

THE NATURAL SCIENCES AND THE SOCIAL SCIENCES

BOSTON STUDIES IN THE PHILOSOPHY OF SCIENCE

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VOLUME 150

THE NATURAL SCIENCES AND THE SOCIAL SCIENCES

Some Critical and Historical Perspectives

Edited by

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FOREWORD – “AN INNOVATION IN THE HISTORY OF SCIENCE”

It is a privilege to be able to comment briefly here with the purpose of setting the stage for this remarkable innovative volume in the history of science. The action on the stage itself is masterfully carried out by Professor Cohen (serving both as stage director and as actor himself) and his several colleagues. Their performances, their individual essays, speak brilliantly for themselves. I can only add some remarks on the historical and intellectual background and context of this original enterprise, which I predict will be appreciated not only for its own substance but as a set of models for future work in the history of the sciences, natural and social.

Senior historians of science will remember from their own experience, and more recent members of the profession will probably have heard of the battles or war that prevailed in the 1950's and 1960's between the so-called “internalist” and “externalist” schools in their field. Perhaps over-simply put, the “internalist” historian of science felt that his (very few hers then) task was to trace the development of the substantive *idea or conceptual* systems of science as independent elements, wholly on their own terms, untouched by other social or cultural factors. Little attention was paid even to the importance of what is now intensively studied, the organizational and leadership arrangements for the advancement and maintenance of science. Often, of course, in their focus on the ideas and concepts of science, “internalists” included what would be called philosophical and religious ideas. Such certainly was the case for the classic and very influential work of Alexander Koyre.¹ But the “internalists” were chiefly oriented against what they saw as crude, Marxist emphasis on the economic and social influences on science in the work of such writers as the Russian, Boris Hessen,² and the Englishmen, Bernal³ and Hogben.⁴ This defensiveness ignored work which transcended the “internalist” – “externalist” dichotomy, work such as Robert Merton's *Science, Technology and Society in Seventeenth Century England*⁵ and my own *Science and The Social Order*.⁶ These works proceeded on the assumption of a complex societal system in which science, both natural and social, was only one element, however

important; there were many other equally important social structural and cultural elements, including economic and political factors on the social side, and religion, values, and ideology on the cultural side.

The present volume is another definitive sign of what has been the case on the whole in the history of science for the last twenty years or so, that the “internalist” – “externalist” difference has been dissolved, not only theoretically but by a mass of valuable work proceeding on the new assumption, that science has reciprocal relations with all the other components of society. Read in the light of this assumption, the present volume is not only about the reciprocal relations of the natural and social sciences but also about the close involvement of both of them with many other social and cultural factors. Perhaps this is only what George Sarton, the founder of the history of science and of its journal (in 1912), *ISIS*, had in mind when he said, in introducing the new journal, that it was to be “. . . the sociological journal of the scientists and the scientific journal of the sociologists”.⁷

Another, albeit implicit, virtue of the present volume is that it eschews all simplistic determinisms. Not only is neither natural science nor social science the simple determinant of the other, but neither, also, is simplistically and always determined by any other single or set of social or cultural factors. Science as a whole is partly independent of other factors in the social system, partly interdependent with them.⁸ So it is also for natural science and social science *vis-à-vis* one another. And so is it also for all social structural and cultural factors in the social system.⁹ This is not to say that the task of determining the multiple and complex interrelationships of the natural and social sciences with one another and with a variety of other social and cultural factors will be an easy one. But it can be done, as the several essays in this volume bear witness. In science, even if the necessary tasks are difficult, they must be done. Easiness has no inherent virtue. We need a whole set of case studies, like the present one, to begin to establish how and how much science is independent, how and how much it is interdependent with the rest of the the social system.

The achievement of these tasks in the history of the interrelations of the natural and social sciences will often require collaboration among experts from the different fields. Too often, natural scientists have had simplistic and limited knowledge of the social sciences, and *vice versa* for the social scientists. In some cases, a single individual from one side has gone to school to the other and managed a result that is satis-

factory to all. But more often, pair or even team collaboration will be necessary to get it right.

My impression is that such collaboration will be easier at the present for the historians of the natural sciences, who have a solid tradition of archival and collaborative research. There is very little of such a tradition and such performance among the social scientists.¹⁰ The tradition will have to be built up and legitimated, the performance will have to be demonstrated, before the social scientists can claim a place of equality with the historians of the natural sciences. To see what their future should be like, social scientists should pay as much attention to this volume as natural scientists.

Some efforts toward that legitimation of a proper history of the social sciences have recently occurred. The American Sociological Association, for example, has appointed an Archives Project Committee, of which I am the Chair.¹¹ Our initial purpose is to draw up a guide to all the archival materials for sociology and sociologists that are now scattered all over North America. (P.A. Sorokin's papers, despite his long tenure at Harvard, for example, are not at Harvard, but at Calgary.) If the history of sociology is to be good history it will have to be based on such archival materials, as well, of course, as on oral histories.

I have been waiting for a long time for a volume like this one. I hope others will welcome it as much I do.

Columbia University

BERNARD BARBER

NOTES

¹ *From the Closed World to the Infinite Universe* (Baltimore: Johns Hopkins University Press, 1957).

² Boris Hessen: "The Social and Economic Roots of Newton's 'Principia,'" in *Science at the Cross Roads* (London: Kniga, 1931).

³ J.D. Bernal: *The Social Function of Science* (New York: Macmillan, 1939).

⁴ Lancelot Hogben: *Science for the Citizen* (London: G. Allen & Unwin, 1938).

⁵ Bruges: OSIRIS, IV, Part 2, 1938. For a recent collection of critiques and appreciations of this book, see I. Bernard Cohen, ed., *Puritanism and the Rise of Modern Science: The Merton Thesis* (New Brunswick, N.J.: Rutgers University Press, 1990).

⁶ Glencoe, Ill.: The Free Press, 1952. For an extension of this work, see B. Barber: *Social Studies of Science* (New Brunswick, N.J.: Transaction Books, 1990).

⁷ Reported in May Sarton: *I Knew A Phoenix: Sketches for an Autobiography* (New York: W.W. Norton, 1969), p. 69.

⁸ For a powerful argument for the partial independence of the ideas and concepts of

science against some recent interesting relativist arguments for the determination of these ideas by social and cultural "interests," never too well defined, see Stephen Cole: *Making Science: Between Nature and Society* (Cambridge: Harvard University Press, 1992).

⁹ For a generalized statement of this theoretical assumption and of a provisional model for the societal social system, see Bernard Barber: *Constructing The Social System* (New Brunswick, N.J.: Transaction Books, 1993).

¹⁰ For two recent exception, see Charles Camic (ed.): *Talcott Parsons: The Early Essays* (Cambridge: Harvard University Press, 1992); and Bruce C. Wearne: *The Theory and Scholarship of Talcott Parsons to 1951*. (Cambridge: Cambridge University Press, 1989). Older exceptions can be found in the continuing work of George W. Stocking on the history of anthropology.

¹¹ Attention should be called to a growing body of important studies by historians, social scientists, and historians of science that deal with various aspects of the history of the social sciences and the interactions of the social sciences and the natural sciences. Many of these works are mentioned in the Preface to this volume and in the references in the individual chapters.

PREFACE

The present volume focuses on certain historical interactions between the social sciences and the natural sciences.¹ While there is a large body of literature on the logical, philosophical, and “scientific” foundations of social science in general and of individual social sciences, such literature generally has not been conceived in a historical mode. The result is that, with some notable exceptions, it tends to examine the methods of the social sciences by comparison and contrast with the methods of the natural sciences but does not to attempt a critical analysis of the historical encounters and interactions between social scientists and the natural sciences of their day.

