categorical difference between natural and cultural sciences. The cultural sciences, they argued, were not "generalizing," like the natural sciences, but were, instead, "individualizing" in the sense that their only concern and interest were individual events at particular times and places.30 For these writers, the social sciences were essentially "history." Confronted with the general theoretical system of economics, a foremost representative of this school of thought stuck to his principles and without hesitation separated economics from the other social sciences by designating it as a natural science.31 The cultural sciences were "by definition" concerned only with historical events.

However widespread this notion was at one time, nowadays it is at best a chapter in the history of ideas. Philosophers of science, irrespective of their differences on many issues, are now fully agreed that almost all disciplines have a core of general propositions, with applicability to concrete situations or particular cases. This is true of the natural and the social sciences alike. Of course, application does not mean that the propositions of the discipline will be sufficient to explain a concrete situation, change, or event (or to predict actual outcomes or to prescribe for desired outcomes). As a rule, propositions of several disciplines will have to be brought to bear on explanations (predictions, prescriptions) in particular cases. No discipline is self-sufficient when it comes to applications. Incidentally, there is much division of labor among those professing a discipline, some of them specializing in formulating, reformulating, and disseminating general propositions—theorists; others on applying them to particular cases—applied scientists and engineers (including social engineers).

Perhaps a few words should be said about one discipline which is exclusively concerned with applications of general propositions from other disciplines to particular situations and events: I refer to history. The historian is an applied sociologist, political scientist, psychologist, social psychologist, economist, anthropologist, archaeologist, military scientist, philologist, linguist, physiologist, biologist, chemist, geologist, physicist, statistician, and what not. Since he deals chiefly with human history, he is predominantly an applied social scientist and will, where propositions of natural sciences are relevant to historical research, either rely on generally known propositions (for example, that certain chemical substances are deadly poisons) or turn to specialists for advice. The historians who explain Caesar's decision to cross the Rubicon and the historians who explain Roosevelt's decision to devalue the dollar apply different mixtures of social sciences, although psychology is a strong ingredient in both.

I have said that almost all disciplines—though not history—have a core of general propositions with (usually indirect) applicability to concrete situations or particular cases, and that this is true for natural and social sciences alike. Yet, strangely enough, when we search modern treatises on the philosophy of science for illustrations in all sorts of contexts, we find a consistent inconsistency: The natural sciences are, practically without exception, illustrated by general laws or by propositions about empirical regularities, whereas the social sciences are illustrated by particular instances, singular observations, and historical events. Whatever may have been responsible for this discrimination in analysis and exposition, it cannot help being misleading. Indeed, it has, I believe, led the philosophers themselves into erroneous positions concerning the very issues we have been treating in the present essay.

To show what I have in mind I shall present and briefly examine three propositions, all in the form of questions about price increases:

1. Why did the United States Steel Corporation raise the prices of certain steel products in April 1962 by 3½ percent?

2. Why did prices, as measured by the cost-of-living index, rise in the United States by 7 percent from 1956 to 1958?

3. Why will prices increase if, with a given labor force, given facilities of production, and given technological knowledge, total bank credit is expanded and aggregate spending by government and business increases?

Only the third question is a problem of economic theory. The first is chiefly a problem of business history. To answer it, many things besides economic theory have to be known; indeed, economics may be relatively irrelevant in explaining why corporate management took the particular decision. Psychology, sociology, politics, management science, industrial relations, accounting, and several other disciplines may be involved; a professional economist may, of course, know enough of all these fields to answer the question without calling in a team of experts from ten other
and so forth. If the historian happens to have competence (or a university degree) in economics or any other social science, this does not make physics, chemistry, or agronomy a part of social science. The exhaustion of the soil used in cotton production may be a result of human action (deficient fertilization), partly explained with the aid of economic theory, and in turn also a cause of human action (cultivation of additional land), again in part explained in terms of economics. However, this does not make the exhaustion of the soil the province of economics. Technology is not a social science, even if it plays a great role in many classes of phenomena with which social scientists have to deal. My main point is that concrete events in history, particular cases in the real world, are rarely, if ever, explained with the aid of a single discipline but require application of several fields of knowledge.

