

Cohen, R. S.

[Science is a social phenomenon...]

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Tekst jest udostępniony do wykorzystania w ramach dozwolonego użytku.



In America we see the disappearance of a small scientific community of strongly individualistic character, considering themselves as an *élite*. The new scientists are more "normal", with greater appreciation of national politics, more content with "team research" and all that implies. When the last of the "old guard" retires within a decade, the new leaders of the scientific community will be of this new type. What changes can we expect? Certainly, a more natural cooperation between the scientific community and the other institutions of society.

However, it seems likely that there will also be losses. For one thing, standards of scientific morality can be expected to decline, as personal pride becomes less important as a motivation for research. Also, it seems that the scientist who attacks a difficult problem and sticks to it for years, is passing away. The new men will be less inclined to risk valuable years of their career on such things. We may ask whether in this new cultural situation, creative science will continue to flourish in the same form as heretofore.

R. S. Cohen

Science is a social phenomenon. To understand the history of the social relations of science is itself a scientific problem, to be investigated in history, sociology, anthropology, economics, political science, psychology, and other social and cultural sciences. The social order and science have been related in mutual and complex ways, and I shall concentrate on one aspect: the impact of the social order upon the development of science. We want to explain the characteristics of science as the consequences of other aspects of human culture, so far as possible. This is a concern with the external history of science and it must be distinguished from the internal historical development by which science has generated its own progress. Indeed, it is an open question whether, and to what extent, an external sociological explanation is possible, but enough evidence is known to justify this discussion and to propose certain research problems.

What are the principal questions to be answered by an adequate understanding of the social relations of science?

1) Why do scientists have a certain role and status in a given society? Here, by the term "scientist", we mean broadly those persons who engage in logical thinking, or experimental investigation, or even systematic technological development, whatever their motivation.

2) Why does the science at a given time have a certain internal social organization, as, for example, the quantity and variety of talent, the particular means or lack of communication, the ways of educating both

new scientists and the public, the institutional forms of professional societies and relations to other institutions such as universities?

3) Why are certain problems dealt with?

4) Why are certain solutions, whether practical or conceptual, offered to those problems?

5) Why are certain solutions accepted, and others rejected?

6) Why is a particular mode of explanation, a philosophical principle of knowing, accepted? Can such an epistemological characteristic prescribe the judgment of a man, a school, an epoch, even, perhaps, an entire civilization?

Answers to these questions may differ greatly. It is evident that the sources of problems generally will be distinguished from the sources of answers and solutions to those problems. It is perhaps less evident that we must distinguish the historical conditions of scientific thought from the logical conditions of antecedent theories and accumulated factual knowledge. Later these logical conditions may be seen to entail, or provide probability, to the new thoughts; however, in historical studies we should be particularly careful to remember that causal explanation is not only a matter of logical implication.

Perhaps the logical factors will have their historical reference in a genuinely complete internal history of science, whenever an inner dialectic can be discerned, but always the historian should begin with empirical data and hypothetically formulated historical explanations. And we must also distinguish the psychology of the knowing process from the sources and conditions of knowledge. Only later can the historian and psychologist hope to offer an understanding of the specific thought-processes of individual scientists in relation to the historical sociology of science.

Now we must be extremely careful to recognize that the complexities of society have enabled us to offer strong support for what may appear to be conflicting theories of the genesis and development of science. First let us list some major social factors whose influences upon particular stages, aspects, or incidents of science have been demonstrated. In each case, names of a few scholars are given who have written on the history of science with the relevant material.

1) Religion, and religious institutions and attitudes, whether of positive or negative influence upon the development of science: Merton on Puritanism, Needham on Taoism and Confucianism, Pagel on XVIth century mysticism, Weber on Protestant-capitalist ideology, A. D. White on the church-science conflicts, etc.

2) Art: Ivins on geometry, Read on the relation of icon to idea, Whyte on forms in art and science, Hauser on general history of art and culture, M. Raphael on prehistoric technology and art, E. Fischer on cognitive role of art, etc.

