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THE SCIENTIFIC METHOD AND THE LAW

By BERNARD L. DIAMOND*

WHEN I was an adolescent, one of the major influences which determined my choice of medicine as a career was a fascinating book entitled Anomalies and Curiosities of Medicine. This huge volume, originally published in 1897, is a museum of pictures and lurid descriptions of human monstrosities and abnormalities of all kinds, many with sexual overtones of a kind which would especially appeal to a morbid adolescent.

I never thought, at the time I first read this book, that some day, I too, would be an anomaly and curiosity of medicine. But indeed I am, for I stand before you here as a most curious and anomalous individual: a physician, psychiatrist, psychoanalyst, and (I hope) a scientist, who also happens to be a professor of law. But I am not a lawyer, nor in any way trained in the law; hence, the anomaly.

The curious question is, of course, why should a non-lawyer physician and scientist, like myself, be on the faculty of a reputable law school. Inconsistencies such as this never used to be done in the past. Why are they done now? From my personal standpoint the answer is easy: it is a good job; I find the law, especially criminal law, interesting; the pay is not bad; and I much prefer the academic groves of Berkeley to the hustle of the medical school in San Francisco where my professional training logically would place me. But I doubt that these factors influenced the law school in my selection as a faculty member. The law school certainly must have had something else in mind. And it is about this that I want to talk to you tonight.

Law, like medicine, is a profession. The hallmark of a profession, in contrast to an ordinary vocation, is that the members of a profession determine the substance and practice of their own occupation. They do this primarily through their power to control the education of those individuals who are to be permitted to become members of the profession. Thus lawyers control law schools just like doctors control medical schools. Necessarily this gives a very conservative quality to a profession. For the professional faculty will naturally

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An expansion of an address to the 13th National Conference of Law Reviews, March 17, 1967, San Francisco, California, hosted by Hastings College of the Law.
tend to select students in their own image and teach them to think and behave in the ways that they, the faculty, do.

However, even the most conservative profession must change with the times and evolve modes of thought and practices not more than one or two generations behind the spirit of the times in which the members of the profession are expected to practice. The surest indicator that a change is in the offing is the shift, even a tiny one, in the nature of the faculty of the professional school. So I think it is reasonable to conclude that at least some law schools expect that in the near future the theory and practice of law will have more to do with science than it has in the past. This is hardly surprising when one considers the way science and the scientific outlook pervade every other aspect of modern life.

It is not necessary to detail for you the infinite ways that science and its daughter technology dominate the modern world. The scientific revolution started with Copernicus (1473-1543) and Galileo (1564-1642) and has proceeded with such fury and pace that now, in the 20th century, our entire lives are nearly totally dominated by science. As with all revolutions, the bad goes along with the good: science has produced the greatest benefits for humanity, yet simultaneously it has created forces of evil and destruction which make the powers of pagan gods and Christian demons seem like harmless play.

In the scientific age of today, the issue is not whether the law will also become scientific. Rather, it is whether the law can become scientific in ways which will benefit society and still not destroy humanitarian values.

Science and Prediction

Science does many things. Mostly it is a psychological instrument for predicting the future. Out of its predictive capacities comes its great power of manipulation of the present so that the future can be altered. The truism that the substance and power of science lies within its ability to foretell the future is not always obvious to non-scientists. Nor is it obvious to everyone that science does not, and cannot, provide the value systems which determine the uses to which its great predictive powers are put. For example, one of the greatest of all primitive scientific discoveries was agriculture. Planting a seed in the ground is not a scientific act. Many birds and animals plant seeds but we do not consider such creatures as scientists. But the first primitive man who planted a seed and was able to predict that out of that seed would grow a plant which could be utilized for food immediately acquired great scientific powers which totally altered man's relationship to his environment. And because man's relationship to his environment is one of the fundamental determinants of the
form of his society, so planting that seed drastically altered the economy and the nature of the social world of man.

It is important to emphasize this point: the essence of science is prediction. Observation and description of what has happened is only history. History becomes science when man is able to utilize his observations of things past to predict what is going to happen. It is only through this power of prediction, through his ability to interpolate the past into the future that man acquires the ability to manipulate the present, and so to manipulate the future.

It is likely that the earliest primitive man, even long before mankind was consolidated into the single species of Homo sapiens, knew that prediction was the source of all power. It even seems likely that certain sub-human animal species have the ability to predict the future, but the available evidence suggests that most do not, that they blindly follow built-in, automatic, instinctual patterns of behavior. But we do know that primitive man was preoccupied with prediction of the future, for primitive man developed to a very high level another psychological instrument of prediction: that is, mysticism. Like with science, the essence of mysticism is its ability to foretell the future and to instruct how man is to manipulate the present so as to alter the future.

First, let me define the terms mysticism and science in the simplest possible way: mysticism is the prediction of the future which is not based upon empirical observation; science is the prediction of the future which is based upon empirical observation. It is always difficult for the modern, educated person to understand how it was possible, for such a long period of human history, for man to avoid utilizing empirical observation as the basis of his predictions. Yet it is true to an astonishing degree that the pre-scientific man not only was extremely limited in his ability to observe, but that he refused to do so even when he possessed the ability.

