The Scientist's Responsibility for the Interpretation of Concepts to Laymen[1]

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IN today's world, there is great popular respect for the scientist as a technician dealing with nutrition and food supplies, with remedial drugs and health, with increased efficiency in transportation and communication, with mechanical marvels and wonder-working calculating devices. Even the new and truly revolutionary weapons of modern warfare, for which he is responsible, are applauded by many grateful citizens. In so far as the inventive genius of the scientist is applied to things, he is regarded with admiration and approval by the recipients and users of the new machines, materials, and techniques.

But there is great popular skepticism concerning the ability of the scientist in the areas of economics, politics, and social organization. His willingness to appraise, as objectively as possible, all proposals and suggestions from whatever source is bad enough. His readiness to try experiments that might challenge long-established, time-hallowed procedures is even worse. And when one comes to international affairs, the scientist's deeply embedded sense of fraternity among those who seek knowledge in the same field of investigation, regardless of their nationality, is almost certain to expose him to the charge that he is "soft" in his thinking about the United States vis-a-vis other nations.

This low appraisal of the scientist-as-citizen is an important aspect of the anti-intellectualism that today appears all too commonly in the climate of public opinion. It has been encouraged and strengthened by conservative politicians and demagogues who say to the scientist, in effect: "Continue your research. Improve the machinery. Design new gadgets. Create more powerful weapons. But stick to your laboratories. We will determine how, and for what purposes, all these things shall be used in practical, everyday life."

The age-old cleavage between the idealistic scholar and the hard-fisted man of affairs has not been effectively healed by all the expenditure for universal education upon which the founders of our republic placed such emphasis as the preserver of democracy. Moreover, a chasm, with somewhat different orientation, is widening between a scientific "elite" and a nonscientific "herd," despite all the valiant efforts of those engaged in education at all levels from the kindergarten to the adult education center. The danger to the unity and therefore the welfare and security of our nation is obvious.

There is of course an almost insurmountable barrier of vocabulary between the specialist in nearly every field of scientific research and the man-in-the-street who lacks training in the specialist's particular subject. But the vocabulary barrier is not a threat to the community. Indeed it exists between scientists themselves, without preventing such cooperative activities and such unity of spirit as are exemplified in the meetings of the broadly inclusive Association under whose auspices we meet today.

There is also the well-known schism between the directives of reason and the mandates of emotion that has frequently been viewed with alarm, and rightly so, but this is not the crux of the matter now in hand. Sad indeed would be the day—which fortunately will never come—when human emotions are completely expurgated by the searing flame of pure reason. Rather, let us strive merely to purify our emotions a bit; use reason now and then to help us distinguish between worthy and unworthy emotions; retain a judicious mixture of the two elements of life that when properly yoked can go far toward making life worth while.

The chasm to which I have referred is much more fundamental. It separates those whose minds are frequently and skillfully engaged in conceptual thinking from those who have neglected to cultivate that peculiarly human, mental ability. It distinguishes those who actively seek insight and meaning, from those who merely know how to do that which they have been trained to do. On one side are the minds constantly alert to the possibility of new generalizations and relationships; on the other are minds stocked with a greater or lesser array of factual data, but insecure and frustrated because of inability to make adequate adjustment to new experiences or circumstances.

I have referred to a scientific "elite," divided by this chasm from the rest of the world, but I am not sure that the adjective is correct. A similar distinction may be made among artists; here the contrast is between the maestro and the imitator, the truly great artists, few in number, and the host of lesser artists. Likewise in religion, the same distinction may be made between the prophet and the priest. In politics, a similar gulf commonly separates the statesman from the mere politician. But within the framework of this

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scientific gathering, it is appropriate to focus attention upon those aspects of the problem that affect the vitality and usefulness of science.