3) Political phenomena and associated social institutions: Veblen on science and industrial institutions, Taton and Guerlac on the French revolution, Granet on Chinese thought in its social setting, B. Stern on American medical science, etc.

4) Philosophy, whether explicit or implicit: Burt, Koyré, Cassirer, Meyerson, Maritain, Nef, Northrop on the origins of modern science, etc.

5) Economic practice and institutions, with their military, ideological, and social accompaniments: Marx and Engels, Borkeu and H. Grossmann on XVIIth century, Farrington on classical Greece, Strong on XVIth century craft techniques, Zilsel on comparative sociology of science and scientific ideas, B. Hessen on the economic sources of Newton's work, etc.

6) Social imagery projected upon nature: Durkheim on primitive thought, Kelsen on genesis and development of ideas of causality, etc.

7) Play and games: Huizinga on general theory, Ore on the development of probability theory, etc.

8) Technology, considered as distinct from science: Mumford on the development of urban civilization, Giedion, Dijksterhuis and Bukharin on mechanization of practice and thought, etc.

9) Instinctual or other purely psychological factors which determine, stimulate, limit, or otherwise condition thought: Freud on psychological factors in cultural history, H. Sachs on attitudes toward nature in classical Greece and XVIIth century Europe, Bachelard on psychic genesis of scientific ideas, Husserl on the utilitarian project of scientific epistemology, Simmel on the rational-irrational thought procedures of bourgeois practice, N. O. Brown and H. Marcuse on sociological and philosophical implications of irrational factors in the psychological structure, Feuer on the comparative psychology of scientific intellectuals, etc.

We must ask for comparative analysis of these, and perhaps other social factors in the causal explanation of science. And which are dominant? Which factors, if any, develop in their own, independent way? Under what conditions? What are their dialectical relations of relative conflict and harmony? It seems that we must investigate the separate history of these several factors if we wish to make our explanations of the history of science more complete, for we know that there are direct influences but we are only at the beginning of an understanding of the network of indirect influences upon science.

Even the rather specific hypothesis of historical materialism must confront the multiplicity of social factors when it deals with a single human activity of such importance as science. Our goal is to locate the factor, or factors, which have a self-developing nature, and hence which

may be considered to be the ultimate causal explanation of science as well as of the remaining aspects of civilization. Put briefly, and in Marxist language, we need to establish the base and the superstructure. But the empirical evidence which is relevant to history of science leaves open, thus far, what is the character of the base¹.

We recognize then three stages in the social influencing of scientific ideas. First, there is the social origin of the problem which is attacked, perhaps a direct stimulus, perhaps indirect or even remote. This first stage includes the question of realization: social practice may be negative as well as positive. Society may isolate and crucially inhibit the development of science by failure to put scientific and technological achievements to use.

Second, the social sources of the techniques and concepts which are brought to bear upon the problem. Third, the philosophical principle of verification, which the given stage of culture provides to distinguish nonsense from meaningfulness and what is found to be false from what is found to be true or merely probable. At every stage of development, scientists work and think within the given environment. This is personal and biographical but it is also social. Only by personal and social self-criticism can scientists transcend the limitations of their socio-centric predicament, and indeed such transcending of the historically relative position of knowledge is a path toward greater objectivity.

The third stage of social influence upon scientific knowledge, the historical career of the conceptions of meaning and truth, deserves careful investigation by historians and sociologists as well as by philosophers. Indeed, the sociology of epistemology would be a fruitful meeting ground for research by philosophers of science and historians of science. Science has been constricted by epistemological requirements just as thoroughly as it has been distorted by social determination of ideas and impoverished by social determination of problems.

It is a fair hope that these questions are also of considerable practical interest. It may be possible to free our own times of some present bounds upon thought and human powers by cultivation of historical and psychological research in the sociology of science.

A. Gella

Being moved by Professor Zvorykine's opinion on technological determinism, which is now often conceded by many Western thinkers, usually under the impression of present successes of cybernetics, I would

¹ See, for example, the careful summary of the several factors which may be responsible for the scientific revolution of the XVIIth century in Western Europe in the third volume, section 19k, of Joseph Needham's *Science and Civilization in China*.