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-

poeic function; that is, it generates an

imaginary world that provides the con-

sciousness and meaning of everyday life.

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As a consequence, the method of ar-
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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 "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 1,500 professors and technicians are grouped around a set of multimillion-dollar machines; the money comes from the government whose ultimate aim is national defense.

This change affects the way we teach university science, industry and the military establishment to a remarkable degree satisfy all three. Science has thereby become a large-scale operation with a potential for immediate and widespread effects. It is not frivolous to call physics the liveliest political science today. If for some reason all physicists in the United States needed a call for a moratorium, 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 effective cause was the perfection and dissemination of basic research by teams of specialists with widely different training and interests. The result is a splendid increase in scientific knowledge—"data" instead of "knowledge." The same change is evident in the social sciences. Changes in the mental life of the individual: the bureaucrat, the desexualization of some human relations: To a large extent, these phenomena cannot be avoided. The new scientific revolution will justify itself by the flow of results and the material benefits that will no doubt follow. The danger, the point where the research scientist must be careful, is the friction between the mechanism of scientific research and the people, both within and outside the scientific community.

The new science requires a new kind of scientist. The unthorough, withdrawn individual, on whose most great scientific achievements have rested, the past, does not fit well into the new system. We must keep a special niche for the true scientist—"if only to symbolize our commitment to science itself rather than to the new machinery. Society, on the other hand, will also have to hold against the seductive urge of the scientist to adopt generally the patterns of organization of the corporate world."

Almost every last image implies a revolution from science. We might de- scribe the next one as addition to science. Science divides all thought into two categories—up-to-date scientific knowledge and what is not known. Science adds to this view, but most of its ad- ditions are out of the mainstream. Among the social studies, for example, there are some vicissitudes of the seductive idea that the mathematical sciences offer the only permissible models for success- fully understanding human behavior. A far more significant symptom of science is the growing identification of scientific knowledge with the knowledge of the society it serves. When science is not respected by the society it serves, the society is in trouble.

Those who held a devotion of less than 10 per cent of their courses to these sciences. Moreover, in science classes they aim at the fundamental change in teaching. The 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-saw puzzle of knowledge. This would require schools, though work at every level of education—for example, a good part of the effort at work, as well as to be the rule in colleges fifteen years ago. It would demand imaginative new curricula, strengthened standards of achievement, more recognition of excel- lence—whether exhibited by instructors or by students. Adult education, including the sciences, and the present way of teaching social and cultural 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 extent, some efforts are being made in the right direction, but the total effort is pitifully small. Virtually no- body has been courageous enough to face the magnitude of the problem squarely, so large is the range and amount of knowl- edge needed before one can "know science" in any real sense. The converse need—namely, the humanitarian 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 ideas of cultivated men and women turn- ing daily into what they are anchoring the margins of knowledge. The new intellectual needs new language. It is a language of ideas. Among the scientists themselves, busy with exciting work, the public must be no longer responsible for taking part in the necessary educational efforts; must have forgotten that, essentially, at a time of rapid expansion of knowledge, they have an obligation to the common public, if only because it must feel the bill and forces of the new crop of "knowledge." And among the intellectuals of modern science that democracy of thought is a part of reality, he knows only that he can- not grasp them and never will.

The second degree of ignorance, the contemporary intellectual fools to under- stand how the different people combine together with one another and with the material as different elements of one cosmos. He has left behind those great systems which once comprised our in- tellectual and moral home—the cosmic view of the book of Genesis, Homer, Dante, Milton, Goethe and his people. He has been blinded in a maze without a road need be found. The brutal fact is that by leaving scien- tists with even the elementary facts of modern science, our intellectuals, for the first time in history, are losing their hold on understanding the world. Of all the evils arising from the intellectual void, and the search for scientific knowledge, this bewil- derment and homelessness is the most terrifying.

Indeed, it is amazing to me that the in- tellectuals have not attacked science, the source of the apparent threats to their common-sense sanity, men of science cannot be convinced that the association has not produced an even greater cultural psychosis. This, I am convinced, is likely to occur, for there is at present no mechanism at work in our society for dealing effectively with the situation.

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

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

HORADLE, GERALD, Editor
Science and Society: A New Mind
Beacon Press
$7.50

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

BRONOWEL, IACOB
The Common Sense of Science
Harvard University Press
$2.00

BHALDARD, PATEL, Editor
Education in the Age of Science
Basic Books
$4.50