For example, Aristarchus of Samos, about 200 B.C. proposed that the earth revolved about the sun. This remarkable scientific theory, pre-dating Copernicus by seventeen hundred years, was rejected by the Greek astronomers and philosophers largely upon the argument, formulated by Ptolemy, that if the earth moved through space around the sun then a stone dropped from a high place would not drop vertically, but would take a slanted path as the earth moved out from under it. This faulty notion of the science of mechanics could easily have been corrected by the ancient Greeks through the simple empirical observation of falling bodies subjected to two vectors of forces. Incredibly, this simple experiment was not actually performed until nineteen hundred years later when Gassendi performed the experiment of dropping a stone from the mast of a moving ship.
The stone dropped at the foot of the mast proving Galileo's law that the stone carries in itself the motion of the ship and retains it while falling.

The Greeks had ships. Aristarchus or Ptolemy could have easily performed this same experiment and science would have been nearly two thousand years ahead. Why did not the Greeks perform this experiment? The answer to this question is complicated and in part obscure. But one factor is clear: the ancient Greeks did not believe that important predictions, that is, significant discoveries about the nature of the universe and the operation of its forces, were to be derived from simple observation. Instead, they were convinced that truth could only be discovered through the instrument of pure reason. They thought of all truths as being identical with the truths of Euclidean geometry—a derivation of pure reason with only a transcendental relation to the impure, imperfect, untruthful realities of the perception of the senses. Such mystical notions reached their ultimate development in the idealism of Plato and the logic of Aristotle, and they now permeate much of modern legal theory.

Mysticism, be it the animism of primitive religion, the naïveté of astrology and clairvoyance, or the sophistication of traditional philosophy, does work as an instrument of prediction. All forms of mysticism rest upon faith, conviction and belief. The human mind is so constructed that it can convert faith into action. Such human action can and does manipulate the present and thus change the future, so that the mystical belief that something is true or that something will happen can actually make it so. Mysticism, as a potent force in the world of man, has survived from pre-historical times down to the present-day precisely because it does work. Mystical predictions do have a better than random chance of fulfillment. This happens through the psychological mechanism of the self-fulfilling prophecy. People believe certain things; they act accordingly to make their beliefs come true.

Unfortunately for those who are committed to mysticism as their prime instrument of prediction, none of the universe, with the exception of man himself, responds to the self-fulfilling prophecy. Mystics have always had a difficult task accepting this harsh fact of nature. They have always tried to avoid it by taking refuge in the illusions of magic, miracles, rituals, religion, and wish-fulfillment. Mystics go to great length to develop elaborate systems of rationalization to explain away the failures of their illusions. Most of all, they avoid putting their illusions to the test of empirical observation which might expose their predictions as random frauds.

I believe it is proper to say that mysticism in any form, naively superstitious or philosophically sophisticated, in religion or in law,
is a most potent instrument for the manipulation of people. Because it can be a self-fulfilling prophecy, it can predict and determine the future of people's behavior. But it can do nothing to influence the rest of the universe, particularly the multiplicity of things which go to make up man's immediate environment. For this, one needs science.

Mysticism does not predict and determine the behavior of all people: it works only with the true believers. If there is no belief, no faith, there is no self-fulfilling prophecy, and the future behavior of those people is not determined in the way that the true believer would like. The believer is robbed of his power over the future by the sceptic. This has always been known; hence, the frantic urge to proselytize and convince, and the fanatic intolerance of the faithful believers. The power of fulfillment of the mystical prophecy depends to a considerable extent upon the absence of doubt. The presence of even the least uncertainty can sharply reduce the potency of those psychological forces which drive the human to action and the expected behavior may not be forthcoming or it might take some unpredicted direction.

Consequently, the mystic, in contrast to the scientist, not only has no belief in the value of empirical observation, but he cannot tolerate its use by himself or others. For it would create the uncertainty and scepticism which would quickly reduce his predictive capacities and his determinative powers over the future to that of random chance.

Mysticism does have, however, one enormous advantage over the empirical objectivity of science. Out of the faith and conviction of mysticism (especially in the form of religion and ethics) values can be created. Science, on the other hand, does not create values; it only observes and describes them.

To illustrate these points: building a bridge is not, in itself, science. It may only be the exercise of mechanical labor, custom, desire or convenience. But to build a bridge which the human mind predicts will sustain the weight of those who are expected to cross the bridge requires the application of scientific principles about bridge building, and the materials out of which bridges are built, and the forces which impinge upon bridges. If the predictions come true, one has a usable bridge. If the predictions prove false, the bridge will collapse. But no amount of engineering science will tell one whether it is a good thing or not to build the bridge in the first place. Nor can the scientist predict whether people will want to cross the bridge. And to go further, if it is one's desire to manipulate the future so as to make people cross the bridge, mystical faith will prove a better instrument of compulsion than will science. But note
that science may prove a better instrument to predict whether people will cross the bridge.

