Quantification in the History of the Social Sciences

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Abstract

The wide role of quantification in the modern world is not to be understood as the importation of objective methods from outside of history, but the cultivation of tools and concepts in close alliance with their contexts of use. While differentiated by field, quantitative methods have been shaped also by interactions across barriers of discipline, and even between scientific and political or administrative applications.

Quantification means, very broadly, the use of numbers to comprehend objects and events. While quantification is often identified with science, it has been equally significant for engineering, commerce, labor, government, professions, and human use of the natural environment. Quantitative methods had a crucial role in shaping the social and behavioral sciences, and remain central to them. The purpose of this article is not to supply a practical guide to quantitative tools in social science, but to examine their backgrounds and assess their broader significance from the standpoint of science studies and the history of science. In modern times, quantitative methods and the numbers they produce have assumed a powerful role in most societies as intersecting discourses of science, administration, and the public sphere. This article emphasizes the more public uses of quantification.

The broad category of quantification refers to several allied but distinct human activities. *Mathematization* means the characterization of objects and events in terms of mathematical relationships. While it is not the main topic of this article, it is of course relevant. The expression of scientific theories in mathematical terms has provided one important basis for relying on quantitative or numerical data. There have been other reasons of a technical, administrative, or moral kind. Among the more empirical forms of quantification, *measurement* grew out of such practical activities as surveying lands or buying and selling. *Counting*, the basic tool for assigning numbers to sets of discrete objects, was deployed for such tasks as inventorying one's possessions or tallying populations. *Calculation* refers loosely to methods for combining and manipulating numerical information into more readily useable forms. *Statistics*, a wide-ranging body of methods for analyzing quantitative information, is discussed historically in other articles in these volumes, and receives also some attention here.

Theories and Measures

As early as the 1660s, and more systematically from about 1830, social and economic investigators in the European world held up quantification as the proper method of science. The growth of university-based social disciplines from about 1880, and especially after 1930, was attended by a widespread faith that through numbers, social research could be made genuinely scientific. A generation or more of positivistically inclined researchers looked to systematic measurement as the proper foundation for solid, mathematized theory. Some compared its progress with the development of physics in the seventeenth century, and anticipated a breakthrough in the near future.

The most influential historical and philosophical writers on science in the postwar period took almost the opposite view. Alexandre Koyré (1968), whose philosophical studies of seventeenth-century science inspired the first generation of professional historians of science in the Anglophone world, challenged the supposition that indiscriminate data collection would ever lead to serious science. He doubted, for example, that Galileo had learned much about the laws of motion from rolling balls down inclined planes. The new kinematics applied not to real objects, he argued, but to abstract bodies in geometrical space. Galileo derived his law of falling bodies mainly by working out the logical consequences of what he already knew. This mathematical and metaphysical work was, for Koyré, the most important achievement of the new science. Indeed, only through theory had the measures attained scientific meaning. Thomas Kuhn (1961, 1976) reaffirmed Koyré's broad argument and provided a historical perspective that reached forward to the nineteenth century. The most successful sciences of the seventeenth-century 'Scientific Revolution,' including mechanics, astronomy, and geometrical optics, had already been mathematical in ancient times. The more Baconian experimental studies of the early modern period were comparatively ineffective until a 'Second Scientific Revolution,' beginning around 1800, when new scientific objects such as electricity and heat began to be comprehended mathematically.

Scholars in science studies since about 1980 have inclined to dethrone theory in favor of a more respectful attention to the practices and material culture of science. Accordingly, they take more seriously the quantification of phenomena that had not been grasped by exact laws. Just as the life of experiment has never been strictly subordinated to theory, so numbers have often functioned independently of higher mathematics. They are linked not just to theoretical science, but also, and perhaps even more consequentially, to economic and administrative changes. The history of ideas alone cannot grasp their full significance.

Quantities and Standards

Quantity is not first of all the language of science, imported as something alien into everyday affairs, but an indispensable part

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of the fabric of life. Yet the aspiration to science has gone a long way toward reshaping the role of numbers and measures in the world. In this – as Max Weber suggested – we find much in common between bureaucratic and scientific rationality. Mathematics has often, and plausibly, been held up as an exemplar of universalized knowledge. The rules of arithmetic, or constants like π, are the same everywhere, at least in principle. Yet the universalism of measures and numbers, particularly when these have empirical content, has been achieved only within confined human spaces, and only by overcoming great obstacles. Even now, even in the industrialized West, quantities and prices are managed in everyday activities such as shopping by techniques quite different from those taught in schools (Lave, 1986). Before the rise of modern science, in the preindustrial world, quantification had very different meanings. Numbers were pervasive, but for most purposes their use and meanings were thoroughly local. The process through which they gained general validity is one of the crucial transformations of modern life.