There is also a rapidly growing literature concerning the history of the individual social sciences, and a major journal in this area, *Journal of the History of the Behavioral Sciences*, ably edited by Barbara Ross, is currently in its twenty-ninth volume. Yet most of the research and writing on the history of the social sciences, however valuable in its own terms, has tended to be either internal to the discipline or related to the larger intellectual and social matrix and has not been specifically oriented to the concurrent developments in the natural sciences. Two very useful compendia, for example, Pitirim Sorokin’s *Contemporary Sociological Theories* and Joseph Schumpeter’s *History of Economic Analysis*, barely mention the natural sciences. This lack is glaring in Sorokin’s analysis of the nineteenth-century organismic sociologists who drew heavily on such current or then-recent developments in biology as the cell theory, the discoveries concerning embryological development in mammals, the physiology of the “milieu intérieur,” and the germ theory of disease; this feature is also conspicuous in Schumpeter’s presentation of the founders of marginalist economics who based their concepts and methods on those of rational mechanics. An extreme example of this lacuna is the important and useful historical analysis by Werner Stark: *The Fundamental Forms of Social Thought* (London: Routledge & Kegan Paul, 1962), containing many lengthy quotations that deal with advances in the biological sciences (e.g., the work of Rudolf Virchow); it has no discussion of these biological principles, no hint of their importance in

the development of the natural sciences nor of their significance as examples of interactions between the natural sciences and the social sciences; similarly, the lengthy extracts and descriptions of the use of physical science by social scientists are presented without any inquiry into their having been used as other than pure rhetoric. Even so insightful and important a contribution to knowledge as Dorothy Ross's recent *The Origins of American Social Thought* (Cambridge/New York: Cambridge University Press, 1991) takes no real cognizance of the actual physical and biological sciences that were used by the social scientists whose careers she explores. For example, although Henry Carey (see Chapter 1, §1.5 below) insisted that his social system was an extension of the system of the physical universe, and that he had found a social equivalent of Newton's law of gravity, this part of his work is mentioned only in passing in a single sentence; although Irving Fisher stated in unambiguous terms that he was basing his economics on rational mechanics (see Chapter 1, §5 below), there is not even a mention of any technical aspect of the science used so extensively by this pupil of J. Willard Gibbs. These authors are not here cited for criticism; their works had very different purposes than to explore the interactions between the social sciences and the natural sciences. But they do indicate in a dramatic way that there is another important dimension to the history of the social sciences, a need to understand by case histories how the social sciences and the natural sciences have interacted in the centuries since the advent of "science" as we know it today.

There are some scholars, however, who in recent years have begun to study the history of the social sciences, taking cognizance of the interactions with natural sciences; their writings have proved to be of notable value for the investigations presented here (notably Chapter 1). In particular I have drawn heavily on the writings of some historians of science: Theodore Porter, Robert Richards, Judith Schlanger, George Stocking, and Norton Wise.² A group of economists have been studying the foundations of their subject – in particular, neoclassical or marginalist economics – in the physical sciences and also the biological sciences; those whose writings have proved most important in the context of the present volume include Philip Mirowski, Roy Weintraub, Neil de Marchi, Claude Mesnard, Vernard Foley, Margaret Schabas, and Arjo Klamer.³ Additionally, the fairly recent studies on statistics – notably by Ian Hacking, Stephen Stigler, Lorraine Daston, William Coleman, Gerd Gigerenzer *et al.*, and by Lorenz Krüger and the Bielefeld study

group⁴ – have given new perspectives to the relationship of core techniques to social problems and social theory in this important subject. Although the present work does not deal with anthropology, notice must be taken of the important new historical work in this area, primarily the serial publication, founded and edited by George Stocking, called *History of Anthropology*, of which volume 7 (1992) is the most recent.⁵

The present volume was conceived to illustrate by case histories the actual ways in which the natural and social sciences have interacted. It will be noted that three chapters are devoted to an aspect of this relation that is usually overlooked: the ways in which the natural sciences have been influenced by the social sciences. Some writers who have been aware of this kind of interaction have cited Darwin's use of Malthus in formulating his theory of evolution based on natural selection. Some others have been aware that Virchow, the founder of the great medico-physiological revolution associated with "cellular pathology," frequently used the concept of the state and of social organization in formulating his scientific concepts.⁶ But it may come as a surprise, especially to physicists who do not believe the social sciences to be of any use to their own discipline, to discover in our Chapter Eleven (by Theodore Porter) that mathematical physics (in the persons of James Clerk Maxwell and Ludwig von Boltzmann) was indebted to sociology.

Because of the nature of the subject and the difficulty in finding qualified authors for the several parts, there are important examples of the interactions between the natural and the social sciences that are only barely mentioned or not discussed at all in the present volume. Furthermore, there has been no attempt to introduce material from each of the several social sciences; for example, psychology and anthropology are not discussed, nor is history, while political science appears primarily (in Chapter 4) in the setting of the Scientific Revolution of the seventeenth-century. An additional limitation is the exclusion of general proposals or philosophical statements concerning the state of the social sciences or their future, consideration being strictly limited to actual attempts to create or improve a social science. Thus purely methodological writings, such as those of John Stuart Mill, are not generally explored in the chapters of this book.

My own study of the interactions of the social sciences and the natural sciences was originally undertaken as an extension of previous research on scientific creativity, which had focused on the different ways in which

the sciences have influenced one another. It was but a short step to extend this enquiry into the parallel phenomenon of the interaction of the natural sciences with the social sciences. When I first undertook this investigation, I naively believed that the vast and steadily accumulating literature of books, monographs, and journal articles on historical aspects of the social sciences would provide a useful and readily available, if not fully digested, body of reliable secondary source material to serve my purpose. The very existence of two multi-volume encyclopedias of the social sciences, replete with biographies and bibliographies and historical expositions of main themes, seemed a guarantee that – except in rare cases – I should not have to do all the spade-work research in primary sources that is almost always required in my own field of history of science. After all, I reasoned, the social sciences represent a proud ancient profession with a direct lineage that could be traced to Plato and Aristotle. Surely social scientists would have been concerned with the interactions of their disciplines with the natural sciences during the centuries since the Science Revolution!⁷

I was aware, furthermore, that some social sciences (notably psychology, political science, economics, and sociology) regularly included courses in the history of their respective disciplines in their programs and that others (notably political science, sociology, economics, and history) made creative use of texts of past great masters in their teaching and research. So it seemed to me that my study of the interactions of the natural and the social sciences could take advantage of the fact that the social sciences are unlike the natural sciences in the way that they make use of their history as part of professional training and that they draw upon the writings of the past as part of the useful literature of their subjects. Even economists, the most like physicists of the social scientists, are usually familiar with such fine points of their history as the difference between the systems of Adam Smith and Ricardo, the distinction between the ideas of Jevons and Walras, or the relation of Menger and the Austrian school to Marshall. Few physicists would have an equally sound and extensive knowledge of the work of their nineteenth- and early twentieth-century predecessors.

Another factor that led me to suppose that my task would be easier than in fact it turned out to be was the constant litany in the different social sciences – primarily economics and sociology – of their status as true sciences. I quite naturally fell into the error of believing that, in their studies of the past, social scientists would have particularly

stressed the different ways in which their illustrious predecessors had made use of the science of their respective eras – drawing both inspiration and useful analogies from the work of their contemporary natural scientists as well as from philosophers and their fellow social scientists.

No sooner had I started my research, however, than I quickly discovered that I was mistaken on all the above counts. There was precious little literature, if any, that took account of the ways in which social scientists of the past three centuries had interacted with their fellow natural scientists or had attempted to use concepts, principles, theories, or methods of the natural sciences at large. Additionally, the reverse interaction – the influence of social sciences on the development of the natural sciences – was all but completely ignored and in some cases even denied.

I did not understand how this situation could possibly exist until I happened to re-read Robert Merton's Introduction to the collection of his essays on *Social Theory and Social Structure* (New York: The Free Press, 1968, earlier editions, 1957, 1949). In the course of this general prolegomenon, the important distinction is made between "the *history* of sociological theory" and "the *systematics* of certain theories with which sociologists now provisionally work." This confusion of genuine historical investigation and the search for "utilizable sociological theory" of the past invades much of the writing on the history of sociology and also the other social sciences. A paradigmatic example is given in a work to which I have already referred, Pitirim Sorokin's retrospective survey, *Contemporary Sociological Theories*, a useful first guide, especially for Russian source materials not easily available elsewhere. The title is somewhat misleading, since this work comprises historical surveys of different varieties of sociological theories, usually beginning with the seventeenth century or earlier. The stated main purpose is to provide background information on the current state of knowledge through analytical and critical summaries of the ideas of nineteenth-century and early twentieth-century pioneers. Sorokin's aim was not to understand the thought of the past so much as to criticize the writings of all previous ages from a "presentist" standpoint and to seek for any useful principles which may be still valid in today's systematics. As such this work, however useful as a preliminary survey, is more a contribution to practical sociological studies than a truly historical enquiry and must accordingly be used with the greatest caution.