Expressed in these terms, one can easily see that the dilemma of the 20th century is simply that, through science, we have achieved an amazing mastery over the non-human aspects of our environment, extending even towards the ultimate cosmos. We now travel in space. We are very close to scientifically knowing the origin and destination of the entire universe. We have nearly unraveled all of the secrets of the atom and we already have learned to tap the energy out of the substance of matter, itself. With the powers of nuclear energy we can cheaply and conveniently light our houses at night, and we can also effectively destroy the entire race of mankind with the hydrogen bomb. Unfortunately, science does not tell us which to do. For this decision we need a system of values. To create ethical and humanitarian values, we must resort to faith which, in turn, is the product of mysticism.

The difficulty is that mysticism, be it ethics, religion, or superstition, has not progressed much in the last two thousand years. Any new values which the world has acquired in recent centuries are trivial as compared to the fundamental values which were well known thousands of years ago. Particularly, the law is concerned with the values of virtue, which include ethics, morality, justice, good and evil, plus the special values which arise out of the placing of the virtuous values in a context of coercion and compulsion. Just about everything that is known, or could be said about virtue is pretty old stuff. The values of the law are directly traceable to the four cultural roots of Western society: the Judaic, the Greek, the Roman, and the Christian. The most that can be said for the modern law is that it has selected and amalgamated the value systems of four very disparate cultures into a kind of make-shift whole that works, after a fashion, in a reasonable manner.

The law must not only announce its virtuous values; it must enforce them, as well. For enforcement, the law relies heavily upon the mystical instruments of faith, belief and conviction. Most people have faith in the law and believe in the moral virtues which the law proclaims. For those sceptics who do not share the common cultural mystiques, the law has teeth and can enforce its values by physical force and psychological coercion. But first, of course, the law must catch the disbelievers, then establish that they really are disbelievers, and then dispose of them in some way. It is from these latter functions that the whole machinery of the administration of justice arises: the police, the trial court, the prison and the execution chamber. And because all four of our cultural roots preferred that the law be set down in writing, so do we. This requires codes and
statutes and legislatures to pass them. Laws must be interpreted and understood and so we have appellate courts who perform this function. There are practical reasons why the lawyer and judge should not also be the apprehender, enforcer and executioner, so we place those functions in the hands of the government executive. The law, thereby, becomes thoroughly and inextricably meshed with the political structure of society.

The Law (with a capital "L") now consists of an enormously complicated series of social operations performed by a wide variety of people, from the legislator to the executioner, each with his special tasks to perform, and each with his special problems, inadequacies and failures. With some minor exceptions, such as the substitution of electrocution for hanging, science plays little role in the functions of the law. Why is the Law so unscientific? Would it be beneficial to society if the law were to become more scientific?

I think the answer to the first question as to why the law is so unscientific, even though we live in a world pervaded by science and technology, is easy to give. The answer to the second question is, of course, infinitely more difficult.

The "Hard" and the "Soft" Sciences

The lack of application of the scientific method to the Law is the consequence of the historical sequence of the development of science. Modern physical science (the so-called "hard" or "exact" science) dates from the 16th century, from Copernicus and Galileo. From Kepler (1571-1630) and Newton (1643-1727) to Einstein (1879-1955) and Planck (1858-1947) there has been a continuous succession of smashing scientific victories revolutionizing our ideas of matter, energy, space, time, and the cosmos. Hard science gives us astounding powers of prediction and incredible powers over energy and things. Mysticism, in competition with the predictive and manipulative powers of hard science, did not stand a chance. To build gigantic factories with automatic machinery, to fly airplanes, to send astronauts into outer space, and, tragically, to fight wars, modern man does not utilize faith, prayer or superstition. Hard science, based upon empirical observation and experimentation, is behind all of our modern technology.

But the science which is concerned with life and people has had only a recent start: biological (including medical) in the 19th century; psychological and sociological science mostly in the 20th century. Biological science has made great progress and the pay-off has been remarkable in the cure and eradication of disease, in increased longevity, and in the development and processing of food supplies. Many of the benefits of physical science (like television and air travel) are possible only because the biological sciences have provided the means
for detaching large numbers of people from the irksome task of daily food production. It has been the biological sciences of agriculture and animal husbandry which have permitted sufficient increase in the efficiency of food production so that most of the people could migrate to the cities and our nation be transformed from a rural to an urban economy. Such urban development is probably necessary for the full exploitation of the technology derived from the physical sciences. But note, however, that neither physical science, nor biological science, tells us whether all this is a good thing in the long run. Even worse, empirical observation does not as yet give evidence that people are happier or more peaceful or more self-fulfilled and content in their longer, healthier, better fed, and technologically superior lives.

The "soft" sciences, like psychology, sociology and anthropology, are still in their infancy. Going back at most to the latter part of the 19th century and progressing very feebly since, we do not have even our psychological Copernicus, yet alone our Einstein. We are not even sure that the scientists who work in the soft sciences really are scientists. Their techniques and tools are not those of classical science. Their empirical observations are vague and uncertain, and they are unable effectively to use that most valuable of all scientific instruments, mathematics. It may be that they are still mystics, masquerading as scientists, relying more upon faith and belief than upon observation and experiment.

