

The history of quantification and objectivity in the social sciences

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Abstract

How can we account for the triumph of quantitative methodology in contemporary social sciences? This article reviews several historical works on the use of quantification in the pursuit of objectivity. During the eighteenth and nineteenth centuries, objectivity was increasingly valued due to the absence of an elite culture, increasing anonymity, and the rise of pseudosciences. Before and during World War I, financial and governmental pressures intensified the movement toward objectivity and quantification. Quantification became almost mandatory as a response to World War II and Cold War conditions of mistrust and disunity. In the next decades, research findings started to circulate across oceans and continents and quantification served international communication very well. During the 1980s, the discussed challenges were no longer evident and the 1990s were characterized by continuous argument over the arbitrariness of quantitative decision making. Since then, there have been few reform, and roughly the same criticism applies to current statistical use. One can conclude that quantification has served the demands of social scientists for transparency, neutrality, and communicability, but in order to advance, social scientists should re-evaluate their own critical and creative mind.

Keywords: *quantification, objectivity, statistics, transparency, neutrality, communicability*

Introduction

Describing human phenomena in the language of numbers may be counterintuitive. Although none of the social sciences has truly internalized a quantitative paradigm (Smith, 1994), strict quantification came to be seen as the badge of scientific legitimacy (Porter, 1995). The emergence of quantification is intertwined with the demand for objective research: in a desire to be objective, social scientists gradually eliminated their own judgment and replaced it with quantitative data and statistical procedures. It is evident that there are significant dangers in allowing statistical decision making procedures to replace critical judgment, so the extent to which quantification dominates social research nowadays is remarkable. There has been disagreement over the artificiality of quantification over the ages, as Plato had acknowledged more than 2500 years ago: "A good decision is based on knowledge and not on numbers." It is largely these concerns, that have prompted me to compile this article on the history, present and future of the quantitative method in the social sciences.

How can we account for the triumph of quantitative methodology in the contemporary social sciences? Naturally, many pressures instigated the development of such a paradigm. The period from 1870 to 1920 was characterized by an ongoing tension between the normative position valuing social reform and the scientific position emphasizing objectivity (Smith, 1994). During the 1920s and 1930s a truly quantitative, antinormative science of society emerged, reaching its culmination in the years after World War II (Smith, 1994). The general explanation for this phenomenon was that social sciences consciously modeled themselves on the quantification that reigned supreme in the natural sciences (Porter, 1995). In his book *Trust in Numbers*, Theodore M. Porter justly questions why a model successfully used to study nonliving objects would be seen as an attractive paradigm for research on humans and societies. Moreover, this explanation does not clarify the particular circumstances

under which social scientists came to prefer objectivity over their own expert judgment. Interest in the pursuit of quantification has grown substantially in recent decades and the subject is now addressed by an enormous number of books, articles, conferences and encyclopedic volumes. As part of the commemoration of the 50th anniversary of the Department of Social and Behavioral Science at the University of Utrecht, this article will review four historical works on the use of quantification in the pursuit of objectivity, namely *Objectivity and the Escape from Perspective* by Lorraine Daston (1992), *Social Science in the Crucible* written by Mark C. Smith (1994), Theodore Porter's (1995) *Trust in Numbers*, and two chapters of *The Cambridge History of Science: Volume 4* written by Theodore Porter and Dorothy Ross (2003). I will outline the developments that have led to the rise of quantification, and in doing so I will try to clarify the motives of past and present social scientists for using the quantitative methodology. In the last section, I will address some literature on the recent criticism of quantification and the current use of statistics and I will speculate about the future of quantification in social research.