Merton's analysis applies equally well to other social sciences. Much of the historical writing on the history of economics is conceived in relation to economic theory, as a subject of direct use in understanding or in teaching economics. This field thus tends to be dominated by a critical attitude that has come to be known as whiggism in history: an attempt to judge the ideas of the past by present standards rather than to explore such ideas on their own. This aspect may be seen in the fact that many of the works in this area are devoted to specialized topics of current interest today rather than to the nature of the subject as it existed in some past age. There are, of course, important exceptions – of which an example is Schumpeter's *History of Economic Analysis*, referred to earlier, a highly personal statement drawing on a tremendous store of first-hand knowledge and deep historical insight. One of the most interesting general histories of any of the social sciences, this great work sparkles with individual judgments based on the author's prejudice and the state of economics at the time of writing.

From a long historical point of view, the influence of the natural sciences on the social sciences is not a new phenomenon born of the Scientific Revolution, but rather appears to be as old as the idea of science itself. In his "Politics" (1290^b21–1291^b13), Aristotle recommended that the study of constitutions of states and the determining of "the forms of government" be modeled on the methods of classifying "the different species of animals." According to Sir David Ross (*Oxford Classical Dictionary*, p. 116, §9), Aristotle even attempted to "achieve for States" the same "precise description of their types as he gives for animals in the *Historia Animalium*."

In the Middle Ages and the Renaissance the idea developed of the body politic, in which the functions of government were explained by analogy with human anatomy and Galenic physiology. One survival, of many, from this physiological political theory is the concept of a "head" of state. In the seventeenth century (as explained in Chapter 4) the discoveries of Harvey and the influence of Descartes altered this concept to its more modern form, with which we are familiar today. Another science that was related to political theory is astronomy. In the Renaissance, Elizabeth's power was displayed in a diagram modeled on the current astronomical diagrams of the system of celestial spheres. Elizabeth I (reigning in the "sphaera civitatis") became the prime mover of the system, with inner spheres representing her virtues or "planetary" attributes: abundance, eloquence, clemency, religion, fortitude,

prudence, and majesty. The Scientific Revolution produced a modified astro-political diagram in which Louis XIV was presented in a background of a Copernican rather than an Aristotelian system of the universe, set in a system of Cartesian vortices and marked with the date of birth for computing the royal horoscope. Louis's designation as "roi soleil" may be compared to Harvey's analogy (presented in Chapter 4, §1) between the role of King Charles and the function of the heart. There was, clearly, a long-standing tradition of associating theories of the state or social organization with the current conceptions of science. Our volume, however, deals only with the three centuries following the Scientific Revolution, with the specific ways in which the social sciences have interacted with developing modern sciences.

The present volume was conceived because social scientists, with their own professional agendas, have not fully explored the ways in which the ideas, laws, principles, or theories of their fields have developed by making use of or interacting with the physical and biological sciences or mathematics. The question must arise of whether social scientists have thereby left out of their considerations one of the primary well-springs of the thought of the past. The present volume attempts an answer in a display of example after example of the special impact of ideas from the natural sciences on the development of the social sciences. Such examples will indicate the nature of this transfer of ideas and, at the same time, show why standard historical works on the development of the social sciences must be constantly supplemented by and monitored by an examination of the primary documents of the past.

I have shown (in Chapter 4) that Hugo Grotius was a great admirer of Galileo and conceived his celebrated treatise on international law to have been written in the spirit and manner of a work on geometry. This aspect of his work, of great significance in the present context, is not even mentioned (nor even alluded to) in the article on Grotius in either the older *Encyclopaedia of the Social Sciences* (1932) or the more recent *International Encyclopedia of the Social Sciences* (1968). A recent reprint of an English version of Grotius's treatise omits altogether the preface in which he explicitly states that his work was conceived on a model of classical geometry, even though it does not display the formal aspects of theorems and deductions in the Euclidean mode, as it the case for Spinoza's *Ethics*. Grotius's ideal of geometry is relevant to an evaluation of his work because this feature determined that he would deal with abstract cases rather than historical examples or examples from

the disputes of his own age – an aspect of his presentation for which he has been roundly criticized.

The situation is somewhat the same for another example (also discussed in Chapter 4), James Harrington's politico-social thought, expressed in his *Oceana* and other writings. Harrington's ideas assumed significant proportions in the eighteenth century, influencing many of the American Founding Fathers and becoming embodied in the American Constitution. Although Harrington expressly founded or justified his system on the basis of the new Harveyan physiology, there is no mention of Harvey or his science in the *Encyclopaedia of the Social Sciences*; in the *International Encyclopedia of the Social Sciences*, Harvey's influence is mentioned in passing, but not in a way that would give the reader any sense of the possible extent of Harvey's actual influence on Harrington.

An equally striking example of the neglect of the study of the interactions between the natural sciences or mathematics and the social sciences is provided by an early essay of Leibniz (also discussed in Chapter 4). Although Leibniz devoted this essay to a mathematical demonstration of a method of selecting a king for Poland, this does not appear to have merited any notice whatever in standard presentations of the history of political thought. This essay is not even mentioned in a recent volume devoted to Leibniz's political writings.

Even when the scientific component of social thought is introduced, the significance may be lost because of a lack of understanding of the science of the past. An example (discussed in Chapter 1) involves Berkeley's conception of a social analogue of the Newtonian gravitational cosmology. Berkeley's presentation shows that he understood perfectly the principles of Newtonian celestial dynamics, explaining planetary orbital motion as a combination of a continual central accelerating force and an undiminished initial component of linear inertial motion along a tangent. In the presentation of Berkeley's Newtonian sociology, in Sorokin's textbook survey, Berkeley's correct physics is reduced to the incorrect form of a "balance" between centripetal and centrifugal forces, a standard elementary textbook error that has long plagued the teaching of physics. Berkeley's sound Newtonian physics is reduced to utter nonsense by the additional statement by Sorokin that stability occurs when the alleged centrifugal force is less than the centripetal force. Berkeley certainly would have known, as Sorokin evidently did not, that in such a hypothesized example the unbalanced centripetal force

would not produce stability but rather instability, with a resulting inward motion toward the sun or other center of force. A somewhat similar example (analyzed in Chapter 1) is Henry Carey's model of a social analogue of Newton's gravitational physics, mentioned or discussed in almost every historical work on social theories that I have encountered. In not one have I found a recognition that Newton's law of universal gravity, the basis of Carey's social science, is stated incorrectly by Carey, not once but several times.

A considerable literature exists on the organismic sociologists of the late nineteenth and early twentieth centuries, a company that includes Otto Bluntschli, Paul von Lilienfeld, Albert Schäffle, Herbert Spencer, Lester Ward, Corrado Gini, Walter Bradford Cannon, A. Lawrence Lowell (president of Harvard), and Theodore Roosevelt (President of the United States). With the exception of Spencer, all of these figures are discussed in historical surveys or works on sociological theory without any reference to their use of the leading biological and medical theories of their times. This absence is all the more remarkable to the degree that some of these organismic sociologists (notably Lilienfeld, Schäffle, and Cannon) included extensive bio-medical tutorials in their sociological presentations. Thus (as shown in Chapter 1), however extravagant the ideas of these organismic sociologists may seem to us today, our judgment should take account of the relation of their sociological ideas to the main currents of contemporaneous biological and medical thought.