A Plethora of Units

As Witold Kula (1986) has shown, measures remained immensely variable in Europe as late as the eighteenth century. This was partly by design, since small cities and lesser states often claimed the right to define their own weights and measures as a mark of autonomy and an obstacle to rule by central authorities. A diversity of measures, however, is the natural state of things wherever the pressures of commerce and administration have been insufficient to bring about unification. At a local level, authorities took some pains to reduce the ambiguity of measurement. A bushel measure, valid for the region, would often be fixed to the town hall, and could be used to settle disputes. In the next town, however, its volume would be slightly different, and over greater distances they varied considerably. The subtle geography of measures, moreover, was not defined exclusively by distance. Milk, oil, and wine came in different units; measures of cloth depended on the width of looms, and hence on the costliness of fabric and weave. The practices of measurement, too, were complexly nuanced. A bushel measure, even if the volume was fixed, could be tall and narrow or short and wide; the wheat might or might not be compacted by being poured in from a considerable height; and a complex set of conditions governed whether to heap the bushel, and by how much. Parties to a transaction often negotiated about measures rather than about prices. Add to this the consideration that almost nothing was decimalized, not even money, and it is evident that arithmetical calculation provided no fixed routine for managing affairs or settling disputes (Kula, 1986; Frängsmyr et al., 1990). The conversions required by trade provided an important source of employment for mathematicians.

The simplification and standardization of measures was encouraged by the expansion of long-distance trade, but was achieved primarily by governments in alliance with scientists. Among Europeans, it was the British who came nearest to creating uniformity of measures in the eighteenth century. A more systematic, almost Utopian, scheme, the metric system, was initiated in the 1790s under the French Revolution. In its most ambitious form this included a new calendar using months of 30 days divided into weeks of 10 days, and even a few decimalized clocks, beating out a hundred seconds per minute. The meter was set so that 10 million of them would reach from pole to equator, in the vain hope of integrating geodetic and astronomical measures with those on a human scale (Gillispie, 2004). To this end, bold expeditions were sent out into a disordered countryside to survey and measure a meridian. Although the meter was justified in part as a response to organized petitions (*cahiers de doléance*) calling for fixed measures as protection against seigniorial discretion, the highly rationalized metric system of decimalized conversions and strange Greek names – of milliliters, kilometers, and centigrams – went well beyond this. Not until the July Monarchy, after 1830, did the metric system begin to succeed even in France (Alder, 1995, 2002). In time, however, it has come to provide a common set of measures for most of the world, with the United States a notable, though partial, holdout.

A precise and maximally rigorous definition of units is a basic element in the infrastructure of modern life. The role of standardized measures in systems of manufacturing based on interchangeable parts is widely recognized. They are indispensable also for large-scale networks such as electric power distribution, telephony, and, by now, computers and the Internet. A collaboration of scientists and bureaucrats was required to create them. In some cases, as with the electrical units defined in the later nineteenth century, eminent scientists such as James Clerk Maxwell, William Thomson (Lord Kelvin), and Hermann von Helmholtz were deeply involved in the definition of standards.

Other units, far from the domain of scientific theory, play an indispensable role in the regulation of modern life. Environmental agencies, for example, deploy measures of effluent concentrations, to regulate pollutants. They depend on meticulous specification not only of instruments, but also of sampling methods, training of technicians, custody of materials, and so on. Since penalties and taxes often depend on them, they are always vulnerable to challenge. In this domain, as in many others, an immense apparatus of instrumentation and control lies behind what scientists and citizens have the luxury (usually) of regarding as 'raw,' or merely 'descriptive,' data.

Producing Uniformity

Units and instruments are not by themselves sufficient to quantify effectively. A quantifiable world contains reasonably homogeneous objects, objects whose measures can be compared, or that can be grouped together and counted. Nature and unregulated human labor produce a few of these, though real uniformity occurs mainly on a scale – for example, the molecular one – that is not readily accessible to the human senses. Physics was quantified partly in terms of abstractly 'mathematical' entities, such as forces, and partly through increasingly rigorous experimental controls, involving an expanding apparatus of instruments.