The emergence of objectivity

The concept of objectivity is a controversy in itself, because "objectivity" is often confounded with "the truth." Although objectivity is clearly required in order to attain true knowledge, it is not a sufficient condition for doing so. When philosophers speak of the objectivity of science, they generally mean its ability to know things as they really are (Porter, 1995), but this is a rather vague and impractical definition. According to Daston (1992), our current concept of objectivity comprises several meanings. Different interpretations of objectivity can be defined by the different subjectivities they oppose. In the context of the current article, "objectivity" refers to a conceptual mixture of mechanical objectivity, which opposes interpretation, and aperspectival objectivity, which opposes the subjectivity of individual idiosyncrasies. Aperspectival objectivity is a relatively new concept (Daston, 1992) and seems to be a more comprehensive form of objectivity than mechanical objectivity, because it additionally requires research results to be free from individual influences.

Daston, among others, has shown that the history of quantification is closely related to the emerging importance of objectivity. Ever since the invention of statistical procedures, it was recognized that the language of mathematics is well suited to embodying objective judgments, because it employs structured rules which exclude all forms of personal idiosyncrasy and subjective judgment. As Porter has argued in Daston (1992, p. 609), "certain forms of quantification have come to be allied with objectivity not because they necessarily mirror reality more accurately, but because they serve the ideal of communicability, especially across barriers of distance and distrust."

In search of authority

Smith (1994) points out that, in order to understand the circumstances under which quantitative objectivity has become a desideratum, we need to look not only at the pursuit of objectivity, but even more importantly at the social basis of authority. Ever since the mid-eighteenth century, expertise has gradually become inseparable from objectivity. This development was reinforced by the philosophy of the Enlightenment. The eighteenth century was a period of social and political upheaval. With the American Revolution and French Revolution, Western societies were confronted with a changing social hierarchy. The elite culture was replaced by a culture of professionals and individualism increased in prominence. Porter (1995, p. 195) states that "Where experts are elites, they are trusted to exercise judgment wisely and fairly." However, in the absence of an elite culture, experts must adhere to the rules: expertise had to be objectified (Porter, 1995). Both Porter and Smith state that, in their search for a set of objective rules, social scientists increasingly relied on quantitative

techniques. In addition, Daston (1992) argues that the advancement in communication and transportation technologies has contributed to the objectification of authority. Earlier there had been no great need for overt objective information, because information was exchanged in small networks and sources were known to be reliable. As communication and transportation methods became more and more advanced, networks grew and sources of information became anonymous. In the absence of an elite culture and with anonymous information exchange, name and status were no longer relevant as indicative of knowledge and skills. Consequently, scientists had to find other ways to gain authority and trust. Objectivity was increasingly valued and quantification became the method to achieve it.

Codes of ethics became of paramount importance in the late nineteenth century, when the ongoing crisis of authority gave rise to numerous quackeries and pseudo sciences. Porter (1995) stresses that the social sciences could prove their objectivity by insisting that anyone properly trained in the scientific method could replicate the research and its results. Smith (1994) states that the first generation of professionalized social scientists continued to insist on the normative nature of the social sciences, and that they used the scientific method to prove the truth of their normative opinions. The younger generation of social scientists repudiated the moralism of their teachers and insisted on separating the scientific means from any personal ends. The normative goals that led their predecessors to value quantification faded into the background, and the exclusion of personal values became the cardinal strategy for presenting themselves as unbiased knowers (Smith, 1994). From this time onwards, Smith emphasizes, scientific work had become valued according to the extent in which moral statements and personal judgments were eliminated and were replaced with quantitative data.

Funding requirements and avoidance of controversy

Before and during World War I, professors from all disciplines were reprimanded and at times even fired due to their stands on controversial political and social issues. At the same time, value-neutral experts were offered high-paying and high-status jobs with governments and private businesses, because of the demand for empirical data and standardized tests. Smith (1994) remarks that these institutional pressures intensified the movement toward extreme empiricism and avoidance of moral positions. While quantification had begun to make inroads during the eighteenth century, Porter (2008) states that the statistical method assumed its recognizably modern form during a period of spasmodic neutrality. In the years immediately prior to World War I, Pearson and his students established a number of statistical procedures, including the chi-square test in 1900 and the t-test in 1908. In 1935, Fisher introduced the test of significance and stated his ideal of experimental design, which included controls and random selection. Clearly, Smith argues, the statistical revolution engendered by the eugenics movement was necessary before social scientists could implement these statistical methods in their research. Under the circumstances of the World War I, probability and inferential statistics were considered to be refined methods of quantification and were supposed to replace fallible human judgment (Porter, 2008).