One aspect of the interactions between the natural and the social sciences that is all but wholly absent from the literature of both the history of the social science and the history of the natural sciences is the possible influence of the social sciences on the rise of the biological and physical sciences. Accordingly, there is a special value to the three chapters comprising Part IV of the present book. I have mentioned that Darwin is known to have been influenced by Malthus's ideas concerning population growth while formulating his concept of natural selection. S. S. Schweber (in Chapter 9) has summarized his findings on the sources of Darwin's ideas, notably the influence of the current ideas of agronomy on Darwin's thinking. Camille Limoges (in Chapter 10) has traced the history and use of another idea which Darwin obtained from the social sciences and which became of particular importance in the nineteenth century in the context of the cell theory. The division of labor gained prominence through the writings of Adam Smith, although the idea had been put forth earlier by such writers as William Petty and Benjamin

Franklin. This concept, as we learn from Limoges's presentation, was particularly significant in the thought of the French biologist Henri Milne-Edwards, who used it in relation to the role of individual cells in the physiology of the organism and from whom it was transmitted to Emile Durkheim, who wrote his major doctoral dissertation on the sociological division of labor. Theodore Porter (in Chapter 11), as I have mentioned earlier, has traced the direct and acknowledged effect of the work of Adolphe Quetelet on the physics of both Maxwell and Boltzmann.

The general importance of Quetelet and the rise of statistical thinking in the social sciences may be seen as a special case of the interaction of quantitative considerations and mathematical techniques and social thought. Ian Hacking (in Chapter 2) has traced the development and use of numerical social data by concentrating attention on the enumeration of cases of suicide during the nineteenth century and the ultimate use of these numbers by Durkheim. A parallel study by Bernard Lecuyer (in Chapter 3) explores the significance of quantitative and probabilistic or statistical thinking in nineteenth-century social thought, illuminating the ways in which Quetelet's influence was related to the general rise of probabilistic thinking in the first half of the nineteenth century. We are reminded that the statistical point of view aroused considerable alarm and that many thinkers – e.g., John Stuart Mill and Auguste Comte – considered statistics the resort of incomplete and faulty science which had failed to produce a simple Newtonian one-to-one relation between cause and effect. Comte not only pilloried Quetelet and others for adopting a statistical point of view but even gave up his original title of “social physics” because it had been used in a probabilistic framework by Quetelet; this was the occasion of his invention of the name “sociology.” The subsequent development of social thought may be seen to a considerable degree as a tension between the ideas of Comte and Quetelet, between a social science exhibiting simple cause and effect and one based on statistical considerations – a tension that has not completely disappeared.

In many ways the heart of the present volume is the set of five historical essays comprising Part III. Chapter 4, on the first encounters during the Scientific Revolution, explores the ways in which the new ideas of Galileo, Descartes, and Harvey and the ideals of mathematics, combined with the science of motion, directly influenced the social sciences produced by Grotius, Vauban, Spinoza, Leibniz, Hobbes, and

Harrington. The mathematical spirit of the age is exhibited in the geometric form of presentation by Leibniz and Spinoza, the mathematical abstractions of Grotius, and the demands for social numbers or censuses by Vauban, and the ways in which Graunt and Petty sought to apply a new form of mathematics developed by businessmen (commercial arithmetic) to problems of polity.

Although Newton's ideals proved valuable for social scientists such as Malthus (as explored in Chapter 1, §4), there has never been a social model built directly on either Newtonian rational mechanics or the Newtonian system of the world. But those who dealt with social science continually introduced examples from Newtonian physics. One such case history is explored by Noel Swerdlow (in Chapter 5), in which Sir William Blackstone introduced Newtonian principles in the surprising and wholly unexpected setting of a legal decision. This event may be contrasted with the example of Stanley Jevons, explored by Margaret Schabas (in Chapter 6), in which Newtonian rational mechanics combined with post-Newtonian supplements such as d'Alembert's principle served to justify, by way of analogy, the introduction into dynamics of a system of differential equations. This was a stage in the development of neoclassical or marginalist economics on the foundation, by means of analogy, of rational mechanics (including such post-Newtonian principles as those of d'Alembert and Hamilton) plus energy physics.

One of the influential developments within economics was the system of Karl Marx, with its insistence on a labor theory of value. Much has been written about Marx and Darwin and attention has frequently been called to Marx's expressed admiration for Darwin and his gift to Darwin of an inscribed copy of *Das Kapital*. It is not always noted, however, that this was an afterthought on the part of Marx, since the inscribed copy (preserved in Darwin's library in Down House) is the second edition of 1872 rather than the original edition of 1867. We may be especially grateful to Giuliano Pancaldi for clarifying (in Chapter 7) the intellectual relations between these two titans of the mid-nineteenth century. In particular, Pancaldi has documented and explained both the rise and fall of Marx's admiration of Darwin and the eventual replacement of Darwin in Marx's pantheon by an obscure popularizer of science named Trémoux.

A major theme of the present volume is the role of analogies in the development of the social sciences. The use of analogies provides an important perspective for understanding the thought of Herbert Spencer,

as developed by Victor Hiltz (in Chapter 8). A useful distinction may be made between analogies and homologies and between both of these and metaphor, in particular (as in Chapter 1) to call attention to problems that are likely to arise in using concepts, laws, or theories from the natural sciences in the social sciences. In the nineteenth century there were two notable developments in the use of the natural sciences as sources of analogies for the social sciences. One was the above-mentioned development (explored in Chapter 1, §5) of a mathematical marginalist economics by such figures as Jevons, Walras, and Pareto on the model of rational mechanics plus energy physics; the other (explored in Chapter 1, §6) the use of the cell theory and certain allied aspects of biology and medicine by the organismic physiologists.

Anyone who studies the relationships between the natural and the social sciences quickly becomes aware that this is not a purely academic topic but rather one that has close links to policy questions in a number of different major ways. First of all, the social sciences carry a measure of legitimation by the degree to which they resemble the natural sciences and actually incorporate features, concepts, laws, or theories of the natural sciences. Because most people think of physics when they consider what a science should be like, social sciences are most impressive to the general public when they are based on extensive numerical foundations or exhibit mathematical considerations. A social science that shows the effects of interaction with the exact sciences will be more effective as an instrument for public policy than one which seems to be centered on questions of ethics or social philosophy. Additionally, any public support of the social sciences under the umbrella of "science," as in the case of the National Science Foundation, will seem most appropriate – and may therefore more readily become fact – for those parts of social science that most show the effects of interaction with or emulation of the most advanced natural sciences. Such questions are directly related to the images that natural scientists have of the social sciences and were of notable significance (as described in Chapter 1, §1) during the Congressional hearings on the establishment of the National Science Foundation.

In recent decades, there has been considerable concern expressed by natural scientists for the present state and future needs of the social sciences. This broad subject is relevant to the main assignment of the present volume, although it is far too complex to be incorporated into a single chapter. Accordingly, a different kind of presentation was

envisioned, based on an extended series of focused interviews conducted by the editor with Harvey Brooks, following the lines developed in the graduate seminar on Science, Technology, and Public Policy which was conducted for many years at the John F. Kennedy School of Government by the editor, Harvey Brooks, and Don K. Price. In this way we have been able to use the personal experience, knowledge, and insights of Prof. Brooks, based on his long-term service in the area of national policy, including membership in the President's Scientific Advisory Committee (PSAC), the National Science Board, the Committee on Science and Public Policy (COSPUP) of the National Academy of Science and its successor. This format allowed me to draw on and to record Prof. Brooks's very important initiatives in activities for the promotion of the social sciences in a way that would not have been possible in a chapter of his own composition.

The research on which this book is based has been generously supported by the Richard A. Lounsbery Foundation. I am especially mindful of the courteous consideration and continued kindness of the Director, Mr. Alan McHenry, whose warm support and friendly encouragement has been a helpful factor in the course of my own research and, in particular, in bringing this volume to conclusion. As always, I have a deep gratitude to Julia Budenz, who has worked through many drafts of my own chapters – each of which stubbornly tried to achieve book-length proportions with each successive revision. I am also thankful that I have been able to call upon Prof. Elaine Storella of Framingham State College (Massachusetts) for research help and for continued assistance in revising and checking my several versions. Stuart Strickland was of great assistance in criticizing the early drafts of all chapters. The research assistance and computer skills of Katharine Downes have been very important in the completion of this volume.

