PROBLEM-CENTERING VS. MEANS-CENTERING IN SCIENCE

A. H. MASLOW

Through the last decade or two, more and more attention has been given to the shortcomings and sins of "official" science. Discussion of the sources of these failings has, however, been neglected. This paper attempts to show that many of the weaknesses of orthodox science are consequences of a means or technique-centered approach to the defining of science.

By means-centering, I refer to the tendency to consider that the essence of science lies in its instruments, techniques, procedures, apparatus and its methods rather than in its problems, questions, functions or goals. In its unsophisticated form, means-centering confuses scientists with engineers, physicians, dentists, laboratory technicians, glass blowers, urinanalysts, machine tenders, etc. Means-centering at the highest intellectual levels most usually takes the form of making synonyms of "science" and "scientific method".[1]

1) *Inevitable stress on elegance, polish, "technique", and apparatus, has as a frequent consequence a playing down of meaningfulness, vitality, and significance of the problem and of creativeness in general.* Almost any candidate for the Ph.D. in science will understand what this means in practice. A methodologically satisfactory experiment, whether trivial or not, is rarely criticized. A bold, groundbreaking problem, because it often involves crudeness in conception and prosecution, and also because it may be a "failure", is too often criticized to death before it is ever begun. Indeed, the word "criticism" in the scientific literature seems usually to mean only criticism of method, technique, logic, etc. I do not recall seeing, in the literature with which I am familiar, any paper which criticized another paper for being unimportant, trivial or inconsequential.

The tendency is growing therefore to say that the dissertation problem itself doesn't matter—only so it be well done. In a word, it need no longer be a "contribution to knowledge". The Ph.D. candidate is required to know the techniques of his field and the already accumulated data in it. It is not usually stressed that good research ideas are also desirable. As a consequence it is possible for completely and obviously uncreative people to become "scientists" in spite of the fact that an "uncreative scientist" is as self-contradictory as a mute orator.

At a lower level—in the teaching of science in the high school and college—similar results can be seen. The student is encouraged to identify science with directed manipulations of apparatus, and with rote procedures learned out of a cook book,—in a word, following other people's leads and repeating what other people have already discovered. Nowhere is he taught that a scientist is different from a technician or a historian of science.

[1] The writer concedes that "method" is defined by some in a very broad and very sophisticated manner in order to avoid foreseen dangers. I consider even this to be a mistake if only because undesirable conclusions are drawn by less wise individuals no matter how they are forewarned.

Philosophy of Science 1946.13:326-331.

It is easy to misunderstand the point of these contentions. I do not wish to underplay method; I wish only to point out that even in science, means may easily be confused with ends. It is only the goals or ends of science that dignify and validate its methods. The working scientist must, of course, be concerned with his techniques, but only because they can help him achieve his proper ends. Once he forgets this, he becomes like the man spoken of by Freud who spent all his time polishing his glasses instead of putting them on and seeing with them.

2) *Means-centering tends to push into a commanding position in science the technicians, and the "apparatus men", rather than the "question-askers" and the problem-solvers.* Without wishing to create an extreme and unreal dichotomy, it is still possible to point out a difference between those who know only *how* to do and those who also know *what* to do. These former individuals, of whom there are always a large number, tend inevitably to become a class of priests in science, authorities on protocol, on procedure, and, so to speak, on ritual and ceremonial. While such people have been no more than a nuisance in the past, now that science becomes a matter of national and international policy, they may become an active danger.

3) *Means-centering tends strongly to over-value quantification indiscriminately and as an end in itself.* This must be true because of the greater stress of means-centered science on *how* statements are made rather than on what is said. Elegance and precision are then counterposed to pertinence and breadth of implication. This mistake has often been criticized but its origins have less often been discussed.

4) *Means-centered scientists tend, in spite of themselves, to fit their problems to their techniques rather than the contrary.* Their beginning question tends to be "Which problems can I attack with the techniques and equipment I now possess?" rather than what it should more often be, "Which are the most pressing, the most crucial problems I could spend my time on?" How else explain the fact that most run-of-the-mill scientists spend their lifetimes in a small area whose boundaries are defined, not by a basic question about the world, but by the limits of a piece of apparatus or of a technique? In psychology, few people see any humor in the concept of an "animal psychologist" or a "statistical psychologist", i.e., individuals who don't mind working with *any* problem so long as they can use, respectively, their animals or their statistics.

5) *Means-centering tends strongly to create a hierarchy of sciences, in which, quite perniciously, physics is considered to be more "scientific" than biology, biology than psychology, and psychology than sociology.* Such an assumption of hierarchy is possible only on the basis of elegance, success, and precision of technique. From the point of view of a problem-centered science, such a hierarchy would never be suggested, for who could maintain that questions about unemployment, or race prejudice, or love are, in any intrinsic way, less important than questions about stars, or sodium or kidney function.

