The False Images of Science

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ADVENTURES
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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-
poetic function; that is, it generates an
imagery and provides some of the meta-
physical frameworks that ground our
assumptions about the possibilities and
limitations of our ideology.

As a consequence, the methods of argu-
ment, concepts, and its models, permeate
to first the intellectual life of the time, then the tenets and values of
everyday life. Our language of ideas, for
example, owes a debt to the science of
statics and hydraulics and the model of
mechanics and centrality. The historical
powerful analogies 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, interaction, complemen-
tarily—enrich the general arsenal of imaginative thought. All philo-
osophers share with the science the need to
work with concepts such as space, time,
quantity, matter, order, law, causality,
verification, reality.

A sound image of science must, there-
fore, embrace this third function, in addi-
tion to the first two of thought and appli-
cation to practical applications. How-
ever, more unusually, only one of the three is
recognized. For example, folklore some-
times depicts the life of the scientist as
lonely, isolated, divorced from life and
beneficent action in the larger sense.

In practice, a second important long stan-
ding is that of the scientist as imagi-

cratic. Indeed, almost every major scien-
tific advance has been closely linked to
the postulation of universal gravi-

tation, the discovery of the circulation
of blood to the perfection of anesthesia
administration, has been interpreted as a
blast against religion.

To some extent science was pushed in this direction by the increas-
ging tendency of some philosophers to promote science to solve some
problems which science could not solve at the
time. Newton himself, who was deeply
interested in theology, wrote, "It is not to be
considered that more mechanical causes
could be given so as to support the mo-
tions (in the solar systems). ... This most
beautiful system of the sun, planets, stars
could only proceed from the counsel and
disposition of an infinite and powerful Being."

The same attitude governed thought concerning the evolution of
the theory of geological evolution, the
discussion of the theory of biologi-
cal evolution, and the origin of the

galaxy before modern cosmology.

This aspect of the conflict between sci-
ence and religion results largely from a
religiously motivated absolute con-

time to base one's religious belief on an
exclusive knowledge of the mind as

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but not confined to science. It is also
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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 corruption 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 optimistic, post-war, liberal philosophe have been carried out under the banner of some absolute skepticism, from the Artec massacre to the auto da fé of the Spanish Inquisition, from the massacre of the Hispanics to the Nuremberg gas chambers. It is at an optical illusion which makes the fourth wall 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.

Some of the last four images implied a revolution from science. We might describe the next one as addition to science. Science divides all thought into two categories—up-to-date scientific knowledge, and other thoughts. Each must write to this, but most of its adherents are over the horizon. Among the social studies, for example, there are some voices of the seductive idea that the mathematical sciences offer the only permissible models for successfully understanding the nature of society.

A far more significant symptom of science is the growing identification of science as the chief anchor of thought. We have not yet learned how to deal with the challenge of the intellectual climate. Science, once thought to be the key to understanding will soon be thought of as the ultimate source of knowledge. Like the false images of science, this one is partly an educational problem. All our voracious consumption of technical devices, all our talk about science, and all the more, technical developments cannot hide that most of us are content to remain completely ignorant of science. In a recent nationwide survey, nearly 40 per cent of those who had attended college confessed they took not a single course in physical or biological science. Those who did devoted generally less than 10 per cent of their courses to these sciences. Moreover, in science classes they miss all too often the kind of teacher who can impart to the average student a wider appreciation of both the inherent powers and the inherent limitations of science, who can show how to distinguish challenging from trivial problems, how to detect the inconspicuous hints of the solution by which to dig it forth.

The Root of the Failure. To expose the falsity of the current images of science is not enough, any more than is treating symptoms rather than the disease itself. The inadequate scientific education the general student receives at all levels must explain the distortions, but only in part. When we try to understand why people hold these views and why they are fixed with too little knowledge about science, we discover that the major share of the blame does not lie with the ordinary citizen. In this matter he is only taking his cue from the intellectuals—the writers, scholars, lawyers, politicians, scientists and all others who deal professionally to ideas. Among the scientists themselves, busy with exciting work, answering no strong responsibility for taking part in the necessary educational efforts, may have forgotten that, especially at a time of rapid expansion of knowledge, they have an extra obligation to the general public, if only because it must feel the bill and pay it.

Across the rest of the intellectuals the old core. The wrong images, which they share with the common man, prevail because they are anchored in the same error, the same false science. They escape the answers, and become self-annihilating. The new science requires a new kind of scientist. The unorthodox, withdrawn individual, on whose most great scientific achievements have been born in the past, does not well into the new system. We must keep a special place for the scientist to himself—only to symbolize our commitment to science itself rather than to the new machinery. Society, on the other hand, will also have to hold out against the seductive urge to adopt generally the pattern of organization of the new. Out of science comes the possibility of a fruitful organization of the work of science.

Facts. How few scientists would be likely to suspect a hoax if it were suddenly announced that a phenomenon of light higher than hydrogen had been syn-

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

**HOLTON, EUGENE**

*Introduction to Concepts and Theories in Physical Science*

Addison-Wesley Publishing Company

$7.50

**HOLTON, EUGENE, Editor**

*Science, Philosophy, and the Mind*

Beacon Press

$8.95

**FRANKEL, CHARLES**

*The Case for Modern Man*

Beacon Press

$1.75

**BROMWELL, IACOB**

The Common Science of Sense Harvard University Press

$2.00

**BLAINE, PETER, Editor**

*Education in the Age of Science*

Basic Books

$4.50