Clearly, the law, because of its subject matter of ethics and morality and the conduct and control of people, would have to rely chiefly upon the "soft" sciences if it were to become more scientific. It is very questionable whether, at the present time, the "soft" sciences offer more powers of prediction and determination of human conduct than do the traditional mystical techniques which have been available to us for the last two thousand years. The "soft" sciences certainly have less power to compel people to behave in the ways society wishes them to—so I do understand the law's reluctance to relinquish its old concepts for the flashy, new models of psychology and sociology.

Nevertheless, the day is almost upon us when the balance of power in human affairs between mysticism and the "soft" sciences will be changed. Just as soon as psychology and sociology and the related behavioral sciences such as anthropology and criminology can influence the future conduct of human beings more consistently and in more useful directions than the self-fulfilling prophecies of faith, morality, and spirituality, then will the law, as will all regulators of human conduct, begin to rely more upon science than upon mysticism.
I also am convinced that the law is not going to have much choice about relinquishing its mysticism. With the overwhelming application of science to so many areas of our world with the rapid and substantial pay-off in material benefits, there seems to be a marked lessening in the willingness of people to retain their traditional faith in non-scientific theories and methods. As I described earlier, the law relies heavily upon the fact that most people do not require the actual coercion of the law. They believe in the virtues which the law professes and they regulate their own conduct without the necessity of the law intervening in their lives. But we know from hard experience, such as Prohibition, that when a value which the law asserts is not shared by a majority of the population, the violations become so numerous that the law enforcement machinery breaks down by the sheer weight of the number of cases.

We already have indications that certain types of moral attitudes are no longer as widespread as formerly. This means that large numbers of persons do things which are contrary to the demands of the law. The most conspicuous increases are with white collar crimes, theft, check forgery, sexual deviations, drug use and juvenile delinquency. Already it is painfully evident that the criminal law is able to cope effectively with only a small minority of these offenses. The civil law is hardly better off. Here the sharp rise in personal injury litigation, the increase in government bureaucracy with its demands for complicated administrative law, the spectacular increase in divorce and family law, and the complicated legal problems of the welfare state, all threaten to overwhelm our legal system.

To make matters more complicated, the Supreme Court seems determined to force a higher quality and ethical standard upon the law in criminal prosecutions and to apply the law in areas, such as segregation, where it has long been dormant. In response to these pressures the law is either going to have to enormously expand its operations, or it is going to have to relinquish control over huge areas of human conduct, or it is going to have to become more efficient and effective by becoming more scientific. My guess is that the law will do all three.

How can the law become more scientific and, at the same time, how can the law be sure to retain its major value systems so that they continue to be effective instruments of social control in a world where all traditional values are questioned and where science offers no new values? The answers to these questions seem to me to define for generations to come the task of the new breed of the scientist of the law.
The Scientific Method

I believe that when most lawyers think of the application of science to the law, they have in mind the direct application of the fruits of science to the law. Such lawyers would not object to the consumption by the law of the products of science; but they would object strenuously to the application of science to the theories and processes of law. For example, the law, for its own purposes, is very much interested in the determination of the state of alcoholic intoxication. So the law accepts very readily the use of blood and breath alcohol determinations as evidence. Perhaps the judge who admits such scientific evidence into court feels very modern and scientific about how he is administering the law. But he is not really being very scientific; he is just a consumer of science, in the same way a person who buys a television set is a consumer of science. For the law to be truly scientific, it would have to go much further. For the law to utilize scientific methods to discover what is the nature of alcoholism and how should society (including the law) cope with the problem of alcoholism—then, that would be closer to a scientific law.

In more general terms, it can be stated that a scientific law would require the application of the methods of science to the law's own theories, values, and operations. Every step in the legal process from the public clamor for new legislation to the ultimate disposition of each legal case would require scrutiny by the scientific method. Most, if not all, of the key people in the legal process would have to become, in a sense, scientists, who would apply scientific theories and methods to their work. Most of the work of such key legal people, be they judges, penologists, policemen, or labor arbitrators, consists of decision making. Already science has a great deal to offer for the making of decisions and there is rapidly developing a true science of decision making which promises to revolutionize the way complicated decisions are made. The military, which has always taken to the scientific method more readily than other social institutions, is already using such advanced mathematical techniques in solving its logistic decisions. Why not the law?

I am quite willing to grant that most of the fruits of the behavioral sciences are not yet sufficiently ripe for consumption by the law. So I do not quarrel with the law's caution in accepting what the behavioral scientist has to say—even when it comes to my own field of psychiatry. But the scientific method is something altogether different. The validity and reliability of the scientific method has been proven by nearly five hundred years of uninterrupted success. It is the scientific method which could be applied to the law right now, today, and the benefits, I believe, would be great.
The scientific method is neither complicated nor mysterious. Briefly, the method consists of the making of empirical observations; then, through the use of inductive logic, inferences of general principles are derived. These general principles are subject to test and validation. This is accomplished by using further inductive logic, and sometimes deductive logic, to make predictions about reality. These predictions are then subject to further empirical observation and if these observations correspond to expectations, the general principle (theory) is considered to be an approximation of the truth.