6) *Means-centering tends to compartmentalize the sciences too strongly, to build walls between them that divide them into separate territories.* Jacques Loeb, when asked whether he was a neurologist, or a chemist, or a physicist, a psychologist or

Philosophy of Science 1946.13:326-331.

a philosopher, answered only, "I solve problems." Certainly this ought to be a more usual answer. And it would be well for science if it had more men like Loeb. But these desiderata are clearly discouraged by the philosophy which makes the scientist into a technician rather than a venturesome truth-seeker.

If scientists looked upon themselves as problem-solvers rather than specialized technicians, there would now be something of a rush to the newest scientific frontier, to the psychological and social problems about which we know least and should know most. Why is it that there is so little traffic across these departmental borders? How does it happen that a thousand scientists prosecute physical or chemical research for every dozen who pursue the psychological problems? Which would be better for mankind, to put a thousand fine minds to producing better bombs (or even better penicillin) or to set them to work on the problems of nationalism or psychotherapy or exploitation?

7) *Means-centering in science creates too great a cleavage between scientists and other truth-seekers, and between their various methods of searching after truth and understanding.* If we define science as a search for truth, insight and understanding, we must be hard put to it to differentiate between the scientists on the one hand, and the poets, artists and philosophers on the other hand. Their avowed problems may be the same. Ultimately, of course, a semantically honest differentiation could be made, and it must be admitted that it would have to be mostly on the basis of difference in method and in techniques of guarding against mistakes. And yet it would clearly be better for science if this gap between the scientist and the poet and the philosopher were less abysmal than it is today. Means-centering simply puts them into different realms; problem-centering would conceive of them as mutually helpful collaborators. The biographies of most of the great scientists show that the latter is more nearly true than the former. Many of the greatest scientists have themselves been also artists and philosophers, and have often derived as much sustenance from philosophers as from their scientific colleagues.

8) *Means-centering tends inevitably to bring into being a scientific "orthodoxy", which in turn creates a heterodoxy.* Questions and problems in science can rarely be formulated, classified or put into a filing system. The questions of the past are no longer questions, but answers. The questions of the future have not yet come into existence. But it *is* possible to formulate and classify the methods and techniques of the past. These then are termed the "laws of scientific method". Canonized, crusted about with tradition and history, they tend to become binding upon the present day (rather than merely suggestive or helpful). In the hands of the less creative, the timid, the conventional, these "laws" become virtually a demand that we solve our present problems *only* as our forefathers solved theirs.

Such an attitude is especially dangerous for the psychological and social sciences. Here the injunction to be "truly" scientific is usually translated as "Use the techniques of the physical and life sciences." Hence we have the tendency among many psychologists and social scientists to imitate old techniques rather than to create and invent the new ones made necessary by the fact that their problems and their data are intrinsically different from those of the physical sciences.

Philosophy of Science 1946.13:326-331.

8a.) *One main danger of scientific orthodoxy is that it tends to block the development of new techniques.* If the "laws of scientific method" have already been formulated, it remains only to apply them. New methods, new ways of doing things, must inevitably be suspect, and have usually been greeted with hostility, e.g., psychoanalysis, gestalt psychology, Rorschach testing. The expectation of such hostility probably is partly to blame for the fact that there have not yet been invented the relational logics and mathematics demanded by the new psychological and social sciences.

Ordinarily, the advance of science is a collaborative product. How else could limited individuals make important, even great, discoveries? When there is no collaboration, the advance is apt to stop dead until there shows up some giant who needs no help. Orthodoxy means the denial of help to the heterodox. Since few, (of the heterodox, as well as of the orthodox,) are geniuses, this implies continuous, smooth advance only for orthodox science. We may expect heterodox ideas to be help up for long periods of weary neglect or opposition, to "break through" rather suddenly (if they are correct), and then to become in turn orthodox.

8b.) *Another, probably more important, danger of the orthodoxy fostered by means-centering, is that it tends to limit more and more the jurisdiction of science.* Not only does it block the development of new techniques; it also tends to block the asking of many questions, on grounds that the reader might well expect by now, that such questions cannot be answered by currently available techniques, e.g., questions about the subjective, questions about values, questions about religion. It is only such foolish grounds that make possible that unnecessary confession of defeat, that contradiction in terms, the concept of the "unscientific problem", as if there were *any* question that we dared not ask. Surely, anyone who had read and understood the history of science would not dare to speak of an *unsolvable* problem; he would speak only of problems which have not yet been solved. Phrased in this latter way, we have a clear incentive to action, to further exercise of ingenuity and inventiveness. Phrased in terms of current scientific orthodoxy, i.e., "What can we do with scientific method (as we know it)?", we are encouraged to the opposite, i.e., to voluntarily imposed self-limitations, to abdication from huge areas of human interest. This tendency can go to the most incredible and dangerous extremes. It has even happened in recent discussions of congressional efforts to set up a national research foundation, that many physicists suggested the exclusion from its benefits of all the psychological and social sciences on the grounds that they weren't "scientific" enough. On what possible basis could this statement have been made if not an exclusive respect for polished and successful techniques, and a complete lack of awareness of the question-asking nature of science and its rooting in human values? How shall I as a psychologist translate this and other similar jibes from my physicist friends? Ought I to use their techniques? But these are useless for my problems. Ought I then to give up my problems to deal only with physical problems? But how would that get the psychological problems solved? Ought they not to be solved? Or ought scientists to abdicate from the field completely and give it back to the theologians? Or is there perhaps implied an *ad hominem* sneer? Is it implied that