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NOTES

¹ In this Preface, as in the volume presented here, reference is made to social science and social scientist (or social sciences and social scientists) in early periods before such terms were in current usage. On this topic see the *Note on Social Science & Natural Science*, following this Preface, where reasons are given for using the terms natural science and natural scientist.

² The studies by Porter and Wise deal primarily with the interactions of physics (and mathematics) with economics in the nineteenth century; Porter has also been exploring some of the aspects of numeracy and quantification in social science at large. Richards has been analyzing certain aspects of nineteenth-century social theory, primarily in America and Britain, in its general intellectual-cultural and social background, tracing its roots in the contemporaneous sciences. Judith Schlanger has examined the role of metaphor in organismic theories at large. Stocking has been reorganizing the history of anthropology, showing – inter alia – its contacts with the other social sciences and with certain main aspects of the natural sciences.

³ Many of their works are cited in various parts of Chapter 1.

⁴ These works are referred to in nn. 28, 30, 36, ch. 1 *infra*.

⁵ I do not take account here of the growing literature on the history of anthropology and psychology, since the case histories in the present volume do not come from either of these fields. In this regard, however, it should be noted that anthropology has had a long tradition of writing its history and that psychology has long been known for having produced a large body of distinguished historical writing, for which see the *Journal of the History of the Behavioral Sciences*.

Furthermore, since the case histories from political science are drawn only from the seventeenth century, I take no account here of the vast body of writings on almost all phases of the history of this subject. For similar reasons, I have not discussed the literature concerning history and science.

⁶ See Ch.1, §6 *infra*.

⁷ Although there are few general works on the interactions of the natural and the social sciences, there are many important monographs or articles on particular aspects of this general topic. Many of these are cited in footnotes throughout this volume. Some examples, to which particular attention may be called, are Paul Lazarsfeld: "Notes on the History of Quantification in Sociology," *Isis*, 1961, 52: 277–333; Bernard Lecuyer & Anthony R. Oberschall: "The Early History of Social Research," *International Encyclopedia of the Social Sciences*, vol. 15 (1968), pp. 36–53; A.R. Oberschall (ed.): *The Establishment of Empirical Sociology* (New York: Harper and Row, 1972); and the brief but incisive presentation by Theodore Porter: "Natural Science and Social Theory," pp. 1024–1043 of R.C. Olby, G.N. Cantor, J.R.R. Christie, & M.J.S. Hodge (eds.): *Companion to the History of Modern Science* (London/New York: Routledge, 1990).

Special note should be taken of the important study by M. Norton Wise (with the collaboration of Crosbie Smith) on "Political Economy and Natural Philosophy in Nineteenth Century Britain," four parts, *History of Science*, 1989–1990, vols. 27, 28.

A NOTE ON "SOCIAL SCIENCE" AND ON "NATURAL SCIENCE"

Throughout certain parts of this book, the terms "natural science" and "social science" (or "natural sciences" and "social sciences") are used to designate, respectively, the physical and biological (and earth) sciences plus mathematics and the subjects known today as social or behavioral sciences.¹ Roughly speaking, these divisions correspond to the German "Naturwissenschaften" and "Sozialwissenschaften"² and are in current use in the Anglo-American world. The use of these two terms – natural sciences and social sciences – when dealing with any chronological period before the mid-nineteenth century is somewhat anachronistic to the degree that it imposes on earlier thought the rigid categories and values of a later time. Today the phrase "science of society" would suggest a subject much like physics or biology but in the eighteenth century and well into the nineteenth the implication would have been only a system of organized knowledge. When Thomas B. Macauley wrote that "Politics is an experimental sciences," he meant no more than that this subject was a system of organized knowledge that was based on experience, the same sense in which these words "experimental" and "science" had been used by Hume and Burke (see Chapter 1, §1.1). Such examples alert us to the dangers of using such terms as "science" or "experimental" anachronously.

In many places in this volume (the Preface, Chapters 1 and 4, Chapter 12) the physical and biological sciences are referred to as "natural sciences," a term that may embrace mathematics. In an earlier presentation of my researches into the interactions of the natural sciences and the social sciences – at a meeting convened by Karl Deutsch and John Platt at the Wissenschaftszentrum in Berlin in 1982 – I introduced the dichotomy of "mathematics and the natural and exact sciences" and the "social sciences," but for convenience of discourse I abbreviated "mathematics and the natural and exact sciences" into the simpler expression "sciences."³ In the first comment on my paper, Alex Inkeles criticized this usage. I had "obviously," he said, implied a difference in values assigned to the two fields of creative endeavor, one being "science" – "natural" and "exact" – the other "social." The justice of

his criticism has led me to use the term "natural science" (and its plural "natural sciences") in order to avoid any pejorative implications, even though there may be some possible ambiguity because "natural science" may wrongly suggest "natural history" or the life sciences. I have long believed, however, that if one were seeking an antonym for "natural" science, it would not be "social" science but rather "unnatural" science; which, in turn, suggests that the proper antonym for "social" science would be "anti-social" science.

The designation "social science" arose and became current in the late eighteenth century. The introduction of "social science" has two somewhat distinct aspects. First of all there is the actual occurrence of the term; second, the emergence of a concept in which knowledge of society is perceived to be a "science" in the sense of the physical and biological sciences. A good part of this book is devoted to an exploration of the ways in which what we would call the social sciences made use of the established natural sciences, beginning with the age of the Scientific Revolution (see Chapter 4). Many examples show the different ways in which a variety of thinkers, under whatever name or rubric they classified their activity, conceived their own subject in relation to the natural sciences and mathematics of their day. Therefore, for expository purposes I may have somewhat anachronously used the term "social sciences" (and also "moral sciences") for their thoughts and writings on such topics as political theory or statecraft, organization of the state or of society, natural law, international law, economics, and kindred subjects.

I do not know who first used the terms "social science" and "science of society." In a letter to John Jebb, written from London on 10 September 1785, the American statesman John Adams (later to become the second president of the United States) wrote of "the social science." A year before, in a letter to A.M. Cérissier, he applauded the way in which French savants (Cérissier among them) had "turned to the subject of government"; he voiced his judgment that "the science of society is much behind other arts and sciences, trades and manufactures." Even earlier, in June of 1782, Adams had declared that "politics are the divine science."⁴

I do not believe that Adams invented these expressions. In those days, however, as has been mentioned, the term "science" did not have the identical meaning which it was to acquire later in the nineteenth century. The nearest equivalent of what we would consider to be a

science, in the sense of a natural science, was natural philosophy, but that subject was more akin to our physics plus astronomy and part of chemistry. (See, on this topic, Chapter 1, §1.1.)

The earliest recorded use in print of the actual expression "social science" ("science sociale") seems – according to Keith Baker – to have been in 1781 in a pamphlet addressed to Condorcet.⁵ It has been suggested that since the term "art sociale" was commonly used by the Physiocrats before the Revolution, perhaps the transformation to "science sociale" occurred before 1791.⁶ In any event, Condorcet himself used the new term in a draft plan presented to the Committee on Public Instruction of the Legislative Assembly in January 1792. Condorcet also introduced "social science" in his writings after 1792, notably in his "Esquisse,"⁷ translated under the title *Outlines of an Historical View of the Progress of the Human Mind* (London, 1795). Faced with a new and difficult expression, the British translator chose to render "science sociale" as "moral science,"⁸ a name used widely in England throughout the nineteenth century for social science.⁹ In France the equivalent, "sciences morales," was in common usage early in the nineteenth century, as in the name of a "class" in the Institut de France, constituted after the Revolution: Sciences Morales et Politiques.