In the social world, where quantification is also a tool of administration, these same regulatory processes have helped to produce new quantifiable entities. The investigation and compensation of joblessness, for example, solidified the category of 'the unemployed.' In most countries, the official definition of an unemployed person has been linked to a state obligation to provide benefits. To collect unemployment insurance requires that a person meet certain standards, which are more or less closely monitored, and to which persons who lack work are encouraged to conform. They also must enroll themselves, thereby adding their unit datum to the numbers. The point here is not that government offices cause people to be without work, though mechanisms of compensation will certainly affect the rates. It is that official categories sharpen definitions, and so help to create countable entities. Those entities are also vulnerable to manipulation: a looser definition will be popular among those collecting benefits while a tighter one will not only reduce costs, but in the same stroke will lower the official unemployment measure. Most human and social types are variable, or at least fuzzy at the margins (Hacking, 1995). Measurement, for example, of crime, ethnicity, or mental illness, is allied to processes that make them more uniform, and hence countable. Economic categories such as profits, investment, and trade are dependent on the processes through which they are recorded and regulated. Financial and other measures can be *performative* in the sense that a theoretical articulation may cause values in the world to conform more closely to them (MacKenzie, 2006). But there is another side to this dialectic, since the thinness of quantitative description can invite manipulation, leading sometimes to breakdown and even catastrophic failure of an order based on measurement.

The Authority of Calculation

Numbers and measures are not merely tools of description and analysis. They work also as guides to action, especially public action. An explicit and formal analysis, often largely quantitative in form, is by now required for a variety of public decisions involving investment or regulation. Business organizations depend increasingly on measures and projections in order to make decisions. These analyses are often expressed in money terms, and their modern expansion attests to the triumph of capitalism. But public reliance on economic quantification is by no means a mere imitation of its commercial uses. The tools of quantitative analysis were developed as much for government as for business purposes, and have become increasingly dependent on academic researchers. In the background is an evolving political and administrative culture, reflecting changes in the status and composition of elites.

Commensuration

It is characteristically modern to suppose that a conscientious decision should involve explicit consideration of the available data. Decision by calculation goes beyond this, requiring a course of action to be dictated 'objectively' by facts. One prototype of this ideal of public reason is benefit–cost analysis (BCA). In practice, BCA involves predictions in many domains, including weather patterns, health, hydrology, ecology, and commerce, but its most distinctive aspect is the attempt to convert a great diversity of considerations into a common financial metric. The obstacles to commensuration are most compelling in regard to such considerations as human lives lost or saved, the disappearance of biological populations, or the degradation of a beautiful landscape. In public debate, such exchanges may seem profoundly immoral. Yet commensuration flourishes particularly as a strategy of simplifying, and perhaps of ranking, for lay people trying to make choices regarding complex problems for which they lack real access to specialized tools of knowledge (Espeland and Stevens, 1998).

Economics provides a rationale for much commensuration, but BCA did not develop out of theoretical economics. It was imposed by the U.S. Congress and by the exigencies of legal and administrative challenges during a massive expansion of federal water projects beginning in the 1930s. Engineers, not economists, initially faced the immense difficulties of incorporating life, health, recreation, and scenic beauty along with economic development as they proffered measures of the costs and benefits of water projects. Despite political opposition to some of these measures, a political logic of rationalized choice made them necessary nonetheless. The task was to devise methods that would hold up to administrative and legal challenge. In this context, what was not quantified tended to disappear, and the experts found it necessary to put aside what seemed the implausibility or even immorality of expressing everything, including lives saved or lost and traditional ties to the land, as a sum of money. Beginning in the 1950s, economists and social scientists were recruited into agencies like the U.S. Army Corps of Engineers and the Bureau of Reclamation to provide more consistent or more acceptable solutions to these thorny problems. Finally, during the 1960s, BCA emerged as an applied field within welfare economics (Porter, 1995; Espeland, 1998).

Trust and Impersonality

Academic problems of social measurement and commensuration are thus embedded in social and political conditions that put a premium on scientific objectivity in the specific sense of freedom from personal or self-interested bias. Since David Hume, at least, facts have often been sharply distinguished from values, and for some purposes the credibility of science is enhanced by its separation from their 'subjective' domain. The ambition to provide a scientific, possibly quantitative, basis for public decisions remained quixotic or utopian so long as an aristocratic political class retained power. Few would assent now to Frédéric Le Play's assessment that numbers became necessary as a second-best option under democratic governments, in the wake of revolution, when leaders no longer possessed the inherited wisdom of birth and experience (Porter, 2011). Yet the aspiration to replace judgment with objective, quantitative rules grew up in situations where elite authority had become suspect.