Often, but not always, the appropriate empirical observations can only be made in an artificially simplified situation. This simplification is accomplished by limiting the variable factors operating at a given moment so that the variables in which the scientist is interested can be observed better. This is what is meant by a scientific experiment. Certain sciences, like astronomy and sociology, find it difficult or impossible to perform the right kind of experiments. So they take advantage of natural experiments. They make their observations of natural occurrences where there is reason to believe that the sought for variables are showing their maximum effects and the undesirable variables have a minimum effect. Obviously, this slows down the pace of such non-experimental sciences for the scientist must spend most of his time searching for and waiting for his observational opportunities. Yet even the most confirmed non-experimental science, like astronomy, can sometimes devise the means of experimentation. The orbiting of a satellite is actually an astronomical experiment.

It is fairly easy to devise critical experiments in the behavioral sciences which would, if performed, immediately accelerate the progress of these sciences. However, those experiments which would be most desirable from a purely scientific viewpoint generally turn out to be those utterly prohibited by ethical and humanitarian considerations. So the behavioral scientist is forced to restrict himself to relatively unimportant experiments or to wait for unusual opportunities for observation of naturally occurring phenomena.

Because of the fantastic complexity of the subject matter of the behavioral sciences and because of the huge number of variables involved in even the simplest of human actions, the behavioral sciences are very immature compared to the hard sciences. We are likely to possess a valid and more complete description of the origin of the universe long before we will have a valid understanding of the origin of a single, trivial, human thought. Because the nervous system of man is by far the most complicated biologic structure which exists, it is very probable that we shall learn the secret of life and actually create living creatures out of inanimate chemicals in the laboratory before we know, for sure, every step in the process by which a human
child learns to call for his mother with the word "mama". But all the scientific discoveries which have already been made, and all those which are yet to be made, have been or will be, the fruit of the scientific method.

The scientific method is deceptively simple; its application as a means to the acquisition of knowledge required many centuries of blood and sweat by many people of great courage. The limiting factor was not the ability of the human mind. All of the ancient Greek philosophers had ample intellectual capacity to think and function scientifically. However, they did not, and could not, because their minds were obstructed by a mystical view of the world. When they did attempt to think scientifically, (and they often thought they were), in reality they were merely being mystical in more refined and sophisticated ways. It took two thousand additional years before certain mystical preconceptions about knowledge and reality were given up, and only then did the scientific method become possible.

**Empirical Observation and Feedback**

One of the biggest differences between science and mysticism is that science utilizes the instrument of feedback. Feedback means that the output of a given process is used to regulate the process which produces the output. Feedback is a naturally occurring device which occurs in all biological processes and is, in part, responsible for an essential characteristic of all living activities: homeostasis. In any chain of biological events, the products of the living process are not delivered like objects out of a factory to be consumed. The products, themselves, are used to regulate the process which produces them. A simple technological example of feedback is our automatic home furnace. The product of the furnace is heat. The heat is used to keep the house warm. But some of the heat is used to manipulate a transducer—the thermostat—so that the amount of heat produced by the furnace also controls the furnace by shutting it on and off. So the house is maintained in a condition of homeostasis—not too hot and not too cold, irrespective of alterations in the environmental temperature.

The transducer which responds to the output of the process may, in technology, be a simple mechanical device such as a thermostat or the governor on a steam engine, or the sensory perceptions of the driver of an automobile. In science, the transducer is everything subsumed under the concepts of empirical observation and inference. The first primitive scientist who planted seeds empirically observed which seeds would grow and which would not and he inferred the conditions, such as rain and type of soil responsible for the growth of the plant. He then fed back these observations and inferences to
his planting procedures, modifying them so that they would produce optimum results. He became a true scientist as soon as he stopped planting seeds of a type, and under conditions, which he predicted would not produce viable plants.

Mystical systems, including the law, do not do this. They, like Plato, deduce what ought to be and how things ought to be done. They proceed, as an act of faith, and then, in order not to shatter their faith and create doubts and uncertainty, they carefully avoid feeding back their results into the process by empirical observation of the output. The advantages of such a mystical system are clear. The system is not subject to challenge or dispute, and hence, acquires great permanence and stability, existing unchanged over periods of hundreds and even thousands of years. The faith in the certainty and rightness of the process facilitates the creation of values: convictions which quickly acquire autonomous attributes, and which can be believed and accepted by the participants in the process and large numbers of others who are merely the beneficiaries of the process.

Particularly, these autonomous values and the avoidance of feedback through empirical observation of the output, allow the participants, observers and beneficiaries to sleep well at night. That is, the belief in the value and righteousness of the process reduces the level of anxiety, eliminates doubt and uncertainty, and gives the illusion that something desirable is happening. Especially, it contributes to a teleological view of life: that one is doing something for a purpose transcendent to one's own selfish needs of the moment. It is then as easy step to the ultimate mystical preoccupation: the purpose and meaning of life and of the universe, itself. As these are the very fundamental questions with which religion is concerned, it is not surprising that law, like all mystical processes, is firmly embedded in a theological matrix.

