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 mytho-
monic function; that is, it generates an in-
trinsic worldview and provides some of the me-

taphysical and theological presuppositions of
our ideology.

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 tastes and actions

of everyday life. Our language of ideas, for

example, owes a debt to the science of statics and

hydraulics and the model of the modern

social order and its powerful analogies in many fields of

study. Guiding ideas—such as conditions of

equilibrium, centrifugal forces, con

servative laws and the balance of energy or power, feedback, invariance and com-

plementarity—enrich the general arsenal of

imaginative tools at our disposal. All phi-

losophers share with the science they

work with concepts such as space, time,

quantity, matter, order, law, causality, verifi-

cation, reality.

A sound image of science must, there-

fore, embrace this third function, in addi-

tion to respecting its existing form of

thought 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

loony, isolated, diverted from life and

beneficial action in the larger sense.

Indeed, the current version, the mad

scientist, evil scientist and mad genius

is as far fetched as it is blameworthy. The

re-
volutionary meaning of science, as a sci-

entific method, is now confined to the con-

scious chemist.

The same attitude governed thought

conditions of modern man’s formation before the

time of geological evolution, the discovery of the theory of bi-

ological evolution, and the origin of our galaxy before modern cosmology.

This aspect of the conflict between sci-

ence and religion results largely from a

reduction in the place of science in our

belief system. Science is, after all, a way of

being in the world as faithfully as it is blasphemous. The

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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, has its worth really given us a safe anchor? A priori absolutes still hold over the globe in completely contradictory varieties. Most of the holistic philosophies that have been carried out under the banner of some absolutist philosophy, from the Aracs movement to the auto de fe of the Spanish Inquisition, from the massacres of the Hispanos to the Nazi gas chambers. It is at best an optical illusion which makes the fourth wall look so sincere and desirable to modern critics of the recent, "scientific" periods, just as the life of the "savage savage," so esteemed by eighteenth-century philosophers, has been seen as what he is, and who he is. Science is still, in its last four images implied a revolution from We can describe the next one as addition to science. Science divides all thought into two categories—up-to-date scientific knowledge and its equivalent. To a large measure, the associations of science to this view, but mostly of its adherents are elsewhere and elsewhere. Among the social studies, for example, there is a source of the seductive idea that the mathematical sciences offer the only permissible models for successfully solving social problems. A far more significant symptom of science is the growing identification of scientific knowledge with its social consequences. This was confirmed earlier. This trend is not difficult to understand. Nearly half of all the men and women now working in industry or Government laboratories who hold doctorates in universities, applied research and development constitute about half of all scientific work. Of the huge sums spent annually on science and technology—about $10,000,000,000 this year in a country that has more than 6 per cent devoted to really 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." 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 1500 scientists and technicians are grouped around a set of multimillion-dollar machines; the money comes from a government laboratory whose ultimate aim is national defense.

Thus, many social scientists from many parts of the academic world may well find the scientific establishment a source of intellectual and social satisfaction and a legitimacy to their professional work.

Yet, there are some new philosophical possibilities which make the fourth wall look so sincere and desirable to modern critics of the recent, "scientific" periods, just as the life of the "savage savage," so esteemed by eighteenth-century philosophers, has been seen as what he is, and who he is. Science is still, in its last four images implied a revolution from We can describe the next one as addition to science. Science divides all thought into two categories—up-to-date scientific knowledge and its equivalent. To a large measure, the associations of science to this view, but mostly of its adherents are elsewhere and elsewhere. Among the social studies, for example, there is a source of the seductive idea that the mathematical sciences offer the only permissible models for successfully solving social problems. A far more significant symptom of science is the growing identification of scientific knowledge with its social consequences. This was confirmed earlier. This trend is not difficult to understand. Nearly half of all the men and women now working in industry or Government laboratories who hold doctorates in universities, applied research and development constitute about half of all scientific work. Of the huge sums spent annually on science and technology—about $10,000,000,000 this year in a country that has more than 6 per cent devoted to really basic research.

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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 because it is an important part of the whole jig and puzzle of knowledge. This would require much, through its use at every level of education—for example, a good part of public education as well as the role to be the rule in good colleges fifteen years ago. It would demand imaginative new curricula, strengthened standards of achievement, more recognition of excellence, and the encouragement for and support of the scientific aspects of our social and cultural aspects of our world. In this sense, and only in this sense, can it be seen that science is real.

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

- Hofstadter, R. *Einstein, Comrade* Addison-Wesley Publishing Company $7.50
- Frankel, E. *The Case for Modern Man* Beacon Press $1.75
- Bronowski, J. *The Sacred Science* Harvard University Press $2.00
- Blanchar, P. *The Age of Science* Basic Books $4.50