The False Images of Science

Citation

Permanent link
http://nrs.harvard.edu/urn-3:HUL.InstRepos:37879547

Terms of Use
This article was downloaded from Harvard University’s DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA

Share Your Story
The Harvard community has made this article openly available. Please share how this access benefits you. Submit a story.

Accessibility
ADVENTURES OF THE MIND

The False Images of Science

By GERALD HOLTON
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 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 in-
finite number of myths and provides some of the me-
ta-physical foundations for the development of our con-
ceptions of our ideology.

As a consequence, the methods of ar-
gument of science, its conceptions and its mimesis, 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
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, invariance and com-
plementarity—enrich the general arsenal of imaginative tools. All of this, in short,
share with the science to work with concepts such as space, time, quantity, matter, order, law, causality, verification, reality.

A sound image, a science must, there-
fore, embrace this third function, in addi-
tion to the first two, if it is to serve as an im-
portant 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
lonely, isolated, divorced from life and
beneficent action in the larger sense.

Such attempts to science was pushed in this way, that the new func-
tionary of science had become an in-
creasingly dangerous type of some philosophers to provide a practical solution to 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 causality, might have enough power to move the system in the solar system. . . . This most beautiful system of the suns in their orbits, whose fidelity could only proceed from the counsel and dominion of an intelligent and powerful Being."

The same attitude governed thought concerning the human being's formation under the theory of geological evolution, the development of the theory of bi-
ological evolution, and the origin of the galaxy beyond modern cosmology.

This aspect of the conflict between sci-
ence and religion results largely from a
lack of a concept of evolution as a self-
conscious thought; it is as if it were a blasphemous. The re-
version of the naturalist view of science, is equally precarious, for scien-
tific knowledge continually grows, super-
ceeding even our present knowledge. We
are not secure for religious belief, as a
result, in a way, science and religion may be
a failure if we are not secure in our
belief
ness or the limits of his science—but faith.

Today political overtones make a wide understanding of science's formation more urgent and more difficult. "Religious propaganda," a recent dispatch in Irish Curtaintimes advised, must be coun-
teracted by "scientific apologists" by local societies for "the dissemination of political and scien-
tific knowledge."

The iconoclastic image of science has, apparently, else, not the power to be-
able to an elementary misunderstanding of its functions. For example, the his-
torian Arnold Toynbee changes science
technology and technology with usurping the place of
Christianity as the basis of all the sciences in the East. Orthodox theologians call
science the "self-estrangement" of man because it is his "lens," reality and not

But this image fails to recognize the multitude of influences that have
formed a person— 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 bi-
ological life, the facts fully laid, to find the opportunities and accidents of his history
on the other. Moreover, to set science and religion at odds, to view them as inter-
secting paths, is to neglect the valuable possibilities of synthesis. As Alfred North
Whitehead wrote in Science and the

the "two great stems of science, science
and general forces, apart from the more
impulses of the various senses, which in-
fluence man... On their relationship
depends the future course of history."

In short, that "the force of our re-
ligious intuitions, and the force of our
educational power—both those 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
eternal and powerful drives. This is like
forcing a child to choose between his
five-day-old father for concluding because they dis-
agree on some matters.

ETHICAL PARADOXES. The next image of science seems to have
no vade, possess, pervert and destroy man.
The protagonist in this novel, Loofada's "Adventure," the naturalist turned
ultrarealist at his leisure, on the other hand, is the source of his beliefs because they dis-
agree on some matters.

The ethics of this novel are not
in science, for science has not a free choice of action. He does not
advocate this point of view, quite the contrary, knowledge advances toward him and
overwhelms him. Even a superficial glance at the work of a Kepler, a Darwin
or a Pasteur shows that the driving power of
of science is as strong as is the spirit of the scientist for the
art for the artist.

The fear behind this attitude is genuine, but not confined to science. It is also
directed against writers, artists, philoso-
"The creative scientist does not have a free choice of action.

ficult and amusing. Thus we are in an impossible dilemma—irresistibly tempted to
reach for the knife-edge; this is an ever-
continuing dilemma. When you are aware that our biological and psycho-
logical development will not be able to cope with this ever-increasing appetite.

Probably the dilemma can no longer be
resolved, and this increases the

and confusion concerning science. A cur-
rent topic is the problem of the relevance of science with the technology of super-

The dilemma is that of the microscope as a symbol of modern science. All efforts to convince people that science itself can only give meaning to
himself and his environment, and the possibility of science is that it is always renowned.
The scientist as scien-
tist can take little credit or responsibility either for the facts he discovers—or for the uses made of his discoveries, his work is merely
nor man may be inherently evil, the rise of

number of plants and animals to die. One calls the development of science the "death
of science," and the development of technology the "death of nature."
The fifth prevalent image of science, the "death of science," is that
or may not be inherently evil, the rise of the competence, if so, to bear the

of science shows the planetary system to be
heliocentric, and man toppled from his throne. In the words of theologian
Jacques Martina, the "deadly disease" science and technology is the "death of
culture and the "death of eternal and ultimate values."

How did this change come about? The main steps are usually presented in this
way: Before modern science, man was not of himself as the ultimate purpose and the
end of all the center of creation. Absolute
science showed our planetary system to be
heliocentric, and man toppled from his throne. In the words of theologian
Jacques Martina, the "deadly disease" science and technology is the "death of
culture and the "death of eternal and ultimate values."

