THE RISE OF EARLY MODERN SCIENCE

Now in its third edition, *The Rise of Early Modern Science* argues that to understand why modern science arose in the West it is essential to study not only the technical aspects of scientific thought but also the religious, legal, and institutional arrangements that either opened the doors for inquiry or restricted scientific investigations. Toby Huff explores how the newly invented universities of the twelfth and thirteenth centuries, and the European legal revolution, created a neutral space that gave birth to the scientific revolution. Including expanded comparative analysis of the European, Islamic, and Chinese legal systems, Huff now responds to the debates of the last decade to explain why the Western world was set apart from other civilizations.

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Islam, China, and the West

Third Edition

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Preface to the Third Edition

This study is grounded in the sociology and history of science, but it has to be admitted that it evolved out of pondering Max Weber's agenda focused on why the Western world developed as it did. Having cast an eye upon various religious goads to the rise of modern capitalism, Weber suggested that the "next step" was to explore the rise of modern science and to determine whether its rise was connected to the same social and cultural forces that gave rise to modern capitalism.

Unlike contemporary sociologists, Weber adopted a broad comparative, historical, and civilizational framework. That framework implied that we must look at the Islamic world as well as China in order to discover the key factors that set off Western cultural development from other civilizational areas, including ancient India, ancient Judaism, and so on.

While that Weberian context was always in the background of my thinking, it was the following clue given by Benjamin Nelson that set the agenda for my inquiry. Pursuing the question of why modern science arose only in the West, Nelson suggested:

> it is not nearly so important whether in any given science a given people did or did not actually make an advance upon the Greeks in respect to one or another discipline for example, chemistry, optics, and mathematics . . .

The fundamental issue was whether or not cultural and institutional breakthroughs occurred that opened up the widest possibilities for inquiry and free exchange of ideas.

Consequently, a central strand of this thesis concerns the public sphere (or neutral space). The study of that takes one not just into broadly defined institutional arrangements, but into legal systems and the ways in which they can create public spaces for open inquiry – or not. This approach proves to be a rich terrain of inquiry, one not followed by either historians or comparative historical sociologists. It turns out that the structurings of socio-cultural process by legal conceptions have many long-lasting

consequences for political, economic, and scientific development. Constitutionalism and parliamentary democracy are a direct result of such legal innovations and were gestated nearly a thousand years ago during the formation of the Western legal tradition.

Given this sketch of a research agenda, it was imperative that I explore these leads not only in the case of European but also Islamic and Chinese law, as illustrated in Chapters 3 and 4 as well as 7, 8, and 9.

A second component related more directly to religious and cultural values. This stems from Thomas Kuhn's oblique (and unanalyzed) reference to "those values without which no one is a scientist." I was drawn by this agenda into pursuing religious and philosophical questions in cross-civilizational comparisons.

Taken together, this concern for the development of neutral space and a set of values conducive to naturalistic inquiry, along with the thought that Western legal history had a great deal to do with the formation of open and stable spheres of discourse, pointed toward the importance of European universities. The creation of a public sphere supportive of open discourse and the autonomous pursuit of science is thus inextricably conjoined to the history of Western universities. Without Weber's pioneering insights regarding the uniqueness of Western cultural development, and later the appearance of the classic study by Harold J. Berman, *Law and Revolution* (now in two volumes), I would not have gone in this direction, a direction that clearly would not be pursued by historians of science. In a word, this effort to understand the rise of modern science in the West (and its non-rise elsewhere) employs a broad net of conceptual ideas ensconced in a comparative, historical, and civilizational framework.

Whether or not the present study (in its third revised incarnation) seems timely, it is a fact that very few sociologists ventured in this comparative direction. Robert K. Merton understood the vital connection between science and society back in the 1930s when he wrote his classic study, *Science Technology and Society in Seventeenth Century England*, yet that work remains a singleton of its kind among sociologists. It was only the monumental work of the biochemist-turned-historian of science, Joseph Needham, that carried the project forward and led, through the inspiration of my mentor Benjamin Nelson, to the book in hand.

As will become clear, the present approach focuses on two essential elements: ideas and institutions. There must be underlying ideas, however proto-scientific they may be, in order for the cause of science to advance. Likewise, what become critical in the long run are the institutions that

either enable new ideas to be pursued as openly and freely as possible, or, conversely, restrict the public statement and pursuit of such ideas.

