

Ravetz, Jerome R.

[Professor Zvorykine has given us a deep...]

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Tekst jest udostępniony do wykorzystania w ramach dozwolonego użytku.



J. R. Ravetz

Professor Zvorykine has given us a deep and coherent analysis of some very difficult problems; those who have followed the discussions in journals such as "Technology and Culture" can appreciate his achievement. Because the paper is so important, I have studied it closely, and my criticisms are a mark of my admiration and respect for his work.

First I might comment on the problem of the interaction between "technology" and "society". It seems that most scholars lack a concept of "cause" which is sufficiently rich to comprehend this phenomenon. If Marxism succeeds in clarifying such situations, and Professor Zvorykine's study gives us hope that it will, then scholars all over the world will appreciate the power of that philosophy for concrete problems of social analysis. I would like to make one small contribution to this point.

Some confusion can be avoided if one distinguishes between the means of production in existence at any time, and the rate and direction of growth. We can surely treat the level of technology as a limiting factor in the organization of society, and for some purposes even consider it as an "independent variable". However, the pattern of the growth of technology is strongly influenced by social forces existing at any moment in a given society. We find the same distinction in natural science. The stock of scientific knowledge at any time is (to a great extent) an impersonal, objective truth. But the advancement of science is a highly personal and social affair.

Now I must pass to certain criticisms of the paper by Professor Zvorykine. These come mainly from my impression that his conception of "technology" is too narrow, being limited to the basic means of production. What other significant aspects of technology are there?

First, production for luxury and military purposes. For a brief example of the latter, I would remind you that we would almost certainly have no *Sputniks*, were it not for the military demand for intercontinental ballistic missiles carrying nuclear warheads.

I would also remind Professor Zvorykine of the sophistication of the technology of the advanced nations with an ever larger component of "white-collar workers", in America now rapidly displacing the "blue-collar workers". These new workers are in the administrative and "service" fields, and as society advances there will be a growing need for such "non-productive" workers, providing personal services to the community.

A more serious criticism is one which I cannot prove from the text of the paper. But I feel that Professor Zvorykine has an insufficient appreciation of the importance of history. Only historical study can tell

us which elements of social life are most stable and resistant to change from technological development. I have seen this from my own experience, coming from America to England, and seeing how two nations with a similar technology have such differences in culture, and indeed such different prospects for a peaceful transition to a higher form of society.

The understanding of history is related to appreciation of another aspect of technology, which Professor Zvorykine did not mention at all. I refer to agriculture, surely a fundamental sector of the means of production. Although I am not a specialist, I believe that there are deep differences between agricultural and industrial production, which could be most usefully explored. These differences affect the social relations of production, and could help us understand the impossibility of a "mechanical" transformation of a pre-capitalist peasant agriculture to a socialist one. Understanding of these problems might give comfort and strength to supporters of Socialism all over the world; the superior productivity of American agriculture compared to Soviet agriculture can be seen not as a result of "free enterprise" but partly as a result of the more favourable historical background to the present situation.

Professor Zvorykine speaks as a member of Soviet society, and uses his understanding of technology and society to make statements of a social and political nature. I would like to enjoy a similar privilege in these remarks. He correctly points out some serious contradictions in capitalist society, and claims that these can only be solved under Socialism. He may be correct, but unless we can put these problems in an historical context we may find ourselves making statements which are empty of all content. I would remind him that it is possible to explain political and social events by "the rise of the bourgeoisie" at times extending over a period of five hundred years. I would like to know whether the science of Marxism can offer us an estimate of how long it will take for the bourgeoisie to fall. If the laws of social development are insufficiently known for this problem, we still have much to learn.

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I think that the Symposium would benefit from certain reflections of Professor Price, which he discussed with me recently. Since he could not be here this afternoon, I am taking the liberty of telling them to you, without his permission.

First, creative natural science is a highly specialized cultural product, which has flourished only in certain limited parts of modern European civilization. Second, the transformation from "little science" to "big science" has profoundly altered the internal social conditions of science.

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