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ADVENTURES
OF
THE
MIND
43.

The False Images of Science

By GERALD HOLTON

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Of the influences that shape man’s actions, none is more powerful than the images we carry in our heads. Every subject is apt to invoke in our minds a specific image, made up of concrete information, misinformation, folklore, desire and prejudice. Thus, how people see themselves as a nation determines to a large extent how they will respond to any new challenge. The roles we play in our family life, particularly with respect to our children, depend greatly on what roles we assign ourselves in the society around us.

In the same way, our images of science vastly affect the relationship between science and society. Practically, these images determine the level and the sources of financial support, the quality and quantity of instruction offered, and the development of new scientists. The effects on professional morale and the goals scientists set for themselves—in short, on the scientists’ image of their own work—are also considerable. But even more important is the role images play in deciding this urgent question: Can scientific activity be an integrated part of our culture, or will it be forced to develop independently?

Right or wrong, ideas are powerful. Therein lies the chief danger of false images. Like bad grammar, bad images become dominant when they gain wide currency, and so undermine communication among thoughtful people. It is high time, therefore, to consider the prevailing public images of the role of science, using the most straightforward language possible.

Pure Thought and Practical Power. Each person’s image of science is different from the next, but all are composed of seven main elements. The first goes back to Plato and portrays science as a tonic with double benefits—science as pure thought helps the mind find truth, and science as power provides the tools for effective action. The main flaw in this image is that it omits a third vital aspect. Pure science allows us to understand the physical world and, through its applications, allows us to control and change.

About the Author

Gerald Holton, professor of physics at Harvard University, is active in three fields—physics, teaching and scholarly editing. Doctor Holton pursues experimental research on the properties of materials under high pressures; he teaches and writes in the fields of physics and the history and philosophy of science; and he is also editor-in-chief of Daedalus, the journal of the American Academy of Arts and Sciences. Born of Austrian parents, Doctor Holton is thirty-seven years old. Photograph by Arnold Newman
that world. But science also has a myopic function: that is, it generates an intellectual vacuum in the life of the scientist, and provides some of the meta
political and ideological underpinnings of the values and beliefs on which our societies are founded. As a consequence, the methods of argu
ment of science, its conceptions and its models, permeate first the intellectual life of the time, then the tenets and usage of everyday life. Our language of ideas, for example, owes a debt to the science of statics and hydraulics and the model of massing in the study of powerful analogues in many fields of study.
Guiding ideas—such as conditions of equilibrium, centrifugal forces, con
servation laws and the balance of energy or power, feedback, invariance, comple
mentarity—enrich the general arsenal of imaginativeness at our disposal. All philoso
phers have sought a share in the science that we use to work with concepts such as space, time, quantity, matter, order, law, causality, verification, reality.
A sound image of science must, therefore, embrace this third function, in addi
tion to the first two functions of explanation and to practical applications. How
ever, more usually, only one of the three is recognized. For example, folklore some
times depicts the life of the scientist as a science of wisdom, isolated, diverged from life and beneficent action in the larger sense. This view is shortsighted in that it is based on an un
reasonable tendency of some philosophers to positivize science. It misses the problems which science could not solve at the time. Newton himself, who was deeply interested in theology, wrote, "It is not to be conceived that mere mechanical causes could ever give us so vast a range of con
ceptions in the solar system. . . . This most beautiful system of the suns in their just places proceeding their regular motions and so pe
culiarly adapted could only proceed from the counsel and dominion of an intelligent and powerful Being."
The same attitude governed thought concerning science's formation around the year 1789. In the context of the struggle between the theory of geological evolution, the doctrine of natural selection and the theory of biolo
gevolution, and the origin of the galaxy before modern cosmology.
This aspect of the conflict between scien
tce and religion results largely from a morphological gap, a fact which is as foible as it is blameworthy. The re
viewer of the history of science, is equally precarious, for scien
tific knowledge constantly grows, super
sedes, and is itself supplanted. Science is a secure foundation for religious belief, as a whole, but its parts have taught, is neither the capacity nor the failure of man to escape from the notion of scien
tists near the limits of his science—but fact.
Today political overthrow makes a wider understanding of science's formation more urgent and more difficult. "Religious propaganda," a recent dispatch in Irish Catholic accounts, must be counteracted that "scientific atheistic propa
ganda" established by local societies for "the disseminating of political and scien
tific knowledge.
The iconoclastic image of science has, apparently, become prevalent, neither the possi
ble to an elementary misunderstanding of its functions. For example, the his
torian Arnold Toynbee changes science and technology with usurping the place of
Christians as the source of some Negro theologians call science the "self-estrangement" of man because it is a relation of the world to the ultimate—that is, religious—concerns of
But this image fails to recognize the multitude of influences that have deter
mined—or a person. Neither to Christianity nor to science can one properly assign more than a limited part in the interplay between man's psychological and biolo
gical, the rest fulfills its task, to design the opportunities and accidents of his history on the other. Moreover, to set science and religion at odds, to view them as mutually inter
secting paths, is to neglect the valuable possibilities of synthesis. As Alfred North Whitehead wrote in Science and the
Future, "We are in the presence of "two great con
trasting general forces, apart from the more impulsive of the various senses, which influence man. . . . On their relationship depends the future course of history."
In short, the "force of our religious intuitions, and the force of our scientific understanding and de
duction," are complementary rather than conflicting. The way many scientists and theologians state the issue today makes it seem as if we must choose between two normals and powerful drives. This is like forcing a child to choose between his fish and his flower because they dis
agree on some matters.
ETHICAL PERVASIVENESS. The next image of science seen by the observer who has no vade
morio, possess, pervert and destroy man. The enterprise is in Amsterdam in the first 18th century, called Lavoisier's, the naturalist turned chemist, an at
tacks at his niece who dare speaks to him pausily of religion, and retires angrily to his laboratory, now that the religious weight of starved rats, half of them partly eating, has been found to be the weight which are dying faster.
In the current version, the soulless, evil scientist is the mad researcher of science fiction, or the nuclear destroyer—imperial in his depredations. He is an unbridled, unregula
ted, unbridled, unregulated laboratory, a laboratory that is a weight of loss and gain, of which are dying faster.
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not long ago the typical scientist worked alone or with a few students and colleagues and built his own equipment with "love, string and sealing wax." Today he usually belongs to a group working under a contract with a sizable annual budget. In the research institute of one university more than 1,500 professors and technicians are grouped around a set of multimillion-dollar machines; the money comes from government or university endowments whose ultimate aim is national defense.

Even if the very people who make the research look so scarce and desirable to modem critics of the recent, "scientific" perion as just the life of the "noble savage," as so esteemed by eighteenth-century philosophers, has been seen in what he is, and who he is.

Science is a body of facts, and the last four images imply a revolution from which we may be able to tell the one next addition to science. Science divides all thought into two categories—up-to-date scientific knowledge and "theories"—to which it "subscribes" to this view, but most of its adherents are overimplified meanings. Among the social studies, for example, there are some vicissitudes of the seductive idea that the mathematical sciences offer the only permissible models for successfully predicting the variables.

A far more significant symptom of science is the growing identification of science with the scientific method. We have seen the same thing occur in all scientific work. Of the huge sums spent annually on science and technology—about $10,000,000,000 this year in the United States—less than 8 per cent is devoted to real basic research.

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