Philosophy of Science 1946.13:326-331.

the psychologists are stupid and the physicists intelligent? But on what grounds can such an inherently improbable statement be made? Impressions? Then I must report *my* impression that there are as many fools in any one scientific group as in any other. Which impression is more valid? No! I can see no other translation possible except one that by concealed implication gives the primary place to technique—perhaps the only place.

8c.) *Means-centered orthodoxy encourages scientists to be "safe" rather than bold and daring.* It makes the normal business of the scientist seem to be moving ahead inch by inch on the well laid out roads rather than cutting new paths through the unknown. It forces conservative rather than radical approaches to the not-yet-known. It tends to make him into a settler rather than a pioneer.

The proper place for the scientist—once in a while at least—is in the midst of the unknown, the chaotic, the dimly seen, the unmanageable, the mysterious, the not-yet-well-phrased. This is where a problem-oriented science would have him be as often as necessary. And this is just where he is discouraged from going by a means-stressing approach to science.

9) *Over-stress on methods and techniques encourages scientists to think a) that they are more objective and less subjective than they actually are and that b) they need not concern themselves with values.* Methods are ethically neutral; problems and questions may not be, for sooner or later, they involve all the knotty arguments about values. One way of avoiding the problem of values is to stress the techniques of science rather than the goals of science. Indeed, it seems very probable that one of the main roots of the means-centered orientation in science is the strenuous effort to be as objective (non-valued) as possible.

But science was not, is not and cannot be completely objective, which is to say, independent of human values. Furthermore, it is highly debatable whether it ought even to *try* to be (that is, *completely* objective rather than as-objective-as-it-is-possible-for-human-beings-to-be). All the mistakes listed in this paper attest to the dangers of attempting to neglect the shortcomings of human nature. Not only is it impossible to divorce reason from human emotions and motivations, but it is highly undesirable even to attempt it. Reason *relatively* divorced from the emotions and motivations, is a neurotic manifestation. Not only does the neurotic pay a huge subjective price for his vain attempt, but ironically enough, he also becomes progressively a poorer and poorer thinker.

9a.) *Because of this fancied independence of values, standards of worth become steadily more blurred.* If means-centering philosophies were extreme (which they rarely are), and if they were quite consistent (which they dare not be for fear of obviously foolish consequences), then there would be no way to distinguish between an important experiment and an unimportant one. There could be only technically well-prosecuted experiments and technically poorly-prosecuted experiments. Using only methodological criteria, the most trivial research could demand as much respect as the most fruitful one. Of course, this does not actually happen in an extreme way, but this is only because of appeal to criteria and standards other than methodological ones. However, although this mistake is rarely seen in a blatant form, it *is* often enough seen in a

Philosophy of Science 1946.13:326-331.

less obvious form. The journals of science are full of instances that illustrate the point.

If sciences were no more than a set of rules and procedures, what difference would there be between science on the one hand and, on the other, chess, alchemy, "umbrellaology", or the practice of dentistry?

RESUME

Means-centered approach to science is contrasted with a problem-centered orientation. Overstress on and too exclusive concern with method, instrument, technique or procedure fosters the following mistakes:

1) Emphasis on polish and elegance rather than on vitality, significance and creativeness.

2) Giving the commanding positions in science to technicians rather than discoverers.

3) Over-valuation of quantification for its own sake.

4) Fitting problems to techniques rather than vice-versa.

5) Creation of a false and pernicious hierarchical system among the sciences.

6) Overstrong compartmentalization between the sciences.

7) Emphasis on the difference rather than the similarities between scientists and other truth-seekers (poets, novelist, artists, philosophers).

8) Creation of a scientific orthodoxy, which in turn a) tends to block the development of new methods, b) tends to exclude many problems from the jurisdiction of science and c) tends to make scientists "safe" rather than daring and unconventional.

9) Neglect of the problems of values, with a consequent blurring of the criteria for judging the worth or importance of an experiment.

Brooklyn College

Philosophy of Science 1946.13:326-331.