The False Images of Science

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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 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 myopic function: that is, it generates an intellectual climate that is necessary and provides some of the metaphysical foundations for our society and its institutions. And this is a self-propagating force that can undermine our fundamental values and our ability to function in society. Science should be a tool for understanding and advancing our knowledge, not a tool for manipulating and controlling our behavior.

Concerning the fact that science can be used for evil purposes, the question arises: What should we do? One answer is that we should educate the public and encourage critical thinking. We should also ensure that scientific knowledge is used for the benefit of society, not just for economic gain. It is important to remember that science is not value-free and that scientific knowledge can be used for both good and bad purposes. The key is to ensure that scientific knowledge is used for the benefit of all people, not just a select few.

In conclusion, science is a powerful tool that can be used for good or bad purposes. It is important to use science responsibly and to ensure that scientific knowledge is used for the benefit of society. The future of science depends on our ability to use it wisely and for the benefit of all people.
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 import 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 outside the globe in completely contradictory vacuums. Most of the holistic philosophers have been carried out under the banner of some absolutist philosophy, from the Arcte mask-sacriiice to the auto da fe of the Spanish Inquisition, from the massacre of the Hispanics to the Nazi gas chambers. It is at best an optical illusion which makes the fourteenth-century ploughman look so sincere and desirable to modern crticists of the recent, "scientific" periods, just as the life of the "noble savage," so esteemed by eighteenth-century philosophers, has been seen by what he is, and what he used to be.

Science is a last example 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 fiction. We are instructed to "study in this book, but most of its adherents are outside the sciences. Among the social studies, for example, there are some victims of the seductive idea that the mathematical sciences offer the only permissible models for successfull understanding of society.

A far more significant symptom of science is the growing identification of scientific progress with the scientific enterprise. This is a development which I have observed with increasing alarm. Our major universities are moving in industry or Government laboratories, up to the levels of, say, a Harvard or a MIT, and we have university-student 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 the United States alone—only about 8 per cent is devoted to real 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 professors and technicians are grouped around a set of multimillion-dollar machines; the money comes from the Government whose ultimate aim is national defense. Changes in the social structure of university science, industry and the military establishment have brought in a new way satisfactorily to all three. Science has thereby become a large-scale operation with a potential for immediate and world-wide 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 mcrmocracy, nobody would be more deeply disturbed than would the Congress and the State Department, the institutions whose ultimate aim is national defense.

These are merely indications that we are passing through a revolutionary change in the nature of science. The effective cause was the proliferation and disorganization of basic research by teams of specialists with widely different training and interests. The result is a splendid increase in scientific knowledge, but the side effects are analogous to those of sudden and rapid urbanization—a strain on transportation facilities, an increase of bureaucratic bureaucracy, the depersonalization of some human relations. To a large extent, as a result of the flow of results and the material benefits that will do not follow. The danger, the point where the scientist and the public meet, is very clear in the transition from the mechanical construction of scientific research may change the patterns of human scientific activity. The nonscientist realizes that the old common-sense ways of understanding the world have become obsolete and that he must grope without guidance. Instead of tending to his feet, gone are the simple interpretations of scientific knowledge. He is not as far as he was once made to feel. Even the most sophisticated scientists realize that the old fashioned measure of scientific knowledge is that which has been observed is no longer measurable on the old scale. The nonscientist realizes that the old common-sense ways of understanding the world have become obsolete and that he must grope without guidance. Instead of tending to his feet, gone are the simple interpretations of scientific knowledge. He is not as far as he was once made to feel. Even the most sophisticated scientists realize that the old common-sense ways of understanding the world have become obsolete and that he must grope without guidance. Instead of tending to his feet, gone are the simple interpretations of scientific knowledge. He is not as far as he was once made to feel.

The next lesson that is often ignored comes from the social sciences. We might describe the next one as addition to science. Science divides all thought into two categories—up-to-date scientific knowledge and fiction. We are instructed to "study in this book, but most of its adherents are outside the sciences. Among the social studies, for example, there are some victims of the seductive idea that the mathematical sciences offer the only permissible models for successful understanding of society.

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