

voices, cars, anti-Semitism, and any other uncomfortable singularity.”

The incoherence and ugliness of such assessments contrast with the clarity and grace of the laudations read at the recent conference in Paris cosponsored by the Clay Mathematics Institute and the Institut Henri Poincaré celebrating Perelman’s proof. Bill Thurston, for example, closes his by remarking that “in our modern society most of us reflexively and relentlessly pursue wealth, consumer goods, and admiration. We have learned from Perelman’s mathematics. Perhaps we should

also pause to reflect on ourselves and learn from Perelman’s attitude toward life.” (See <http://www.claymath.org/poincare/laudations.html>.) One cannot expect Gessen to understand the mathematics, but one wishes for some sense of her own limitations, some caution, some generosity, and some openness to difference. Her cheeky self-confidence and willingness to trample on what she does not understand, so typical of popular culture, wears thin. Perelman and his work deserve better. So, too, do the discipline and the profession.

## Book Review

# Numbers Rule: The Vexing Mathematics of Democracy, from Plato to the Present

*Reviewed by Jonathan K. Hodge*

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### **Numbers Rule: The Vexing Mathematics of Democracy, from Plato to the Present**

*George G. Szpiro*

*Princeton University Press, 2010*

*US\$26.95, 248 pages*

*ISBN-13: 978-0691139944*

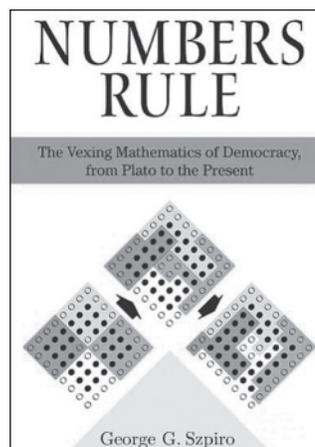
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In recent years, the mathematical social sciences—particularly voting and social choice theory—have become a hot topic in both academia and popular culture. Liberal arts mathematics courses now often include sections on fair division and voting theory, and a number of recent textbooks and monographs devote themselves entirely to these topics.

Szpiro’s book focuses on one such topic, namely, how mathematics—and mathematicians—have impacted both the theory and practice of democracy. It is an excellent addition to a growing body of literature that aims to convey ideas from the mathematical sciences to general audiences. Moreover, Szpiro’s book is unique among other offerings in

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the mathematical social sciences in that it focuses on the historical development of the field. The narrative is engaging, witty, and easy to read.

As the book’s title would suggest, the story begins in Athens, in the fifth century BC. Szpiro describes how the Athenian government was set up so

that “everybody who had any sort of interest in running the city could either participate in the Assembly as he pleased, or was selected by lot, as in the Council, the Court, or the civil service” (p. 7). Plato was highly critical of this form of unrestricted democracy. In fact, it was a majority decision (280 of 501 jurors) by a randomly selected jury that had condemned his beloved teacher, Socrates, to death. Plato concluded, as Szpiro puts it, that “regular folks were not fit to rule and to dispense

justice” (p. 2). He came to despise democracy and was “chastised as the worst anti-democrat by his detractors” (p. 1).

Plato’s counterproposal, as conveyed by the Athenian stranger in the unfinished manuscript, *Laws*, involved multistage elections, significant privilege to the wealthy and well educated (who, to Plato, were one and the same), and other suggestions that, in Szpiro’s words, “seem pulled out of a hat like a magician’s rabbit” (p. 17). Plato’s earlier work, *The Republic*, largely ignored elections and votes, which were viewed as superfluous because, as Szpiro summarizes, “the qualities necessary to become philosopher-king...do not often grow together” and “individuals who possess all these qualities are so rare that the state will hardly ever find more than one who fits the job description” (p. 20). In *Laws*, however, Plato dives in head first, setting the stage for centuries of future debate about the merits and implementation of democracy.

What we see in the story of Plato, Socrates, and Athenian democracy is a fundamental tension between competing social values. How is the ideal of full and equal participation in government to be balanced against the fact that majorities can, and sometimes do, endorse erroneous or unjust propositions? How does one ensure that government officials are qualified for the tasks under their charge when they are selected based solely on popular opinion? These are difficult questions, and in many ways they set the tone for the remainder of the book, which Szpiro accurately describes in the preface as “an elucidation and a historical account of the problems and dangers that are inherent in the most cherished instruments of democracies” (p. x).

As the account unfolds, the reader is given the opportunity to turn back the clock and embark on a journey that spans thousands of years and includes both well-known figures and their lesser-known counterparts. For instance, anyone who has studied voting theory is undoubtedly familiar with the work of eighteenth-century French contemporaries Borda and Condorcet. But readers might be surprised to learn that both the Borda count and Condorcet’s method of pairwise comparisons were proposed centuries earlier, the former by a German cardinal named Nikolaus von Cusanus and the latter by a Catalan monk named Ramon Llull. In fact, Szpiro notes that “until quite recently most researchers believed that interest in the theory of voting and elections had started toward the end of the eighteenth century, at the time of the French Revolution. But toward the middle of the twentieth century, medievalists were surprised to discover manuscripts in the Vatican library and elsewhere that showed that sophisticated ideas had already been around half a millennium earlier” (p. 33). Szpiro has clearly done his research with

this book, and the result is a strikingly thorough and engaging read.

