What Have We Learned About Science and Technology from the Russian Experience?

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To Russian scientists and engineers:
They have created, they have suffered,
and they have instructed

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Loren Graham

Grand Island, Lake Superior
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Preface

By the early 1980's, the Soviet Union had the world's largest community of scientists and engineers, exceeding in number those in the United States by 10 to 30 percent, depending on the definition of degrees and fields.[1] The rapid development, in just a few decades, of such an immense scientific establishment in a social and economic environment strikingly different from the West, the birthplace of modern science, presents us with an unusual opportunity. We can better understand science and technology as social and intellectual institutions if we examine the extent to which they take on different forms in sharply contrasting environments.

This book, then, is not primarily about Russia and the Soviet Union, but about science and technology, with illustrations from the Russian experience of some of the characteristics of science and technology. These examples point to a discussion of an issue very active in the West today: whether science is a social construction. The Russian example, not commonly cited in the West, adds additional dimensions to this current controversy.

To what extent are science and technology affected by the specific environments in which they develop, and to what extent do they reflect universal concerns? Is science a social con-

struction or is it a reflection of the natural world? Are science and technology inherently westernizing influences, or can they promote, or be used for, anti-Western purposes?

The collapse of the Soviet Union in 1991 has submitted science in Russia to new tests that can increase our understanding of science. During the existence of the Soviet Union, scientists and engineers were generously supported there financially but were sharply restricted politically and ideologically; Russian scientists and engineers after the fall of the Soviet Union have been given political freedom but have been deprived of much of their previous financial support. Science and technology, in both the Soviet and post-Soviet periods, have been submitted to quite extraordinary pressures. How robust are science and technology under stress? What is more important to science, freedom or money? Do the ways in which science and technology are formed under authoritarian and centralized controls give us insights into the relative advantages and disadvantages of democracy as an environment for technical creativity and social benefit? How welcoming were Russian scientists and engineers to democracy and a free market? How much were they willing to change their own institutions when the country in which they lived overthrew an authoritarian system that actually gave them enormous advantages and perquisites, at least compared to what followed?

Finally, the experience of Russia sheds much light on the place of technology in modern society. To what extent should technology be under the control of ordinary citizens and to what extent should it follow the preferences of engineers and technical experts? On this question, I have in the final chapter of this book compared the experiences of Russia, China, and the United States.

I have studied Russian science for many years and have writ-

ten at considerable length elsewhere on all the questions raised above. The invitation to give the Donald M. Kendall Lectures at Stanford University in 1995 was the impetus to write down in a concise form the conclusions I had reached on some of these questions. The book that follows is a revised and expanded version of what originated as the Kendall Lectures, and might be described as a small book about big questions.

What Have We Learned About Science and Technology from the Russian Experience?

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CHAPTER ONE

Is Science a Social Construction?

What does the Russian experience tell us about the nature of science? Let me explain why I find this question intriguing, and why I believe that the Russian experience sheds light on some of the main issues dividing historians and sociologists of science today.

In the fields of the history and sociology of science, the most striking change in recent decades has been the rise in contextualism, a growing recognition that science is embedded in society and must be studied in societal terms. In the field of the history of science, the "internalism" prevalent in the 1950's and 1960's was more and more challenged in the 1970's and 1980's by "externalism." Internalists were scholars who emphasized the power of scientific ideas and the significance of experimental findings as the major influences on the growth of scientific knowledge. Externalists, who represented a newer trend in the history of science, stressed social, economic, and other nonscientific influences on the development of science.