For science and the scientist this separation of mankind into two disparate groups poses an increasingly poignant problem. Scientific research is becoming ever more dependent upon popular support. There is no reason for anxiety about the support of practical applications of scientific concepts or the technologic development of new ideas conceived in research laboratories. Industrial progress and military strength depend so obviously upon the technician that his comfortable niche in the social structure is indefinitely ensured. In sharp and dangerous contrast, the continuing support of fundamental research, as distinguished from applied science, is in a sadly precarious position. Such research requires financial backing. It also requires an environment of freedom. The present climate of public opinion is scarcely favorable for either.

The responsibility of the scientist for ameliorating that climate is both selfish and unselfish. He desires, of course, a better opportunity for his own personal achievements and he has deep commitments to the progress of science in general. But he is also responsible for human welfare and the health of society at large. He knows that in the last analysis the security of the nation depends upon the vitality of the fundamental research in which its creative scientists are engaged.

To respond victoriously to the challenge implicit in the contemporary ebb of confidence in science and scientists, it is necessary for the scientist to interpret his work to the layman in terms of concepts and mental constructs, rather than in terms of gadgets and applied techniques. This interpretation, however, must be something more than an inculcation of knowledge concerning the new concepts of each new stage in the forward march of science. It is the process of conceptual thinking that must be explained, the scientific habit of mind that must be made attractive.

Fortunately, conceptual thinking is not nearly as esoteric as many seem to believe. The human brain normally and constantly scans the sense data of experience to select those that seem to have significance. Patterns are perceived in the regularities of occurrence or relationship. Concepts that explain, or account for, the observed regularities and patterns are a result of the natural functioning of the brain. Even the simplest and most primitive of concepts lead to prediction and further observation and generalization.

The fundamental concepts of even the most complicated of modern sciences can be comprehended by almost everybody. That, indeed, is one of the earmarks of a fundamental concept; it explains what appears to be complex and chaotic in terms of relationships that give significance and meaning. Concepts are mind-stretching; they enlarge the horizon of one's mental grasp. They are also mind-satisfying; they rejoice the spirit of man. These satisfactions that every scientist feels when he has successfully used inductive reasoning to solve his problems can be shared by most laymen.

Scientists are handicapped in their endeavor to share fundamental concepts with the layman because they have not yet succeeded in sharing fundamental concepts with one another. The process of conceptual thinking is, however, universally acclaimed by every research scientist, and its power and virtue are known to all who have made effective use of it. Its nature can therefore be proclaimed with a unanimous voice, a voice that will carry across the chasm and make at least some impact on the attitudes of those within range.

It will, however, be necessary for scientists to seek concepts that unite not only the sciences with one another, but also the sciences with the arts and the humanities. That such concepts can be found is a part of the faith of many modern men. It is in fact a faith that is held implicitly if not explicitly by every man who seeks a truly satisfying philosophy of life, who really believes that life has meaning. When found, such ineffably basic concepts should be proclaimed to all the world.

As a first approximation to a universal, fundamental concept, I would suggest that the concept of order in the universe is basic in all science. The regularity may be of a statistical nature, rather than individual, but the result is orderliness just the same. There is indeed much evidence even of spiritual law in the world of nature.

The concept of a universe of law and order has fallen into sad neglect in these years of our lives. Chaos seems to be a characteristic of modern life. The old foundations have crumbled. Ancient verities no longer undergird the morals and ethics of modern man. To a distraught society the scientist may speak words of wisdom.

Freedom is a function of order, not of disorder. It may be found only within the pattern or framework of an orderly universe. And that is the universal pattern which scientists discern.

Much progress has already been made in the search for the basic concepts that will integrate the many segments of knowledge and of life that now seem fragmented and unrelated. Many men, working in widely varied disciplines of thought, are actively concerned with this search. The Foundation for Integrated Education, of which I have the honor to be president, has brought a few such researchers together. But this is in its very nature a cooperative enterprise and more workers are needed. With research, education must be combined, as indicated by the name of the Foundation. Too much of our so-called "General Education" is concerned with the acquisition of factual data culled from a broad array of sources. It is conceptual thinking that should be stressed; integrative concepts that should be made known.

Here then is the contribution that scientists may make toward the ordering of our chaotic world. More widespread understanding of the scientific approach to knowledge may yet save that world from disintegration.