One of the things I like most about the book is that it reveals mathematics to be a decidedly human endeavor, fraught with controversy and able to both expose and help solve real problems. Both the characters and the plot of the story defy the one-dimensional stereotypes that students sometimes associate with mathematicians and the study of mathematics. The historical figures surveyed include economists, lawyers, theologians, military officers, philosophers, artists, politicians, scientists, and yes, mathematicians. The personal and professional lives of each are explicated in detail both within the text and in biographical appendices at the end of each chapter. The effect is to add meaning to the intellectual contributions explored and to place them in the broader context of human experience.

Part of that experience includes spirited debate and a fair dose of name calling. Recall our friends Borda and Condorcet. As it turns out, they weren’t friends at all. In fact, Condorcet was a fairly vocal critic of Borda. As Szpiro notes, “Condorcet did not think highly of Borda. In fact he did not even consider him a very capable mathematician... Condorcet wrote that Borda likes to talk a lot and wastes his time tinkering with childish experiments” (p. 89).

But the rift between Borda and Condorcet was nothing compared to that between Edward V. Huntington, a professor of mathematics at Harvard, and Walter F. Willcox, a professor of social science and statistics at Cornell. Their rivalry, which spanned decades in the early 1900s, involved polarizing rhetoric, highly publicized personal attacks, and more than a hint of deception. The substance of Huntington and Willcox’s debate was the problem of apportionment—that is, how to allocate the appropriate number of seats to each state in the U.S. House of Representatives. Once again, the difference of opinion between the two professors was ultimately one of competing values. Willcox was a proponent of Webster’s method of major fractions, which shows no bias to either large or small states, whereas Huntington supported Hill’s method of equal proportions, which minimizes the relative differences in representation between the states. (Incidentally, Huntington could be viewed as the winner in this battle, as the method of equal proportions was adopted in 1941 and is, to this day, the method used to apportion the U.S. House. On the other hand, Michel Balinski and Peyton Young would later provide some vindication for Willcox, stating: “It seems amazing therefore that Hill’s method could have been chosen in 1941... and that Webster’s method was discarded. A peculiar combination of professional rivalry, scientific error, and political accident seems to have decided the issue” (pp. 195–196).)

The stories of Borda and Condorcet and of Willcox and Huntington serve to illustrate another valuable takeaway from Szpiro's book—namely, it dispels the myth that mathematics is a value-free endeavor, a matter of black and white, of finding the one right answer. If there is anything to be learned from the mathematical study of voting and elections, it is that sometimes there are no universally correct answers. Paradoxes abound, and the correct procedure often depends on the values and beliefs of those using it. Arrow proved this for voting systems, and Balinski and Young did the same for apportionment methods. These examples and many others support Bradley and Schaefer's [1] assertion that as the mathematization of the social sciences continues, "norms, values, and purpose need to become part of the common discourse of researchers." Szpiro notes that even the great mathematician Pierre-Simon de Laplace "did not find it beneath himself to bend the rigorous rules of mathematics somewhat when needed" (p. 97).

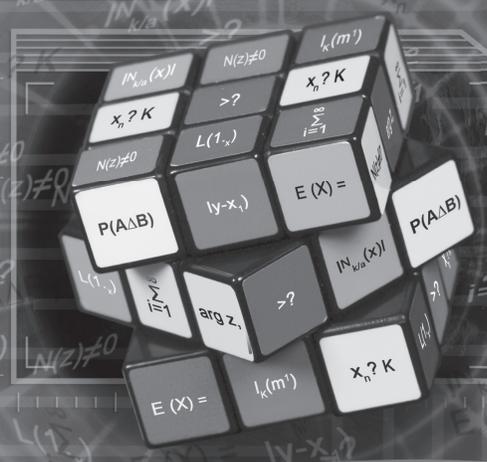
In summary, Szpiro's book fills a unique role in an increasingly popular field. Being written for general audiences, it suffers from some oversimplifications (such as stating that "misrepresenting one's preferences brings no advantage" (p. 212) in approval voting; in fact, approval voting is not completely immune to strategic voting, although it is less vulnerable than other nonranked systems) and minor imprecisions in language (for instance, the occasional conflation of the words *plurality* and *majority*). My only other substantive complaint is that the book feels like it ends too soon. The final chapter mentions single transferrable vote and approval voting, but only briefly. In addition, although works by some of today's leading mathematical voting theorists, such as Donald Saari and Alan Taylor, are included in the bibliography, they are not discussed at all within the text. Of course, every author must make choices about what to include and what to omit. Szpiro, in general, has chosen well. The result is a readable, engaging, and intellectually stimulating book that accomplishes its goal of "[introducing] readers to the subject matter in an entertaining way" (p. x).

#### Reference

[1] W. J. BRADLEY and K. C. SCHAEFER, *The Uses and Misuses of Data and Models: The Mathematization of the Human Sciences*, Sage Publications, 1998.

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