The move by American state engineers to an increasingly rigorous benefit-cost methodology was a response to systematic challenge, and exemplifies this point. So also do other exemplary tools of 'mechanical objectivity.' Social and medical researchers have been criticized for preferring the impersonal rigor of the statistically significant result over proper measures of quantities that matter for health and wealth (Ziliak and McCloskey, 2008). Accountants did not willingly abandon what many saw as their professional responsibility to offer an expert assessment of the financial condition of firms. These choices may be understood as a sacrifice of meaning for the sake of quantified objectivity, whose ascent is part of a broad cultural and political history of the twentieth century. Some basic features of that history would include the growth of government, bureaucratic conflict, resistance to administrative secrecy, and public distrust of 'bureaucracy.' The unprecedented quantitative enthusiasm of postwar social science involved, along with its optimism about the 'methods' of science, an ethic of renunciation that more and more was to be anchored in rules of method rather than high moral character (Porter, 2004).

A Historical Perspective on Social Science Quantification

Reflective accounts about the social and behavioral sciences have often supposed that these fields have short histories, and that the pursuit of quantification means following the path of natural science triumphant. But the rise of a quantitative ethos in natural science can be dated no earlier than the early eighteenth century. Systematic measurement until then was almost confined to astronomy, and with it astrology, which extended over every inhabited continent. For a long time, astronomical measurement was geometrical and not numerical. Its purposes were practical as well as scientific: to survey land, navigate ships, calculate calendars, and horoscopes. Barometers and thermometers helped to extend the domain of measurement into meteorology during the seventeenth century. Measurement in early modern Europe was associated as closely with natural history as with experimental physics. By 1750, savants bearing instruments wandered the Earth measuring mountains and other natural wonders, conjoining precision to their appreciation of nature. The development of an exact science of electricity in the later eighteenth century marked the advent of systematic experimental quantification (Heilbron, 1979). Measurement had also become routine in technological endeavors, such as mineral assaying, decades before Lavoisier and his contemporaries began to insist on its centrality to chemistry.

From this perspective, it would be difficult to argue that political and economic studies lagged behind natural science in their reliance on numbers. Among the early members of the Royal Society of London, founded in 1660, were William Petty and John Graunt. Petty announced a new science of 'political arithmetic,' which in his hands involved speculative estimates of population and of wealth. Graunt is noted for his more strictly empirical compilations from the London bills of mortality. Just a few decades later, Jan de Wit, the Dutch Stadtholder (magistrate), used rudimentary probability theory to assign rates for the sale of annuities, and the astronomer Edmond Halley calculated the first mortality table. Political arithmetic, which entailed the compilation as well as the analysis of demographic and medical records, flourished in the eighteenth century, and public health was among the earliest and most influential of the quantitative studies. At the same time, probability theory was pursued as a mathematical theory of belief and credibility (Hacking, 1975; Daston, 1988; Rusnock, 2002). The *philosophe* and mathematician Condorcet, a leader of the French Revolution who then was hunted down by it, hoped to develop probability into the theoretical basis for elections and judicial decisions (Baker, 1975).

The Nineteenth Century and the Rise of Statistics

By the early nineteenth century, as Kuhn observed, the natural historical investigation of heat, electricity, and the physics of light had given way to sciences that were both mathematical and quantitative. Possibly the analysis of mortality records for insurance can be regarded as comparable in certain respects. But the explosive growth of quantification beginning in the 1820s, what Ian Hacking (1990) has called an 'avalanche of printed numbers,' was not concentrated in the experimental sciences. Rather, it involved systematic surveys of stellar positions, terrestrial magnetism, weather phenomena, tides, plant and animal distributions, and social statistics.

The collection and investigation of social numbers had expanded gradually over the course of the eighteenth century. Few eighteenth-century states had the bureaucratic means to conduct a full census, and most were disinclined to release such sensitive information to their enemies or even to their subjects. In many places, too, the people would have viewed census officials as harbingers of new taxes or military conscription, and in Britain the census was blocked by a gentry class that refused to be counted. In contrast to piecemeal efforts at home, there were some systematic surveys abroad, the machinery of centralized state information gathering having been turned loose first of all in colonial situations. Among European states, Sweden pioneered the regular census, in 1749; its results remained secret until 1764. The French used sampling, of a sort, and enlisted mathematicians such as Pierre Simon Laplace to estimate the population. The U.S. census of 1790 heralded a new era of regular, public censuses, which were encouraged in Europe by French military conquest and by the pressure of wartime mobilization. The British instituted their decennial census in 1801. Finally in the 1830s, bureaucratic professionals began to take over the collection of social and economic numbers in the most advanced European states.