In his critical discussion of "meaningful" or "interpretative" explanation in the social sciences, Nagel tries to show that the imputation of motives or sentiments to human agents is quite unreliable.

We may identify ourselves in imagination with a trader in wheat, and conjecture what course of conduct we would adopt were we confronted with some problem requiring decisive action in a fluctuating market for that commodity. But conjecture is not fact. The sentiments or envisioned plans we may impute to the trader either may not coincide with those he actually possesses, or even if they should so coincide may eventuate in conduct on his part quite different from the course of action we had imagined would be the "reasonable" one to adopt under the assumed circumstances.

We may note that in this illustration Nagel again refers to our imagined identification with a particular trader in wheat, even asks about "the sentiments and envisioned plans" which he actually possesses, and raises questions about his actual conduct. Since I may assume that Nagel is not alluding to the psychoanalysis of a wheat dealer of his acquaintance, but rather to the methodology of economic analysis, I take the liberty of offering an interpretation of the "actual" role which "interpretative" explanation has in economics, and I propose to do this with an illustration involving traders in wheat.

The economist is concerned with questions of the following kind: How will the price of wheat be affected by a report of a drought; by a reduction in the import quota for wheat; by a reduction in the rate of interest; by an increase in freight rates; by an announcement that the ice cover on the Great Lakes will delay the opening of shipping for several weeks? These questions can be answered with the aid of general propositions of economic theory. The answers do not presuppose that the economist knows any wheat dealer personally, let alone his psychological make-up. They do presuppose, however, that the economist has constructed an ideal type of dealer conduct. Its main feature is that dealers would rather make more money than less. This imputation of the profit motive to anonymous characters—"in-

NAGEL ON PROPOSITIONS OF SOCIAL SCIENCES

I am not sure whether Nagel sees the concepts and theories of the social sciences in this or in a very different light. For he does not choose for his illustrations general propositions of social sciences, but rather singular events involving particular persons at a specified time and place. He states this most clearly when he discusses MacIver's example of the man fleeing from a pursuing crowd and finds that it involves "an assumption, singular in form, characterizing specified individuals as being in certain psychological states at indicated times."

At one point Nagel discusses a point of economic history: Southern cotton planters were "unacquainted with the laws of modern soil chemistry, and mistakenly believed that the use of animal manure would preserve indefinitely the fertility of the cotton plantation." He holds that the "social scientist's familiarity with those laws" will help him explain the gradual deterioration of the soil and the consequent need for virgin land to maintain the output of cotton. I submit that it is not the "social scientist" who needs this knowledge of soil chemistry; it is the historian who, in explaining the events and changes he has selected for investigation, has to know all sorts of things, including some general laws of physics, chemistry, agronomy,
and interpret verbal communications about introspections by others, and, most importantly, he can construct models of individual minds deemed adequate for the explanation and prediction of human "output."