Such a system has a high capacity to survive unchanged irrespective of the value of its output. But it is important to emphasize that the output is not entirely illusory. Because these psychological effects are potent movers and controllers of human action, the output becomes a self-fulfilling prophecy to a certain degree.

For example, the law utilizes punishment as the chief device to deter criminal behavior. Sociology and psychology can easily demonstrate that the functions of punishment are manifold, but the law has always been quite clear as to the single purpose of punishment; it is to deter crime. As an article of faith, the law has accepted for thousands of years that punishment is an effective deterrent of crime. Most people in and out of the law firmly believe this to be true. And because they believe it, to some extent it is true. Yet the mystical nature of this belief is apparent when it is realized how
carefully the law has avoided subjecting its punishment output to empirical test. When faced with the empirical observation that punishment may not deter crime, the law simply refuses to feed back that observation into the legal process, thereby refusing to modify the basic belief that punishment does deter and obstructing the possibility of the development of new methods of influencing criminal behavior. Or if any feedback is permitted, it is exclusively positive, rather than negative. The trial and error method of science uses both positive and negative feedback: the output can be used to either accelerate or decelerate the process. But the law, when it does acknowledge that its punishment output does not deter crime, has only one remedy: increase the severity of the punishment. Typically, this is the legislative approach to the crime problem.

What would the law do if it were scientific? Simply this: it would examine most carefully its output—the types of crimes and criminals who did respond to punishment as a deterrence and the types that did not. It would pay particular attention to the variety of individuals and kinds of circumstances in which specific kinds of punishment were effective and those where punishment was not effective. Depending upon the empirical observations the law would either abandon its basic hypotheses of crime and punishment or it would use its observations to make inductive inferences as to the nature of the interaction between crime and punishment to create new hypotheses about their relationship. These new hypotheses could then be put to test in action programs and the new output could then be evaluated. After several hundred years of such trial-and-error experimentation, scientific conclusions might be drawn which would permit accurate predictions as to the effect, or lack of effect, of punishment on all different kinds of persons in many different kinds of circumstances. Thereby would gradually grow a sizeable body of accurate scientific knowledge about crime which would be effective in the control of criminal behavior. If the results in other areas of scientific knowledge can be interpolated into this area the result would be that the law could accomplish its goals more effectively than its mystical self-fulfilling prophecy techniques permit it to do now.

One of the major benefits of such observation and experimentation might be the discovery that some criminal behavior, such as parking violations, are easily deterred by punishment, while other types of criminal behavior, such as murder, are not only not deterred by punishment, but actually enhanced by punishment. If it could be further discovered, as those of us in the field of criminology already strongly suspect, that those persons who commit crimes of one sort under some circumstances are motivated altogether dif-
ferently than those who commit crimes of another sort under different circumstances, then the law might be induced to develop a wide variety of techniques to cope with the vast number of problems with which it is faced.

Actually, of course, the law does do this to some extent, and it can be considered scientific to the degree that it does so. But the law has been astonishingly reluctant to accept as its responsibility the discovery of why some of its hypotheses work and others do not. I contend that it would be the proper province of a truly scientific law to scientifically investigate just such problems as why increasing the punishment for parking violations reduces the incidence of such violations, while increasing the punishment for murder does not affect, or actually increases, the incidence of murder.

One could easily think up literally thousands of such tasks for a scientific law. If these tasks were well performed in accordance with the well established techniques of the scientific method, the law could easily become more effective in its ability to predict the effect of its manipulation of people. Out of this predictive capacity would come the ability to control people's behavior, which is, after all, the primary task of the law.

The Null Hypothesis and The Quest for Certainty

The null hypothesis of the scientific method means that for a concept to fall within the realm of science (that is, to be subject to the investigative methods of science and scientific deductions and inductions to be made therefrom) the concept (hypothesis) must be capable of disproof by empirical observation.

For a theory to be scientifically valid, there is no requirement that the theory be correct. All that is required is that the theory be proposed in language that makes it possible to disprove it by observation of the actual events circumscribed by the theory. Thus, it can be proposed as a scientific theory that the planets revolve about the sun in elliptical orbits. It can then be deduced mathematically, or otherwise, that certain empirical observations will disprove this. The observations are then made. If the theory is disproved, it is discarded. If the theory is not disproved, the theory is tentatively accepted as approximately valid.

The reason scientific hypotheses are put in this negative form is that the positive proof of a theory by empirical observation by no means establishes the permanency or the certainty of the theory. The theory must remain perpetually subject to new observations and subsequent correction and refinement. Only an infinity of observations could establish certainty.
This is to be contrasted with the mystical idealism of ancient astronomy. The planets were believed to travel in perfect circular orbits. This was a theory established upon faith of a highly mystical kind: that God established the orbits of planets, that the orbits, being His creation, must necessarily be perfect, that the circle was a perfect geometry while the ellipse was not, and that, if man's observations of the orbits denied their circularity, then it was man's senses which were defective, not the planetary orbits. Such a theory of natural phenomena may be interesting, but it is logically incapable of disproof. But such a theory does have, to the mystical mind, the attraction of being both certain and permanent, unchangeable by the whims of future observation. Unfortunately the theory is also empty, meaning that it does not tell us anything we did not already know by our original assumptions. The mystical mind has great difficulty in grasping the fact that his theories are empty. To understand why they must necessarily be empty would require a diversion into elementary logic. For this, I refer you to Reichenbach's excellent treatise: The Rise of Scientific Philosophy (1951).