"Social science" entered American English in a translation of Destutt de Tracy's *Treatise on Political Economy* (Georgetown, [Washington] D.C., 1817), sponsored by Thomas Jefferson, to whom Destutt had sent the manuscript, which he could not then publish in France. Jefferson apparently checked the translation and wrote a prospectus approving the use of a number of neologisms, among them "social science."¹⁰ In British English, "social science" seems to have come into being through a circuitous route that included a Spanish translation, made by Toribio Nuñez (Salamanca, 1820), of some selections from the writings of Jeremy Bentham. Nuñez introduced "ciencia social" into the title: *Espíritu de Bentham: Sistema de la ciencia social*. Bentham later congratulated Nuñez for his use of "ciencia social," referring to "the science so aptly styled by you the *social science*."¹¹

The history of this development has been admirably encapsulated by Victor Branford as follows:

Between Vico's 'New Science' and Comte's 'Sociology' the infiltration of various kindred phrases, such as Social Science, Science of Society (Condorcet), Science of Man (St. Simon), would seem to mark a general tendency toward the expansion of science into the field of humanistic studies. Among Comte's contemporaries, J.S. Mill (only eight years

younger than Comte) held pronouncedly that the time was ripe for marking off from other studies – both scientific and philosophical – a general social science, and for this he himself proposed a particular designation. In 1836 Mill defined the scope and character of this department of studies, using as titular synonyms, these, among others phrases – Social Philosophy, Social Science, Natural History of Society, Speculative Politics, and Social Economy. This essay of Mill ('On the Definition and Method of Political Economy') appeared six years before the completion of the 'Positive Philosophy.' Lacking the large historical interests of Comte, Mill necessarily conceived of Social Science in a considerably different way from Comte. But after the appearance of the 'Positive Philosophy,' Mill was very considerably modified in his views of Social Science.¹²

The use of "moral sciences" became quite extensive during the nineteenth century in England. Thus in John Stuart Mill's *A System of Logic, Ratiocinative and Inductive* (London, 1843), Book Six on "The Logic of the Moral Sciences" discusses the methodology suitable for the social sciences. But in the text itself, Mill uses both "sociology" and "the social science" as distinct from political science or political economy or history. In the beginning portion of Chapter Nine, Mill originally wrote in his manuscript about "the Social Science . . . which I shall henceforth, with M. Comte, designate by the more compact term Sociology." On reflection, however, he would not so easily pass over this neologism, based on the compounding of a Latin and a Greek root, and so the published version discusses "the Social science . . . which, by a convenient barbarism, has been termed Sociology."¹³ By the end of the nineteenth century moral sciences had become the name used in Cambridge University and elsewhere for the subject now known as philosophy.

In French culture the expression "sciences morales," which had been in regular use since early in the nineteenth century, has become obsolete. Curiously enough, it has been said – by Etiemble, the quixotic defender of the purity of the French language – that the factor causing a change from "sciences morales" to "sciences humaines" was an obsession for "la classification yanquie." That is, he considers "sciences humaines" to be a new term introduced as the French equivalent of the supposedly American "social science," a name under which (according to Etiemble) "the Americans assemble history, human geography, normal and pathological psychology, and the different branches of sociology" (but not, it would appear, economics, anthropology, or political science). The editors of Dupré's *Encyclopédie du bon français* (1972) observe that the name "sciences humaines" is perhaps maladroit, since it does not include human anatomy and physiology. "Faute de mieux," they

conclude, the new name should be adopted, even though "sciences morales" would "be more logical," although antiquated and even "reactionary."¹⁴

In Germany, as I have mentioned, the usual distinction is between "Naturwissenschaften" (natural sciences) and "Socialwissenschaften" (social sciences), but in the late nineteenth and early twentieth centuries, there came into general usage an additional distinction, "Naturwissenschaften" and "Geisteswissenschaften," roughly the natural sciences (including mathematics) and the sciences of man or, possibly, the arts and humanities plus the social sciences.¹⁵ Current German usage also includes "Soziologie" and even "Sociologie."¹⁶

* * *

The use of the term "social science," as opposed to "social sciences," reflects the historical climate of the late eighteenth century and of much of the nineteenth. The emerging subdisciplines which we know as economics or sociology or political science (as opposed to political theory or political history) could then be still considered as part of a general "social science."

In America in the nineteenth century, belief in such a general subject – coupled with the goal of improving society – found expression in a strong Social Science movement which had as its stated aim "to create a special and unified science of human society and human welfare."¹⁷ This Social Science movement has been described as "a non-political attempt to produce a social theory and a methodology which could be used as an intellectual instrument for the betterment of the lot of mankind."¹⁸ Eventually (in 1865) there was formed the American Association for the Promotion of Social Science, on the model of the British Social Science Association and obviously patterning its name on the American Association for the Advancement of Science. In the 1880s specialized sub-disciplines broke away from the parent organization with the formation of the American Historical Society and the American Economic Association, followed by a separate organization of the political scientists. In 1909 the rise of the separate disciplines brought the general association for Social Science to an end.¹⁹

Another attempt in America to have a single "umbrella" organization for all the social sciences produced the Social Sciences Research Council. The SSRC differed from the older Social Science Association in that it did not set forth an ideal of a unified and general social science,

but was created as a cooperative organization of separate and individual social sciences. Traditionally, the social sciences have included five fundamental disciplines: anthropology, economics, political science, psychology, and sociology. When the Social Science Research Council was organized in 1923 as the counterpart of the National Research Council, the core membership consisted of the professional or scholarly associations representing these five disciplines plus two others – history and statistics.²⁰ History is sometimes classed with the social sciences, sometimes with the humanities.²¹ George Homans's list of "social sciences" includes "psychology, anthropology, sociology, economics, political science, history and probably linguistics."²²

The first article in the *Encyclopaedia of the Social Sciences* (1932), written by the editor, Edwin R.A. Seligman, posits three classes of social sciences – the "purely social sciences" (the earliest ones, in historical order – politics, economics, history, jurisprudence: and the later ones, in historical order – anthropology, penology, sociology, and social work); the "semi-social sciences" (ethics, education, philosophy, psychology); and the "sciences with social implications" (biology, geography, medicine, linguistics, and art). In the Introduction to the successor *International Encyclopedia of the Social Sciences* (1968), the editor, David L. Sills, acknowledges (pp. xxi–xxii) that no final answer can be given to the question, "What are the social sciences?" The reason is that the scope of the social sciences varies from one time period to another. Sills calls attention to certain controversies, e.g., whether history is a social science or part of the humanities, whether psychology is a social or a natural science. The editors, he reports, determined that "the majority of the topical articles" would be devoted to anthropology, economics, geography, history, law, political science, psychiatry, psychology, sociology, and statistics.

Another grouping of disciplines is the "behavioral sciences," a name which came into general use in the 1950s. A major factor in the spread and acceptance of this term was its use by the Ford Foundation in a large-scale and well funded program that was at first unofficially and later officially known as "behavioral sciences." The behavioral sciences, according to Bernard Berelson, is a rubric usually understood to include "sociology; anthropology (minus archeology, technical linguistics, and most of physical anthropology); psychology (minus physiological psychology); and the behavioral aspects of biology, economics, geography, law, psychiatry, and political science."²³

In *The Behavioral and Social Sciences* (1969), the primary subject areas considered were: anthropology, economics, geography, history, linguistics, political science, psychiatry, psychology, sociology, and aspects of mathematics, statistics, and computation.²⁴ This may be contrasted with *Knowledge into Action* (1969), where it is said that “historically,” five social science have been “central”: anthropology, economics, political science, psychology, and sociology. Other disciplines dealing with “social phenomena” are said to be demography, history, human geography, linguistics and social statistics.²⁵

In the chapters of our present book, particular social sciences (e.g., economics, sociology) are referred to under their specific names while the terms “social science” or “social sciences” are used either in the nonspecific sense of former times (to include all the “sciences” relating to human behavior and to human societies) or to indicate an all-encompassing “science” that might embrace all human social activities. For the earliest periods under consideration (e.g., the Scientific Revolution in Chapter 4), theories of government or of the state (the works of Hobbes and Harrington) and the conduct of international relations (Grotius) are included under the rubric of “social sciences” because they represent areas of study which later became part of the recognized social sciences.