Among sociologists of science, a similar shift toward contextualism was growing. The older Mertonian sociology of science studied the norms of science, its reward system, and the growth and demise of disciplines and subdisciplines, but it did not study the content of science itself.[1] An assumption of the

Mertonian school was that social context may influence the careers of scientists and their institutions, but not scientific knowledge, which was treated as a "black box" and left for scientists to discuss.[2] But the new sociologists of science who began to emerge in the 1970's addressed the question of whether the very knowledge produced by scientists, including what is accepted as the best knowledge, is not shaped and formed by the society that surrounds it. According to the new approach, even the content of the densest "hard" sciences, such as physics, mathematics, and biology, can be seen as socially formed. Rooted in Peter Berger and Thomas Luckmann's 1966 book *The Social Construction of Reality*, this new trend became known as "constructivism" and was promoted in the 1970's and 1980's by sociologists of science in Britain at the universities of Edinburgh, Bath, and York.[3] At Edinburgh, in particular, Barry Barnes, David Edge, Donald MacKenzie, Steven Shapin, and Andrew Pickering were especially articulate proponents of what came to be known as the sociology of scientific knowledge, or SSK.

These representatives of new trends in the history and sociology of science were united in their belief that science is a part of culture, and that it has both natural philosophical and social dimensions. In order to test this hypothesis, one would have thought that there would be a comparison of science in contrasting cultures. Surprisingly, however, relatively little research has been done that compares the growth of scientific knowledge in societies with strikingly different cultural and political traditions. On the contrary, most of the new contextual studies have been on topics in Western science, such as the scientific revolution of the seventeenth century, or modern physics and biology in Europe and America.[4] As they sought to identify the ways in which science is a part of cultural do-

mains, scholars were working, on the whole, within a rather narrow set of such domains, and ones that were, in many instances, a part of their own mentalities. Scholars rooted in Western traditions were studying Western science and attempting to identify the particular effects of Western society on that science. The task was not an impossible one, as is evidenced by some of the good work that has come out of it, but it was surely a difficult assignment. The problem of reflexivity here is enormous. How well can a scholar identify the influence of factors on the science that he or she studies when those same factors may be a part of his or her own analytical framework? By studying such a confined portion of the spectrum of available social contexts, and one in which they were themselves embedded, the followers of the social study of science often failed to reveal the full richness of their own intellectual program.

A useful way of testing the "social constructivist" thesis in science studies is to examine the evolution of science in a society that is distinctly different from those of Western Europe and North America, looking to see how the different environment affects science. I would like to propose Russia as a particularly appropriate case study for the examination of the social constructivist hypothesis. No one will deny that Russian society and culture have in the 1,000 years of Russian history differed from society and culture in Western Europe, where modern science was born. Russia has followed a different economic path from that of Western Europe and America, and it has religious, political, and cultural traditions quite unlike those of its Western neighbors. If the social constructivist thesis is correct, Russian science should be very different from Western science.

The most fruitful comparisons are not, however, made be-

tween entities that are totally different; rather, they emerge when one studies entities that are similar enough that some common elements can be seen but different enough that the variations can be studied. Russian science fits these criteria well. Imported initially from Western Europe, it took root and developed in distinct ways. The study of Russian science may, therefore, be a more finely tuned test of the social constructivist thesis than a study of Chinese science, since science in ancient China achieved a level of development and independence for which there is no equivalent in old Russia. Science in Russia is recognizably Western, in the sense that it was brought to Russia from Western Europe, but it is simultaneously Russian, in the sense that for almost three centuries it has continued to develop in an environment distinctly different from that of its origin. The effects of the different environment on a given scientific field may be more visible in the case of Russia than in that of China, since in the Russian case, the history of the field can often be traced back to Western European origins. Any changes that have occurred since that time are likely to be visible. In the Chinese case, the situation is more complicated because of the existence of an older native scientific tradition.

My research of Russian science as a test of the social constructivist thesis took on new significance in 1996, when Alan Sokal, a physicist at New York University, published a highly effective spoof of social constructivism in the journal *Social Text*.[5] For the first time, arguments about constructivism reached the pages of popular publications, such as *Newsweek*. In this chapter I present some of the results of my research. As a preview of my conclusions, I shall observe that in my opinion, the history of Russian science reveals both the strengths and the weaknesses of the social constructivist approach.

One of the most fruitful principles of social constructivism