In addition to avoiding controversy and gaining access to attractive job opportunities, Smith suggests that the requirements of funding had been very influential in the development of quantification. Several private foundations like the Rockefeller, Russell Sage and Carnegie Foundations, began to fund social science research generously during the 1920s and continued to do so through the 1930s. These foundations refused to fund organizations concerned with politics, or to become involved in any social reform. Furthermore, foundations demanded empirical research with practical results. Social researchers were eager to meet the requirements of funding, and thus became even more rigorous and neutral than before. By insisting on objectivity and refusing to support reform activities, the foundations imposed the newly developed inferential statistics on social research (Smith, 1994).

Disunity and mistrust

From about 1930 to 1970, statistical analysis became almost mandatory for empirical or experimental research in all of the social sciences (Porter, 2008). During World War II and in the decades thereafter, quantification became part of a strategy of intervention and decision making, not merely of description (Smith, 1994). According to Porter (1995, p. 200), "the extraordinary modern success of inferential statistics must be understood partly as a response to conditions of mistrust and exposure to outsiders." Quantification served as an antidote to the conflicts of the twentieth century, because it made observations and experiments repeatable, and hence scientific knowledge was not dependent on faith (Porter, 1995). Not only the 1940s, but also the 1950s were times of extreme disunity and disorganization: Europe was literally divided in two and the United States was in the grip of the Cold War. In Smith (1994, p. 28) the sociologist George Lundberg argues that "If social scientists possessed an equally demonstrably relevant body of knowledge and technique [...], then knowledge would be equally above the reach of political upheaval. The services of social scientists would be as indispensable to Fascists, as to Communists and Democrats." Scientific objectivity seemed to provide an answer to a demand for impartiality and fairness. Smith concludes that quantification equated openness, and was implemented in the struggle against corruption, prejudice, and totalitarian regimes.

International communication

Daston (1992, p. 609) postulates that "Already in the eighteenth century, scientists had begun to edit their facts in the name of scientific sociability; by the mid-nineteenth century, the contraction of nature to the communicable had become standard practice among scientists." Beginning in the 1960s, when postwar tempers had begun to cool, the development of an international scientific community could continue. The rapid growth of English as a second language began during the 1950s and facilitated international study, cross-cultural research contacts, and worldwide publication (Ross, 2008). Research findings began to circulate across oceans and continents. Daston acknowledges that this growth of scientific communication was in part made possible by better communication methods and means of transportation, but argues that it cannot be attributed entirely to these technologies. The exchange of scientific knowledge required transparency, openness, and universalism. Cross-country and cross-cultural communication is by definition communication with people who are unknown to one another, and who thus have no personal basis for shared understanding. Through quantification, scientists have come to speak one and the same language, even if they use different mother tongues. Consequently, the language of quantification may have been even more important than English in establishing an international scientific community. (Porter, 1995)

Quantification challenged

As we have seen, social scientists' eagerness for quantification and objectivity was reflected in a demand for transparency, neutrality, and communicability, but as Porter (1995, p. 5) acknowledges "they provide no panacea." Porter (2008) notes that criticism of the loss of information due to quantification had already been stated in response to Quetelet's methods of averaging. By the 1980s, the discussed challenges were no longer evident, consequently scientists became increasingly critical of the utility of quantitative research and the validity of statistical decision making. Social scientists increasingly recognized the arbitrary rules on which statistical methods are founded. Rodger (2010) remarks that the twentieth century ended with a raging debate over the dichotomous judgment in null hypothesis significance testing (NHST). The NHST-controversy reached a crisis in the 1990s, especially stimulated by Cohen's (1994) passionate and compelling plea against its use.