SOZIALWISSENSCHAFT AND GEISTESWISSENSCHAFTEN

In the twentieth century, the words “Sozialwissenschaft” and “Gesellschaftswissenschaft” can be used for sociology and also for social science. Sometimes “Gesellschaftslehre” or “Soziologie” is used as the direct equivalent of sociology. In the latter nineteenth century, however, there came into general usage a distinction between “Naturwissenschaften” and “Geisteswissenschaften,” understood to encompass respectively the natural sciences (including mathematics) and the human sciences (the social sciences and the humanities).²⁶ Some thinkers and scholars, such as Wilhelm Dilthey in 1883 and Erich Rothacker in 1926, have suggested that “Geisteswissenschaften” owes its invention or at least its diffusion to J. Schiel, who in 1849 used this term for “moral sciences” in his German version of John Stuart Mill’s *System of Logic*.²⁷ In rendering the title of Book VI, “On the Logic of the Moral Sciences,” Schiel does write, “Von der Logik der Geisteswissenschaften oder moralischen Wissenschaften,” and he generally employs “Geisteswissenschaften” for “moral sciences” in the text.²⁸ But the appearance of “Geisteswissen-

schaften" in the translation of Mill's *Logic* in 1849 seems not to have established this usage as definitive since the term is not similarly employed in the later translation of Mill's *Logic* by Theodor Gomperz, who in 1873 rendered the title of Book VI as "Von der Logik der moralischen Wissenschaften" and uses this equivalent in his text.²⁹ Moreover, Alwin Diemer has shown that "Geisteswissenschaft" was used as early as 1787, that "Geisteswissenschaften" is found in something like its modern acceptation in 1824, and that the modern sense is clearly attested in the distinction made by E.A.E. Calinich in 1847 between the "naturwissenschaftlichen und der geisteswissenschaftlichen Methode."³⁰

The Hegelians regarded "Geisteswissenschaft" as "philosophy of spirit" and therefore as a noun in the singular. The term "Geisteswissenschaften" in the plural seems to have come into general usage as part of the development of the idea of "Geisteswissenschaften" as a set of interrelated but independent disciplines. An academic address given by Hermann von Helmholtz in 1862 is of particular interest because of the author's eminent contributions to several of the natural sciences combined with his work on philosophy and fine arts. In his address, Helmholtz discussed at some length various relations among "Naturwissenschaften" and "Geisteswissenschaften," indicating both their differences and their interconnections.³¹ But it is Wilhelm Dilthey who should probably be considered the major figure both in the development of the concept and in the dissemination of the term "Geisteswissenschaften."³² For Dilthey's term the English rendition until recently tended to be "human studies" but is now increasingly "human sciences."³³ Today "Geisteswissenschaften" may be considered more or less the equivalent of "human sciences" or "sciences of man" (and so somewhat similar to the French "sciences de l'homme" or "sciences humaines"), a rubric that embraces the traditional subjects of philosophy, philology, literary study, jurisprudence, history, and political science, along with the newer subjects of anthropology, archeology, psychology, economics, and sociology. Other fields, such as theology and education, may also be included with prominent subdivisions, such as the study of folklore and the history of art, even being regarded as separate disciplines.

NOTES

¹ There is no universal agreement today on which subjects of knowledge or inquiry should be included among the social or behavioral sciences; see ch. 1, §1 *supra*.

² For the additional problem of "Geisteswissenschaften" see nn. 26–28 *infra*.

³ Karl W. Deutsch, Andrei S. Markovits, & John Platt (eds.): *Advances in the Social Sciences, 1900–1980: What, Who, Where, How?* (Lanham [Maryland]/New York/London: University Press of America: Cambridge [Mass.]: Abt Associates, 1986), pp. 149–253.

⁴ Charles Francis Adams (ed.): *The Works of John Adams*, vol. 9 (Boston: Little, Brown and Company, 1854), pp. 512, 523, 450.

⁵ Keith Michael Baker: *Condorcet: From Natural Philosophy to Social Mathematics* (Chicago: The University of Chicago Press, 1975), Appendix B: "A Note of the Early Uses of the Term 'Social Science.'"

⁶ *Ibid.*, p. 391.

⁷ Baker (*op. cit.*, ch. 4, esp. pp. 197–202) gives an excellent and succinct presentation of Condorcet's views of the "science sociale." On p. 201 Baker discusses Condorcet's concept of "social science" and indicates how Condorcet contrasted Greek political theory ("a science of facts, an empirical science, as it were") with "a true theory founded on general principles which are drawn from nature and acknowledged by reason." In the course of this elaboration, the term "political sciences" was, not surprisingly, introduced by Condorcet along with "social sciences".

⁸ *Ibid.*, p. 392. For the reverse situation, in which the German translator of Mill's *Logic* introduced "Geisteswissenschaften" as the German equivalent of "moral sciences"; see the second part of this "Note of 'Social Science.'"

⁹ For example, the economist Francis Ysidro Edgeworth wrote in 1881 of economics as one of the "moral sciences"; in the same work he also wrote of social science, using the French term "mécanique sociale," which he hoped would some day "take her place" as the equal of Laplace's "mécanique céleste." See Francis Ysidro Edgeworth: *Mathematical Psychics: an Essay on the Application of Mathematics to the Moral Sciences* (London: C. Kegan Paul & Co., 1881).

¹⁰ Gilbert Chinard: *Jefferson et les idéologues* (Baltimore/Paris: The Johns Hopkins Press; Paris, Les Presses Universitaires de France, 1925), p. 43–44; also Baker (n. 5 *supra*), pp. 393–394.

¹¹ J.H. Burns: *Jeremy Bentham and University College* (London: University of London, Athlone Press, 1962), pp. 7–8.

¹² Victor Branford: "On the Origin and Use of the Word Sociology," in *Sociological Papers* (London: Macmillan and Co., 1905), pp. 5–6 quoted in L.L. Bernard & J. Bernard *Origins of American Sociology: The Social Science Movement in the United States* (New York: Thomas Y. Crowell Company, 1943), p. 3.

¹³ John Stuart Mill: *A System of Logic, Ratiocinative and Inductive*, 2 vols., ed. J.M. Robson (Toronto: University of Toronto Press; London: Routledge & Kegan Paul, 1974 – Collected Works, vols. 7–8), p. 895.

It should not be thought that Comte composed this hybrid in ignorance, since he was fully aware that he was compounding a mixture of a Greek and a Latin root. But he saw no other way of having the new science define its subject to be society (using the root "socio-" from the Latin noun "socius") and also declare its stature as a science by

a similarity in its final root to such sciences as biology, geology, physiology, mineralogy, and so on.

¹⁴ Fernand Keller & Jean Batany (eds.): *Encyclopédie du bon français dans l'usage contemporain*, vol. 3 (Paris: Editions de Trévise, 1972), p. 2344.

¹⁵ The complex history of the use of "Geisteswissenschaften" is discussed below in the second part of the present Note.

¹⁶ See further L.H. Adolph Geck: "Über das Eindringen des Wortes 'sozial' in die Deutsche Sprache," *Sozial Welt*, 1962, 12: 305–339.

¹⁷ L.L. Bernard & Jessie Bernard: *Origins of American Sociology: the Social Science Movement in the United States* (New York: Thomas Y. Crowell Company, 1943), p. 3.

¹⁸ *Ibid.*, p. 4.

¹⁹ *Ibid.*, ch. 8.

²⁰ *Ibid.*, p. 546.

²¹ *Ibid.*, p. 658.

²² George Homans: *The Nature of Social Science* (New York: Harcourt, Brace & World, 1967), p. 3.

²³ Bernard Berelson, "Behavioral Sciences," *International Encyclopedia of the Social Sciences*, vol. 2 (1968), pp. 41–42. See, further, Herbert J. Spiro: "Critique of Behavioralism in Political Science," pp. 314–327 of Klaus von Peyme: *Theory and Politics, Theorie und Politik, Festschrift zum 70. Geburtstag für Carl Joachim Friedrich* (The Hague: Martinus Nijhoff, 1971).

²⁴ *The Behavioral and Social Sciences: Outlook and Needs* (Washington: National Academy of Sciences, 1969), a report of the Behavioral and Social Sciences Committee (operating under the joint auspices of the National Academy of Sciences and the Social Science Research Council), pp. xi, 19.