How did this change come about? The main steps are usually presented in this
way: Before modern science, man was not of himself as the ultimate purpose and the
end of all the center of creation. Absolute

In the last two views held that man is inherently evil toward science. He is an image based on the assumption; it expresses the fear that man cannot be trusted with scientific knowledge. He has survived despite his wickedness only be-
cause he lacked sufficient power as a dangerous weapon; now he can immolate his world.

Secondly, salvation cannot be consid-
ern in this case, is more like the case of

This suggestion is based on two mis-
understandings. First, science is not an occupation that one can pursue or change at
short notice, like working on an assem-
bly line. The creative scientist does not have a free choice of action. He does not
advocate this point of view, quite the contrary, knowledge advances toward him and
overwhelms him. Even a superficial glance at the work of a Kepler, a Darwin
or a Pasteur shows that the driving power of
of science is as strong as is the spirit of the scientist for the
art for the artist.

The fear behind this attitude is genuine, but not confined to science. It is also
directed against writers, artists, philoso-
"The creative scientist does not have a free choice of action.

ficult and amusing. Thus we are in an impossible dilemma—irresistibly tempted to
reach for the knife-edge; this is an ever-
continuing dilemma. When you are aware that our biological and psycho-
logical development will not be able to cope with this ever-increasing appetite.

Probably the dilemma can no longer be
resolved, and this increases the

and confusion concerning science. A cur-
rent topic is the problem of the relevance of science with the technology of super-

The dilemma is that of the microscope as a symbol of modern science. All efforts to convince people that science itself can only give meaning to
himself and his environment, and the possibility of science is that it is always renowned.
The scientist as scien-
tist can take little credit or responsibility either for the facts he discovers—or for the uses made of his discoveries, his work is merely
nor man may be inherently evil, the rise of the competence, if so, to bear the

number of plants and animals to die. One calls the development of science the "death
of science," and the development of technology the "death of nature."
The fifth prevalent image of science, the "death of science," is that
or may not be inherently evil, the rise of the competence, if so, to bear the

of science shows the planetary system to be
heliocentric, and man toppled from his throne. In the words of theologian
Jacques Martina, the "deadly disease" science and technology is the "death of
culture and the "death of eternal and ultimate values."

How did this change come about? The main steps are usually presented in this
way: Before modern science, man was not of himself as the ultimate purpose and the
end of all the center of creation. Absolute
science showed our planetary system to be
heliocentric, and man toppled from his throne. In the words of theologian
Jacques Martina, the "deadly disease" science and technology is the "death of
culture and the "death of eternal and ultimate values."

In the last two views held that man is inherently evil toward science. He is an image based on the assumption; it expresses the fear that man cannot be trusted with scientific knowledge. He has survived despite his wickedness only be-
cause he lacked sufficient power as a dangerous weapon; now he can immolate his world.

Secondly, salvation cannot be consid-
ern in this case, is more like the case of

This suggestion is based on two mis-
understandings. First, science is not an occupation that one can pursue or change at
short notice, like working on an assem-
bly line. The creative scientist does not have a free choice of action. He does not
advocate this point of view, quite the contrary, knowledge advances toward him and
overwhelms him. Even a superficial glance at the work of a Kepler, a Darwin
or a Pasteur shows that the driving power of
of science is as strong as is the spirit of the scientist for the
art for the artist.

The fear behind this attitude is genuine, but not confined to science. It is also
directed against writers, artists, philoso-
"The creative scientist does not have a free choice of action.

ficult and amusing. Thus we are in an impossible dilemma—irresistibly tempted to
reach for the knife-edge; this is an ever-
continuing dilemma. When you are aware that our biological and psycho-
logical development will not be able to cope with this ever-increasing appetite.

Probably the dilemma can no longer be
resolved, and this increases the
Not long ago the typical scientist worked alone or with a few students and collaborators 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 1500 technicians are gathered around a set of multimillion-dollar machines; the money comes from the federal government whose ultimate aim is national defense.

Many large-scale research projects in universities, industry and the military establishment are not satisfactory to all. Science has thereby become a large-scale operation with a potential for immediate and worldwide 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. But are there any scientists who would have thought that science was something in itself.

The new science requires a new kind of scientist. The untheorized, withdrawn individual, on whom most great scientific advances have rested in the past, does not fit well into the new system. We must keep a great many more scientists on the faculty to serve the community. On the other hand, there will also have to be tolerance in the educational system to adopt generally the pattern of organization of a community that operates successfully in the world of commerce, in the world of art, science, and technology.

The core of the contemporary intellectual crisis is a fundamental one that has to do with the isolation of the individual and the community. This isolation is not just a problem of science, but it is one that science has to face and deal with.

What science is all about is the attempt to find order in the chaos of the world. Science is not just a tool for solving practical problems, but it is a way of understanding the universe. It is a way of finding meaning in the world.

The role of the scientist in society is to help us understand the world and to find solutions to the problems we face. But this role is not always easy, and it comes with its own challenges.

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

- Holton, Gershon. Introduction to Concepts and Theories in Physical Science
- Addison-Wesley Publishing Company $7.50

- Holton, Gershon. Editor Science and Itsaison of Mind
- Beacon Press $2.00

- Frankel, Charles. The Case for Modern Man
- Beacon Press $1.75

- Bronowski, Jacob. The Common Sense of Science
- Harvard University Press $2.00

- Blanshard, Paul. Editor Education in the Age of Science
- Basic Books $4.50