At the same time, an increasing pace of quantitative study by voluntary organizations made 'statistics' a plausible 'science of society.' One model for it was developed by the Belgian Adolphe Quetelet, whose quantitative pursuits ranged from observational astronomy and meteorology to the bureaucratic organization of census work. He argued for an alliance of data gathering with mathematical probability, in the quest to uncover 'social laws.' Apart from life insurance, however, most statistical collection was under the control of reformers and administrators with little mathematical knowledge. Their enthusiasm for counting was perhaps indiscriminate, yet it was nurtured by specific anxieties about poverty, sanitation, epidemic disease, economic dislocation, and urban unrest. Social investigation, still more than natural science, was an object of contest, and there were active efforts to organize a social science to speak for working people (Yeo, 1996). Karl Marx's immense statistical labors for his *Capital*, drawing mainly from official British inquiries whose results he praised as honest and reliable, testify impressively to the credibility of public numbers. Middle-class organizations had more staying power than working-class ones, and better standing to claim the mantle of 'social science.' In Britain, the Statistical Society of London (founded 1834) joined bureaucrats with professionals and even aristocratic political leaders. In Germany, statistics became a university field, which, from about 1860 to 1900, combined empirical quantification with a historicized 'national economics,' in a quest for state action on behalf of workers and peasants. Some of the founders of social science in America were brought up in this tradition, as was Max Weber. Emile Durkheim, too, engaged with it, as his *Suicide* of 1897 plainly attests (Porter, 1986).

The nineteenth-century science of statistics embraced much of the subject matter of the modern social sciences. It overlapped, and sometimes competed, with political economy, political science, geography, anthropology, ethnology, sociology, and demography. These stood for genres, more or less distinct, though not for anything so definite as modern professional disciplines. Their quantitative methods were not identical, but neither were they sharply differentiated from each other or from measurement in biology. There was much uncertainty and debate from 1830 through the end of the century as to whether statistics was a science, with its own subject matter, or only a method. It was resolutely empirical, to the point that some considered sampling too speculative. Far from being allied to any mathematical social science, statistics was more often at war with deduction and abstract theory. Some, like the economist William Stanley Jevons, would claim that political economy should be mathematical because it was inherently quantitative, but he could not attach the mathematical formulations he introduced to empirical numbers.

Quantification in the Modern Social and Behavioral Sciences

Toward the end of the nineteenth century, a more mathematical field of statistics began to develop. The most influential form of the new statistics was British biometric version created by Francis Galton and Karl Pearson (Stigler, 1986). At almost the same time, however, distinct social and behavioral sciences began to crystallize, in part around somewhat distinct quantitative methods. All were conceived as ways to enhance the scientific standing of their fields, and each was engaged also with issues of politics, policy, and the management of economies and populations. The typology to follow is intended to be suggestive, and certainly cannot be exhaustive.

Physical Anthropology and Eugenics

The measurement of humans was carried out for bureaucratic as well as scientific purposes throughout the nineteenth century. The increasing concern with race in anthropology was linked to a preoccupation with skulls, whose measures were used to distinguish distinct 'races' of Europeans. What Francis Galton called 'correlation' was developed to measure the interconnections among physical human characteristics, their perpetuation from one generation to another, and their relation to measures of merit or achievement.

Education and Psychology

Correlation provided also a solution to a problem of contemporary psychophysics, related to education. Gustav Theodor Fechner began applying the methods of error theory to the measurement of sensory discrimination in the mid-nineteenth century. Systematic use of experimental randomization was developed for studies of this kind (Dehue, 1997). They provided also a wide field of application for correlational methods. Did childhood study of dead languages really train the mind for speedier or more thorough learning of other subjects, such as science, history, or literature? The growth of mental testing in the early twentieth century posed a more general question of correlations. To what extent did students who proved themselves adept in some particular study excel also in others? Charles Spearman's *g*, or general intelligence, and the 'intelligence quotient' or IQ, presupposed a basic unity of the mental faculties. Psychometricians and educational psychologists developed a body of statistical methods to measure this intelligence, or to decompose it, and to assess the relations of its components. The measurement of intelligence assumed an important role in sorting institutionalized populations of students, soldiers, and the like (Zenderland, 1998; Carson, 2007).