²⁵ *Knowledge into Action: Improving the Nations's Use of the Social Sciences* (Washington: National Science Foundation, 1969), a report of the Special Commission on the Social Sciences of the National Science Board, p. 7.

²⁶ See Erich Rothacker: *Einleitung in die Geisteswissenschaften* (Tübingen: Verlag von J.C.B. Mohr [Paul Siebeck], 1920; reprinted with detailed foreword (1930); E. Rothacker: *Logik und Systematik der Geisteswissenschaften* (Munich/Berlin: Druck und Verlag von R. Oldenbourg, 1926 – *Handbuch der Philosophie*, ed. Alfred Baeumler and Manfred Schröter, numbers 6 and 7, collected in part 2, 1927; reprint, Bonn: H. Bouvier & Co. Verlag, 1947), esp. pp. 4–16.

Also Albrecht Timm: *Einführung in die Wissenschaftsgeschichte* (Munich: Wilhelm Fink Verlag, 1973), esp. pp. 37–48 and 137–140; Beat Sitter: *Die Geisteswissenschaften und ihre Bedeutung für unsere Zukunft* ([n.p.]: Schweizerische Volksbank, 1977), esp. pp. 13–17; Wolfgang Laskowski (ed.): *Geisteswissenschaft und Naturwissenschaft: Ihre Bedeutung für den Menschen von Heute* (Berlin: Verlag Walter de Gruyter & Co., 1970); Wolfram Krömer & Osmund Menghin (eds.): *Die Geisteswissenschaften stellen sich vor* (Innsbruck: Kommissionsverlag der Österreichischen Kommissionsbuchhandlung, 1983 – Veröffentlichungen der Universität Innsbruck, 137); Hans-Henrick Krummacker (ed.): *Geisteswissenschaften – wozu?: Beispiele ihrer Gegenstände und ihrer Fragen* (Stuttgart: Franz Steiner Verlag, 1988); Erich Rothacker: *Einleitung in die Geisteswissenschaften* (Tübingen: Verlag von J.C.B. Mohr [Paul Siebeck], 1920; reprint, with detailed foreword, 1930); E. Rothacker: *Logik und Systematik der Geisteswissenschaften* (Munich/Berlin:

Druck und Verlag von R. Oldenbourg, 1926 – *Handbuch der Philosophie*, ed. Alfred Baeumler & Manfred Schröter, nos. 6–7, 1927; reprint, Bonn: H. Bouvier & Co. Verlag, 1947), esp. pp. 4–16. See also L.H. Adolph Geck: "Über das Eindringen des Wortes 'sozial' in die Deutsche Sprache," *Soziale Welt*, 1962, 12: 305–339.

²⁷ For a more recent historical study, including the usage of *Geisteswissenschaften* prior to the translation of Mill, see Alwin Diemer: "Die Differenzierung der Wissenschaften in die Natur- und die Geisteswissenschaften und die Begründung der Geisteswissenschaften als Wissenschaft," pp. 174–223 (esp. pp. 181–193) of A. Diemer (ed.): *Beiträge zur Entwicklung der Wissenschaftstheorie im 19. Jahrhundert* (Meisenheim am Glan: Verlag Anton Hain, 1968 – Studien zur Wissenschaftstheorie, vol. 1); A. Diemer: "Geisteswissenschaften," pp. 211–215 of Joachim Ritter (ed.): *Historisches Wörterbuch der Philosophie*, vol. 3 (Basel/Stuttgart: Schwabe & Co. Verlag, 1974).

On Dilthey, see H.P. Rickman: *Wilhelm Dilthey: Pioneer of the Human Studies* (Berkeley/Los Angeles/London: University of California Press, 1979), esp. pp. 58–73; and H.P. Rickman: *Dilthey Today: A Critical Appraisal of the Contemporary Relevance of his Work* (New York/Westport [Conn.]/London: Greenwood Press, 1988 – Contributions in Philosophy, no. 35.), esp. pp. 79–82. In the latter (p. 80), Rickman errs in saying that Dilthey "introduced the term *Geisteswissenschaften* as a translation of J.S. Mill's 'moral sciences'"; as I have mentioned, J. Schiel did this in 1849 in his German version of Mill's *System of Logic*.

See also Wilhelm Dilthey: *Einleitung in die Geisteswissenschaften*, vol. 1 (Leipzig: Verlag von Dunker & Humblot, 1883), esp. pp. 5–7; this work is reprinted in Dilthey's *Gesammelte Schriften*, vol. 1 (Leipzig/Berlin: Verlag von B.G. Teubner, 1922; reprint, Stuttgart: B.G. Teubner Verlagsgesellschaft; Göttingen: Vandenhoeck & Ruprecht, 1959, 1962), see esp. pp. 4–6; there are a number of translations including Louis Sauzin (trans.): *Introduction à l'étude des sciences humaines* (Paris: Presses Universitaires de France, 1942), esp. pp. 13–15; Ramon J. Betanzos (trans.): *Introduction to the Human Sciences* (Detroit: Wayne State University Press, 1988), esp. pp. 77–79, also pp. 31–33; Michael Neville (trans.): *Introduction to the Human Sciences*, ed. Rudolf A. Makkreel & Frithjof Rodi (Princeton: Princeton University Press, 1989 – Selected Works, vol. 1), esp. pp. 56–58. See also Rothaker: *Logik und Systematik* (n. 26 supra), p. 6.

²⁸ John Stuart Mill: *Die inductive Logik*, trans. J. Schiel (Braunschweig: Verlag von Friedrich Vieweg & Sohn, 1849). This volume is quite rare; I have not been able to consult it directly. A second edition bears an enlarged title, J.S. Mill: *System der deductiven und inductiven Logik*, 2 vols. (Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1862–1863); see esp. vol. 2, pp. 433, 437–438.

²⁹ John Stuart Mill: *System der deductiven und inductiven Logik*, trans. Theodor Gomperz, vol. 3 (Leipzig: Fues's Verlag [R. Reisland], 1873 – *Gesammelte Werke*, vol. 4), esp. pp. 229, 233–234.

³⁰ A. Diemer: "Die Differenzierung," (n. 27 supra), pp. 183–187, and "Geisteswissenschaften," p. 211.

³¹ Hermann von Helmholtz: "Über das Verhältnis der Naturwissenschaften zur Gesamtheit der Wissenschaften," *Philosophische Vorträge und Aufsätze*, ed. Herbert Hörz & Siegfried Wollgast (Berlin: Akademie-Verlag, 1971), pp. 79–108; Hermann von Helmholtz: *Das Denken in der Naturwissenschaft* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1968), pp. 1–29; trans. Russell Kahl & H.W. Eve, "The Relation of the Natural Sciences to

Science in General," *Selected Writings of Hermann von Helmholtz*, ed. Russell Kahl (Middletown [Conn.]: Wesleyan University Press, 1971), pp. 122–143. On this topic, see David E. Leary: "Telling Likely Stories: The Rhetoric of the New Psychology, 1880–1920," *Journal of the History of the Behavioral Sciences*, 1987, 23: 315–331.

³² H.A. Hodges: *The Philosophy of Wilhelm Dilthey* (London: Routledge & Kegan Paul, 1952; reprint, Westport [Conn.]: Greenwood Press, 1974), esp. pp. xxi–xxiii; Michael Ermarth: *Wilhelm Dilthey: The Critique of Historical Reason* (Chicago/London: The University of Chicago Press, 1978), esp. pp. 94–108, 359–360; H.P. Rickman: *Dilthey Today* (n. 27 supra), esp. pp. 79–82; Erich Rothacker (n. 26 supra), esp. pp. 253–277.

³³ Cf. Rudolf A. Makkreel: *Dilthey: Philosopher of the Human Studies* (Princeton: Princeton University Press, 1975), esp. pp. 35–44; H.P. Rickman: *Wilhelm Dilthey: Pioneer* (n. 27 supra), esp. pp. 58–73; and the works cited in nn. 2 and 7 supra.