The legal mind seems constantly on the search for certainty and it naively looks to science for sure answers. The most common legal criticism of psychiatric testimony is that psychiatry is not an exact science, hence, its knowledge is not certain. The psychiatrist is politely told by well meaning judges that if he returns to the courtroom in some future millennium with an exact science (like the judges foolishly believe the hard sciences to be) and can speak with certainty, then the law will welcome his interventions. But until then, the law wants as little as possible to do with his evidence and his theories. The judges fail to realize that they are talking about an empty dream, and are depriving themselves of a lot of useful information which psychiatry has to offer about the kinds of problems the law is concerned with.

On the other hand, the law is most gullible when it comes to scientific evidence which appears to the judges to be expressed in terms of "exact" science. Usually the term "exact" means capable of being expressed in numbers or the visual imagery of graphs and diagrams. The evidence of a ballistics expert with his photographs of bullets taken through his comparative microscope and with the precision measurements of the scratches and grooves on the bullets greatly impresses the legal mind. The law must learn that the value and truth of science lies in its methods, not its numbers and diagrams. The law should search for predictive probabilities, and not be deceived by quantified observations. The highly approximate and crudely expressed observation that the ceilings of most rooms are somewhat higher than the height of the occupants of those rooms
is a useful scientific observation. It tells you what to expect about
the probable height of the ceilings of other rooms \textit{yet to be observed}.
The determination that the height of a certain ceiling is exactly
9 feet 4\frac{3}{4} inches is not science, because it tells one nothing about
the height of other ceilings. It simply defines a unique observation.
It is easy to quantify precisely if one confines the observations to the
unique. To predict requires generalizations, and generalizations al-
ways introduce uncertainty. The law must recognize that the meas-
urements of science are concerned only with probabilities, not with
exactitude. And that many interesting and valuable statements of
probabilities, such as are given by the behavioral sciences, can not be
stated in numbers.

Propositions which do not tell us more than we already know are
empty. They neither predict the future, nor do they communicate
information about reality. They are true only in a definitional sense,
and no amount of logical manipulation increases their information
content. The proposition “2+2=4” is such an empty statement. It is
ture only by definition. Two plus two might have equaled five, if one
chose to use a different set of labels for our digit system. If one
changes the numbering system (as is desirable to do with computers)
to a different system, we get a different answer.

It is not always easy to determine that a given proposition or
chain of reasoning is empty, and modern philosophy, logic, semantics
and linguistics are very much preoccupied with this problem. Particu-
larly there is concern with empty questions—questions that can never
be answered because they are not true questions in the first place,
but only semantic paradoxes. These so-called meaningless questions
may be very puzzling and not easy to establish as nonsensical,
semantic tricks. An illustration of a meaningless question is the
question, “Is there life after death?” This question is incapable of a
logical answer because the answer is already built into the semantics
of the question, and any other answer would violate the definitions
of the words “life” and “death”.

It is very probable that many of the questions which the law has
posed throughout the ages are of this meaningless nature. “What is
justice?” is such a question, as are most of the questions concerned
with definitions of criminal responsibility. The attempt by the law
of personal injury to translate subjective pain into monetary value is
probably also such a meaningless proposition. I suspect a good
philosopher would have a field day if he chose to submit to linguistic
analysis many of the issues which the law regards as critical to its
own existence.

The familiar syllogism, “All men are mortal; Socrates is a man;
therefore Socrates is mortal,” is an empty statement which communi-
icates nothing scientific, in the same manner that the statement, "2+2=4," communicates nothing other than the statement of the definitions. No further processing by deductive analysis will increase the information content of these statements.

However, the inference, "All crows so far observed were black, therefore all crows in the world are black," does communicate more information than contained in the original premise. It predicts the color of those crows not yet observed, and attributes to them a property of the crows which have already been observed. The truth of the Socrates syllogism can be guaranteed. The truth of the crow inference cannot be guaranteed. It must be regarded as an approximation of the truth subject to modification by further observation. If tomorrow a crow is discovered which is not black, we do not discard the inference, but instead we modify it to correspond to the new state of our knowledge. It now becomes: "All crows, but one, so far observed were black, therefore most crows in the world are black." Both "crow" statements are probability statements. The latter one is obviously more simple because it contains a probability word, "most." But the Socrates type of syllogism is not a probability statement and further empirical observation would not affect its truth in any way.

It was the contribution of Francis Bacon (1561-1626) that first recognized that logical derivation must contain inductive methods if it is to be capable of predicting reality. Bacon was also very much aware of the limitations of inductive inference, particularly the type of induction by enumeration as the example of the crows. Such inductive statements always contain the risk of error. But we are willing to take this risk in order to establish a general truth which has predictive value.