From the 1930s, as psychology turned resolutely experimental, quantification became mandatory. Once again, educational psychology as well as parapsychology took the lead in the assimilation of novel methods of experimental design and analysis. The new paradigm of a proper experiment involved a randomized design of control and experimental populations, yielding results that would, in most cases, be subjected to analysis of variance. A worthwhile result was defined in part by a test of significance: the 'null hypothesis' that the treatment had no effect should be rejected at some specified level, commonly 0.05. This was the methodology of the English statistician R. A. Fisher, and for half a century or more beginning in the 1920s his name was practically synonymous with modern statistics (Gigerenzer et al., 1989).

Econometrics and Economics

Economic numbers were preeminent among the concerns of statistics from the eighteenth century. From the late nineteenth century, new tools grew up with new quantified objects such as unemployment and the cost of living (Stapleford, 2009). A new economic mathematics of marginal utility appeared in the 1870s and was self-consciously reconciled to the classical tradition in the 1890s by Alfred Marshall. His work included abundant graphical illustrations, but these presented curves that could not readily be measured. The sources of econometrics are largely distinct. From origins in the 1870s to the establishment of a society and a journal in the 1930s, the field focused on the study of business cycles (Morgan, 1990). Econometricians took their numbers where they could get them, often from public sources. They were highly dependent on national accounts, prepared by governments, and indeed participated in structuring these accounts. The paradigmatic statistical tool of econometrics, adapted from biometrics mainly after 1950, was regression analysis.

Surveys

From the founding of statistical societies in the 1830s, social science has relied on surveys to understand social problems and learn about how the lives and opinions of ordinary people. Charles Booth's monumental studies of East London beginning in the 1880s inspired a movement of surveys of towns and regions in Britain and America. For most of the nineteenth century, statisticians typically aimed to count exhaustively, but then began relying more and more on 'representative' sampling, which was valued for its speed and adaptability. The origins of survey sampling are partly conceptual, but were tied to specific practical problems, as in late imperial Russian efforts by officials, sometimes allied to mathematicians, to manage budgets for communities of recently freed serfs. Arthur Bowley and then Jerzy Neyman worked to develop rigorous sampling methods that would permit generalization using probability theory. The techniques of survey sampling have linked sociology and political science to marketing and political campaigns (Desrosières, 1998; Mespoulet, 2001; Igo, 2007).

Medicine

The statistics of public health, including the treatment of mental illness, was long focused mainly on gathering information and presenting it in tables. Pearson's biometric statistics began the formalization of experimental and quasi-experimental methods, which were reshaped according to a new theoretical logic by Fisher. Health officials institutionalized the randomized, controlled trial in medicine from the 1940s. It soon came to define the 'gold standard' in experimental medicine. More broadly, statistical data and analyses, including 'metastatistical' methods for combining the results of different studies, have become exemplary not just of 'evidence-based medicine,' but of evidence itself in its most public, bureaucratically acceptable form (Marks, 1997; Jorland et al., 2005).

Conclusion

Quantification is as central to social as to natural science. In an era of vast interlinked computational systems and almost infinite data banks, its public prominence and its secret manipulations are more impressive than ever. The expansion of quantification over the last three centuries reveals some key characteristics of the social and behavioral disciplines, among them, the drive for the status of science, the role of applied studies in forming academic ones, the shaping of knowledge by data technologies, and the often problematic relationship of theoretical to empirical work. The quantification of human science draws from centuries of history, and is by no means a mere product of the modern effort to attain scientific standing. Indeed, the advance of measurement and statistical analysis in social science is not distinctively academic, but has been stimulated by administrative and political demands. Yet quantification in social science has, for two centuries, been enveloped in a certain mystique, regarded as an indication of rigor or at least of scientific maturity. We should understand it not as the key to all mysteries, but as a powerful set of tools and concepts, to be integrated as much as possible with theoretical understanding and with other ways of comprehending social phenomena.

See also: Applied Social Research, History of; Computers: Impact on the Social Sciences; Demography, Early History of; Empirical Social Research, History of; Experimentation in Psychology, History of; Intelligence: History of the Concept; Political Science, History of; Positivism, History of; Psychology, History of (Twentieth Century); Quantification in History; Sample Survey Methodology, History of; Science and Technology Studies, History of.

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