The False Images of Science

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ADVENTURES OF THE MIND

The False Images of Science

By GERALD HOLTON

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The False Images of Science

By GERALD HOLTON

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 Dauzelle, 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 metaphysic function; that is, it generates an intellectual framework that organizes and provides a measure of the metaphysical orientation of our philosophical discussions of reality and the limitations of our ideology.

As a consequence, the methods of argument of science, its conceptions and its models, permeate first the intellectual life of the time, then the tenets and usages of everyday life. Our language of ideas, for example, owes a debt to the sciences of statics and hydraulics and the model of the machine that permeates our life; we find powerful analogues in many fields of study. Guiding ideas—such as conditions of equilibrium, centrifugal forces, conservation laws and the balance of energy or power, feedback, inertias, complementarity—enrich the general arsenal of imaginative theories we call art. All philosophe share with science the need 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 addition to referring to theoretical speculation and to practical applications. However, more usually, only one of the three is recognized. For example, folklore sometimes depicts the life of the scientist as a lonely, isolated, diverted from life and beneficent action in the larger sense. Many scientists feel that this is an incorrect view of what it means to be a scientist. This view is based on the misconception that science can be isolated from the world and that scientific work can be done in isolation.

In fact, science is a social activity. It involves the interaction of scientists with other scientists and with the public. Scientific work is not done in isolation, but rather in a community of scientists who share ideas and collaborate on research projects. Scientists also engage in public outreach and education, sharing their knowledge and findings with the public to help inform and empower people to make informed decisions about science-related issues.

Economically, scientists also interact with policymakers, educators, and the media to shape public opinions and influence public policy. They also engage in scientific debates and controversies, which are crucial for advancing scientific knowledge and understanding.

The idea of science as an isolated activity is a misconception that has been perpetuated by popular culture and the media. Scientists work collaboratively with other scientists and with the public to advance scientific knowledge and to ensure that it is used for the benefit of society.

In conclusion, science is a social activity that involves interaction with other scientists and the public. It is not an isolated activity, but rather a collaborative effort that is essential for advancing scientific knowledge and for ensuring that it is used for the benefit of society.
like a tree, ring by ring. Einstein did not prove the work of Newton wrong; he provided a larger setting within which some contradictions and inconsistencies of the older physics disappeared.

But the impact of science as an ecological disaster can be subjected to a more severe critique. Regardless of science's part in the corrosion of absolute values, have those values really given us a safe anchor? A priori absolutes stand still over the globe in completely contradictory vacuums. Most of the humanitarian, humanistic and philosophic struc-
tures have been carried out under the banner of some absolutist philosophy, from the Artec massacre to the auto de-fe of the Spanish Inquisition, from the massacre of the Hispanics to the Nazi gas chambers. It is at best an optical il-
lusion which makes the fourth wall so desperate and merid-
ionally correct that in itself is the image of society.

If, therefore, some of the new phi-
losophies, inspired rightly or wrongly by science, reject earlier bases of authority—values as they define this: they point out that "abolition of the oikos is the era of science"—so esteemed by nineteenth-century philosophers, has been even less what it is, and who it is.

Since the fourth wall has last implied a revolution from we might have
described the next one as addition to science. Science divides all thought into two
categories—up-to-date scientific kno-
eldges, and the seductive urge to adopt generally the passive of pattern of organization of the former, in a manner justified by the quality of creative results in a specialized profession and of dis-

A far more significant symptom of science is the growing identification of scientific knowledge with the supplementary of information. The huge sums spent annually on science and technology—about $10,000,000,000 this year in the United States—treble in 8 to 15 years at the rate of 9
cent to realize basic research.

Not long ago the typical scientist worked alone or with a few students and colleagues and built his own equipment with "low, string and sealing wax." To-

day he usually belongs to a group work under a contract with a sizable annual budget. In the research institute of one university more than 1500 scientists and technicians are grouped around a set of multimillion-dollar machines; the money comes from a government whose ultimate aim is national defense.

Science means change. Society means change. A government of university science, industry and the mili-

tary establishment is moved in a way satisfactory to all three. Science has thereby become a large-scale operation with a potential for immediate and world-

direct effects. It is not frivolous to call physics the liveliest political science to-

day. If for some reason all physicists in the United States banded together for a call to a nonviolence, nobody would be more deeply disturbed than would the Congress and the State Department. These are merely indications that we are passing through a revolutionary change in the nature of science. The effec-
tive cause was the profession and the dis-


What remedies suggest themselves? At least, science must again be made a natural part of every intelligent man's common literacy—not because science is more important than other fields, but be-

cause it is an important part of the whole jigsaw puzzle of knowledge. This we could pursue, through work at each level of education—for example, a good part of the emphasis at our work should be the rule in good colleges fifty years ago. It would demand imaginative new curricula, strengthened standards of achievement, more recognition of excel-

ence—whether exhibited by instructors or by students. Adult education, including the study of modern environmental and cul-

tural aspects of science through mass media, is another obvious measure merit-

ing the support and participation of our best minds.

Here and there to some, some efforts are being made in the right direction, but the total is pitifully small. Virtually no-

body has been courageous enough to face the magnitude of the problem squarely, to large is the range and amount of knowl-

dedge needed before one can "know sci-

ence" in any real sense. The converse need—namely, the humanistic education of scientists—is also urgent, but at least in principle it can be served with existing methods of instruction. The tools of hu-

manistic study are still in touch with our sensibilities. This, unhappily, is no longer so in science.

Every great age has been shaped by in-

tellectuals such as Jefferson and Franklin, who would have been horrified by the idea of cultivated men and women turn-


For readers who wish to pursue the subject further, the following books are recommended:

HOYT, GERALD Introduction to Concepts and Theories in Physical Science Addison-Wesley Publishing Company $7.50

FRANKEL, CHARLES The Case for Modern Man Beacon Press $1.75

BRONOWSKI, JACOB The Common Sense of Science Harvard University Press $2.00

BLANCHARD, PATE Education in the Age of Science Basic Books $4.30