The Two-Valued Logic of the Law

The law betrays its adherence to deductive rationalism by its persistent use of two-valued logic. The law assumes that something is so or is not so. A defendant is guilty or not guilty; or he is sane or insane; a communication is confidential or it is not confidential. Further, the law assumes that its inability to make a proper decision as to what is so or not so is always due to a deficiency of evidence. If it is difficult for the law to decide whether a given defendant is sane or insane by reference to appropriate rules (such as the M’Naughten Rule) then it must necessarily follow that the evidence is either incomplete or corrupt. And the law assumes that if more complete evidence or more honest evidence or more scientifically exact evidence were available, the decision would be easier to make and would be more just.
It does not seem to occur to the legal mind that the difficulty in decision making by the law could be the result of its two-valued logic system, and no amount of evidence of any degree of honesty or exactness can fit certain multi-valued problems into a two-valued system.

The Heisenberg "Uncertainty Principle" of physics can be used to justify the law's belief in free will. This strikes me as metaphysical nonsense. The real meaning of the "Uncertainty Principle" is that if one wishes to know certain things, one cannot at the same time know other things. It also means that certain inconsistencies cannot, and need not, be resolved.

The mystical rationalist with his belief in causality does make some concessions to statistical probability. He recognizes that although one can predict with considerable certainty that with 1,000 tosses of a coin, half of the tosses will result in heads and half tails, nevertheless, with a single toss of a coin, there is no way that the fall of the coin can be predicted. But he assumes that if one knew enough, that if one were a superman, and could take into consideration every force that impinged upon the coin from the position in the flipping hand to the breeze in the air, then one could predict the result of the single toss. Thus, he is a believer in strict determinism.

The physicist is no such determinist. He now knows that certain phenomena, at least on the atomic level, can not be predicted, even if all the impinging forces are known. Although one can apply the statistical concepts of quantum theory to predict the behavior of large numbers of atomic particles, the behavior of a single particle is to a certain extent unpredictable and uncertain. We no longer subscribe to the dream of the French mathematician, Laplace (1749-1827), who reasoned that a super-intelligence who knew the position and momentum of every atom in the universe and who could solve all the mathematical equations, could predict with absolute accuracy all future events within the universe. The law is like Laplace in thinking that a super-law with infinitely perfect rules of evidence and infinitely honest and exact witnesses could achieve absolute justice.

The law is fond of rejecting determinism in the name of free will. But it reveals its confidence in strict determinism in the manner by which it makes its decisions. If the law were to become scientific it would have to give up some cherished notions about guilt and innocence and about criminal responsibility, especially as it applies to the mentally ill. If the law is to come to understand the behavior of people, it may have to do what the 20th century physicist has had to do in order to understand the behavior of atoms.

The atomic physicist is no longer perturbed by the dilemma of the so and the not so. For example, there are two ways of de-
scribing a sub-atomic particle such as an electron. An electron could be described as a very small bullet or particle with definite coordinates in space and time. Or it can be described as an electromagnetic wave. By its very logical definition, a wave is not a particle; so these two descriptions of the electron are logically incompatible with each other. Much time was wasted in the development of atomic physics in disputing this point. Yet the question was eventually resolved by discovering that an electron is both a particle and a wave and that incompatibilities of these two forms of matter exist only within the semantics of the pure reason of the observer. If the scientist cannot think up the proper word to describe the actual structure of the electron, that is the linguistic problem of the observer and not a problem of physics. This linguistic and conceptual difficulty is no problem in physics because it uses the language of mathematics, which does not have these built-in limitations.

The mathematical language of the physicist frees him from the limiting preconceptions and prejudices of conceptual analogies derived from the gross, macroscopic world of the sense organs. I think the law will also have to tend to its language more carefully if it wishes to understand people and if it intends to effectively predict and control their behavior.

Conclusion

I am most optimistic about the possible applications of the behavioral sciences to the law. My optimism may be because applying science to the law is my principal job. It may also be because I am a psychiatrist. Of all the behavioral sciences, psychiatry has been the most influential (not always for the good) in the law; so I see the law becoming more scientific in the reasonably near future. By scientific, I do not mean for the law just to use scientists, but rather to apply the methods and techniques of science to the theories and operations of the law. There could then be a true science of law, just like there is now a science of physics or anthropology. Presumably, the functions of the law would then be accomplished in a more effective manner, and the law could begin to abandon its reliance upon mystical theories and practices which have never worked too well anyway.

The business of the law consists of three main activities: the making of decisions, the resolving of disputes, and the control of human behavior. These are the outputs of the law. Each of these outputs is capable of being scientifically analyzed and the results of such analysis fed back so that the law might regulate its own processes, more effectively achieving its assigned purposes. This would require the law to observe scientifically, by the scientific method, its own processes.
The beginnings of this science of the law have been made by outsiders, who look at the law with non-legal eyes. This will never be sufficient. The law must develop its own scientists, the lawyers and judges who will be skilled in the scientific method, and able to apply it, as insiders, to their own discipline.