Because of the broad civilizational and long-term framework of the present study, it may raise questions about the present state of the Islamic world and China. The so-called Arab Spring has proven to be a disappointment, with some observers concluding that the "Arab Spring" was a misnomer: that the Middle Eastern segment of the Muslim world has come apart.[1] The rise of al-Qaeda and then ISIS, but even before that, the Muslim Brotherhood (founded in 1928), suggests that Middle Eastern discussions are still captured by foundational questions as to whether or not Islamic societies can become fully modern, with the full panoply of modern law and institutions, or whether Islamic law (the sharia) is the answer.

China's economic take-off, on the other hand, at the beginning of the twenty-first century, seems promising, but can China suddenly and radically transform its cultural, legal, and intellectual institutions so as to join the Western leadership of modern science? The spurning of the seventeenth-century missionary efforts to provide China with the foundations of modern science, discussed in Chapters 8 and 9, suggests that changing China's deep institutional arrangements governing the pursuit of science and open discourse is not so easy. Economic take-off approaching the level defined as a "developed" economy is one thing; joining the leadership in science (and applied science) may be something different. The broad and sweeping restrictions on freedom of expression, discussions of Western culture, communication on the Internet, and a host of related constrictions in China today are entirely opposite to the building of a public sphere and neutral spaces seen historically with the rise of modern science. I shall return to these questions in the new Epilogue.

[1] Among others see, Eric Trager, *Arab Fall. How the Muslim Brotherhood Won and Lost Egypt in 891 Days*. (Washington. D.C: Georgetown University Press, 2016).

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This book has been a long time in the making. Consequently, I owe a debt of gratitude to many individuals and organizations. The National Endowment for the Humanities granted me a year of study at the University of California, Berkeley, in 1976–7 (Grant F76 240), where I attended a seminar, "Tradition and Interpretation," directed by Robert Bellah. That fellowship gave me the first opportunity to write down my thoughts on the problem of Arabic science.

In 1978–9 the Institute for Advanced Study in Princeton, New Jersey, sponsored a year of study during which I was supposed to work on the present study. Instead, the year was devoted to Benjamin Nelson's book, *On the Roads to Modernity*, due to his sudden death. That period in Princeton, however, was invaluable in many ways for the present work.

During the fall of 1980, I was granted a sabbatical leave by my own university, and I spent it as a visiting scholar in the history of science department at Harvard University. It was during that fall semester that I first presented the outline of the thesis of this book to the History of Science Seminar at Harvard. I am very grateful to Professor A. I. Sabra of Harvard for his support of my project and for his many comments over the year. I twice partially audited his course on the history of Arabic science and gained many invaluable insights from his discussions. It should be understood, however, that Professor Sabra and I hold different points of view.

Another sabbatical leave from my university in the fall of 1987 allowed me the leisure to explore a variety of questions in the comparative history of law, and without that opportunity, the thesis of this book would be weaker and differently stated. I am most grateful for that leave.

I trust that it will be evident to my readers that this study could not have been carried out without access to a formidable array of library resources and that I have benefited from libraries from Maine to California. The computer-based OCLC (Ohio College Library Consortium) system

through the library at the University of Massachusetts Dartmouth gave me access to many materials that I otherwise would not have been able to consult. The Consortium deserves a special note of thanks and recognition. I also owe a special debt to the new Thomas P. O'Neill, Jr., Library at Boston College, where large portions of Chapters 4 through 8 of this book were written. The O'Neill Library's exceedingly pleasant surroundings, highly efficient information retrieval system, and well-arranged open stacks made progress on this book in its advanced stages much easier and more rapid than would otherwise have been possible. That is a benefit I gratefully acknowledge. Most of the dates of historical figures referred to in this study have been standardized according to Webster's New Biographical Dictionary; otherwise, I followed the Dictionary of Scientific Biography.

Finally, I must acknowledge that this study would not have been undertaken at all but for the example and encouragement of my New School mentor, Dr. Benjamin Nelson. Although he died shortly after reading what was a mere sketch of the present study, which I had written at Berkeley in 1977, by the early seventies, he had already published the essays I needed to guide this study. I can only hope that this book evokes the spirit of his wide-ranging knowledge, the generosity of his person, and the prescience of his many insights.