In 1999 an American Psychological Association (APA) Task Force on Statistical Inference was convened to evaluate the status of NHST (Rodgers, 2010). The task force did acknowledge certain flaws in the use of inferential statistics in scientific decision making, but did not conclude that statistical significance tests should be completely banned. The APA-delegates reached consensus on a number of reforms, three of which Thompson (2002) regards as particularly relevant to the present discussion. First, the task force strongly urged authors to include effect sizes when reporting a p-value. Secondly, it was emphasized that confidence intervals (CIs) are very useful when interpreting data, and are therefore strongly recommended. Thirdly, the task force emphasized the importance of graphics to enhance the interpretation and communication of results.

Present and future practices

Cumming et al. (2006) investigated whether statistical practices have been changing since the publication of the APA recommendations in 1999. The reporting procedures of ten leading psychology journals were examined. At least in these ten journals, NHST continues to be the most frequently used technique, CIs are increasingly reported but still not common, and CIs are seldom used for interpretation. Furthermore, error bars are now commonly seen in graphics, but bars usually indicate standard errors and not the recommended CIs (Cumming et al., 2006). In addition to these findings, Scheff (2011, p. 265-266) concludes that, in social research the effect sizes appear to have been near zero for years and states that "the clearest meaning of small and nil effect sizes is that whatever the main causes are, these studies have not found them, and are moving no closer to them." The absence of relevant effects will remain undetected and unchanged if social scientists do not reform their analysis and reporting procedures.

According to Cumming and his colleagues, it is critically important that the social sciences change their emphasis from NHST to the estimation of effect size. Scheff similarly notes that statistics are misused when effect sizes are not reported, but additionally recommends the reevaluation of deduction and theory. According to Scheff, the application of statistics as a fixed set of procedures precludes creative thinking, while engaging in science requires both rigor and imagination. Furthermore, Rodgers (2010) recommends a modeling perspective, in which inferential statistics are only used to help evaluate the researcher's model or theory.

Conclusion

This article has attempted to reveal the circumstances under which quantification has come to assume a prominent position in the social sciences. The preponderance of the literature highlights the fact that quantification has been used for the purpose of being objective. In this way, quantification and objectivity have come to be intertwined. I have outlined roughly four contributions that account for the desirability of objectivity, and therefore for the triumph of quantitative methodology (viz.: the crisis of authority in the eighteenth and nineteenth century, the avoidance of controversy and the requirements of funding before and during World War I, the conditions of disunity and mistrust in the 1940s and 1950s, and the establishment of an international science in the second half of the twentieth century). Considering all the above, these four contributions seem to correspond to three phases in which quantification has served different aspects of objectivity: namely transparency, neutrality, and communicability. During the crisis of authority in Western societies, transparency was especially valued. In the first half of the twentieth century, neutrality became attractive. After World War II, communicability became of paramount importance.

Quantification has served the three aspects of objectivity due to its strict rules and universal language, but quantification has also eliminated critical judgment. The lack of

critical judgment in the social sciences stand at the heart of contemporary criticism, including the loss of information and the arbitrary rules involved with quantitative methodology. Today, social scientists are not confronted with the same challenges as their predecessors and should therefore not cling to the methods valued under these former conditions. Moreover, current practice has failed to reveal relevant effects. The APA-recommendations of the 1990s did not result in needed reforms. Consequently, roughly the same criticism applies to current statistical use, including the emphasis on effect size and confidence intervals. Quantification does not have to preclude critical thinking, so quantitative methodology and critical judgment should not be viewed in opposition to one another. In order to move forward, social scientists must radically reassess their methods.

In conclusion, quantification has served social scientists in the establishment of an objective science, especially in times of disorganization and distrust. At present, the lack of critical judgment is criticized, because the effectiveness of quantification is no reason for scientists to eliminate their own critical view. The time has come to move beyond the arbitrary decision-making rules of quantification and to start to think critically and creatively, because many effects are still to be revealed.

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