NOTES
8. The idea of subjective interpretation—*Verstehen*—was first advanced by Wilhelm Dilthey. He, however, confined it to interpretations of history and literature. Wilhelm Windelband and Heinrich Rickert extended the postulate to the social sciences, or rather "cultural" sciences, which they, however, strictly historical in character. (For citations, see footnote 30, below.) It is Max Weber to whom we owe the further extension of the principle to generalizing (and predictive) social sciences. Weber for Weber subjective interpretation was a requirement or merely an important aid in the analysis of social phenomena is still controversial.
11. Ibid.
12. Ibid., p. 485.
16. Ibid.
17. I cannot resist recalling the operatic dialogue between young Siegfried, in Richard Wagner's music drama, and old Mime: Siegfried, asking what fear is and how one could learn how to fear, and Mime first trying to teach him fear by describing his own feelings of anxiety and then, when this proves unsuccessful, promising that Siegfried would soon learn it by personal experience when he encounters Fafner, the dragon.
18. We may know what fear and hatred felt like when we felt them and how we think we acted at those times; we may also know how other people acted when they were feeling and hating and how they described their feelings. We then try to find a correspondence or similarity among the relevant features common to these sets of private and public observations.
19. I realize that we can build instruments which tell us by means of signals in English about the physical state of matter. For example, the gauge in my automobile tells me whether the water in the radiator is "cold" or "hot." If the gauge is out of order, the "report" may be wrong. Yet, we would never say that the water was "lying" about its temperature. It is not the water that tells us about its feeling cold or hot; the gauge gives us signals by means of a mechanism which man has invented, built, and installed.
In this example, as Karl Deutsch called to my attention, there is a gap between the report by the gauge and the response by the driver. Gaps of this sort can sometimes be bridged. In the human body, signals are often coupled to a response without the intervention of consciousness, as for example by various feedback mechanisms, such as those in our hands or in our digestive systems. Analogous mechanisms are designed by man: self-steering apparatuses. The difference between automatic and conscious responses in the case of human behavior is, I believe, relevant to the scientific procedures in different behavioral sciences. The "strictly behavioral" scientist studies conscious reactions of the body; in contradistinction, the "social" scientist studies conscious reactions of man to signals received from his environment, including actions of other persons.


21. The first step of a scientist confronted with contradictory and dubious confessions (by hitherto silent matter) would be to ascertain how relevant the different motivations reported are for the actual movements observed. He may find that several different confessions would account for the same movements (under the same conditions). In this case he might have no prima facie reason for preferring one "subjective explanation" to another. The differences could become more significant as his range of experimental findings expands and yields critical data allowing or requiring him to exclude one or more of the previously eligible explanations. In any case, however, he would have to search for explanations of the contradictory "subjective" explanations. The record of the contradictory reports presents problems which call for investigation.


23. That commercial banks "create" credit and money is now known to practically all sophomores studying elementary economics and is fully recognized by the officials and heads of banks. Yet the majority of commercial bankers have stubbornly denied it in interviews, public speeches, and declarations. The economist can explain the failure of the bankers to form a correct image of their actions and the consequences of their actions: The banker receives deposits from customers, which adds to his reserves; he grants loans to customers, who then draw on the bank, which will reduce his reserves; thus he cannot lend more than he has received. What the banker does not realize and cannot observe is that many of the deposits he receives are from persons who had received payments from those who had obtained loans from other banks and even from himself. Thus, the banker does not know what he really does or brings about because he cannot observe it. He may, of course, learn it from economists. But his uninstructed opinion—and frequently also his opinion unshaken by attempted instruction—contradicts the economists' theories.

24. This refers to the assumption that the firm attempts to maximize profits. At the bottom of the controversy, in which so-called business economists and professors of management science often take the side of the businessperson contradicting the economic theorist, lies the confusion between the "firm" as an organization—a group of persons with a variety of objectives, somewhat coordinated—and the "firm" as a pure construct in the analytical role of an intervening variable in the theory of prices, inputs, and outputs.


26. While he may not completely disregard constructs and theories communicated by the subjects, he may contradict them for adequate reasons.


30. Among the major representatives of the categorical differentiation between generalizing and individualizing sciences were Wilhelm Dilthey, Einleitung in die Geisteswissenschaften (Leipzig: Duncker & Humbolt, 1883); Wilhelm Windelband, Priidulen (Tübingen and Leipzig: Mohr, 1903); and Heinrich Rickert, Die Grenzen der naturwissenschaftlichen Begriffsbildung (Tübingen Mohr, 1902, 2nd ed. 1913). See footnote 8 above.


32. Most economists are satisfied that some people—sufficiently to act in ways similar to the programmed decision-making by the homunculi. But there are also economists who do not care about even that much correspondence between real and imagined men, as long as the conclusions that can be derived from conjunctures between the constructed types and certain sets of specified conditions broadly correspond to the observed records of events that have actually occurred after conditions of the specified sort have actually existed.

33. Nagel, op. cit., p. 482. The emphasis is mine.

34. Ibid., p. 476.

35. Ibid., p. 483.

36. I am indebted to Karl Deutsch for a stimulating discussion of these points.