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Models as Weapons: Review of *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* by Cathy O'Neil (2016)

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Abstract

Cathy O’Neil. *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (New York, NY: Crown) 272 pp. ISBN 978-0553418811.

Accessible to a wide readership, Cathy O’Neil’s *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* provides a lucid yet alarming account of the extensive reach of mathematical models in influencing all of our lives. With a particular eye towards social justice, O’Neil not only warns modelers to be cognizant of the effects of their work on real people—especially vulnerable groups who have less power to fight back—but also encourages laypersons to take initiative in learning about the myriad ways in which big data influences their lived experiences. In this review, I highlight O’Neil’s core argument and provide beginning thoughts on how the *Numeracy* community might take up the book moving forward.

Keywords

mathematical models, social justice, numeracy, quantitative literacy

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Cover Page Footnote

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Pairing words such as “math” and “weapons” in a book’s title is sure to catch readers’ attention. Beyond its sexy title, Cathy O’Neil’s (2016) *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* is more than pulp fiction for lay audiences—it is a sobering wakeup call for all of us as citizens to be aware of the ways in which mathematical models exert an increasing influence on our lives. Having graduated from Harvard with a PhD in mathematics in 1999, O’Neil worked in academia until 2007, the year she left to pursue a career as a quant in New York City’s finance sector. Her subsequent “journey of disillusionment” (p. 32) lasted about four years and included stints in hedge funds where she participated in the practices of creating, adjusting, and benefitting from the mathematical models she largely distances herself from today. Having seen the culpability of the finance industry in engendering the 2008 collapse of the U.S. housing market, O’Neil left the industry in 2011 to write about what she had witnessed and to work to transform practices in banking and finance.

O’Neil’s *Weapons of Math Destruction* is an attempt to disrupt what she participated in. She hones in on harmful mathematical models, which she calls weapons of math destruction, or WMDs for short. O’Neil argues that WMDs systematically tend to impact individuals from disadvantaged groups, including racial minorities and those in low-income neighborhoods, among others. O’Neil’s argument is that WMDs threaten democracy in the U.S. insofar as their opacity, scale, and damage reinforce existing inequalities through negative feedback loops. Moreover, they create a false sense of inevitability through the semblance that they are fair and unbiased. With examples ranging from value-added models for teacher evaluation and the *U.S. News & World Report*’s various rankings for colleges to crime prediction algorithms and exams that filter job applicants, O’Neil uses the majority of the text to make the case that the application of mathematical models is often harmful. She notes that many of these models are opaque to those whose lives are affected by them because the models use proxies as metrics for characteristics (or even proxies of proxies). When such models have the potential to negatively impact humans, O’Neil argues that they should not be unquestionably accepted as part of any democratic society. Such an argument, in spite of its (potential) flaw of avoiding existing literature on social reproduction¹ or the misuses of quantitative information (e.g., Best 2001), will likely resonate well with members of the *Numeracy* community who aim to empower students as citizens living in the data deluge.

Indeed, important for many in the *Numeracy* community, the book is accessible to secondary and postsecondary students at all mathematical levels, and its message is relevant to those pursuing careers both inside and outside of STEM fields. One

¹ Social reproduction is a common construct in sociology for understanding how structures tend to reproduce existing inequalities. See Willis (1977) for an example of this in relation to schooling.

downside of such accessibility is that the actual mathematics behind much of what O’Neil discusses is not included in the text, and thus the text could reinforce a student’s belief that mathematics is beyond reach or that its effects are always insidious. The latter would run counter to O’Neil’s purpose in writing the book in the first place. With that in mind, I can readily imagine potential lessons for diverse audiences that utilize O’Neil’s text in some way, a few of which I have already piloted this past academic year (Table 1).

Table 1.
Highlighting WMDs in the classroom.

Anchor chapter	The model and associated problems	Classroom uses
Chapter 3 Arms Race: Going to College	The <i>U.S. News & World Report's</i> system for ranking universities, programs, and majors uses specific metrics that universities are actively able to exploit; this has resulted in some universities taking actions to increase their ranking in ways that are disingenuous. Though not opaque, the mode’s scale is wide and its effects are largely negative (to O’Neil).	At Michigan State University (MSU), I have asked students in a quantitative literacy course to read this chapter and then analyze the case of graduate school rankings for education, the goal being to see that administrators at MSU actively engage in practices to take advantage of the model to maintain the College’s dominance in rankings.
Chapter 5 Civilian Causalities: Justice in the Age of Big Data	Software such as PredPol and policies such as New York City’s stop-and-frisk program use models to predict where crime is likely to occur; these models favor efficiency over fairness. By using nuisance crimes as proxies for violent crimes, these models ultimately disadvantage neighborhoods with higher proportions of racial minorities and those of low socioeconomic status. That is, by more policing of nuisance crimes, there is more data for the model to draw from to accurately predict <i>nuisance</i> crime, which reinforces the likelihood that police will surveil specific areas for all crimes—and hence the loop continues.	The feedback loops associated with these models (and other examples throughout the book) are relevant in many disciplines, including sociology, criminal justice, and geography, among a host of others. I have used this chapter for a course in mathematical problem-solving, asking students to think about how they would actually go about using a mathematical model for crime prediction in a way that would not systematically disadvantage specific groups.
Chapter 9 No Safe Zone: Getting Insurance	Honing in on the practices of insurance companies (and actuaries in particular), O’Neil argues that models for setting insurance premiums are opaque (e.g., one cannot see <i>why</i> they pay a specific premium) and use proxies such as credit scores that reinforce existing inequalities.	An obvious use for this chapter is in actuarial science programs. Given that students have little control over whether their company is driven foremost by profits, there are certainly no easy answers here. Nonetheless, I can readily imagine an instructor devoting time to discussions of the ethics behind insurance practices.

Weapons of Math Destruction is at once both a call for quantitative literacy and for social change; though not grounded in the jargon of quantitative literacy, O’Neil’s message is eerily similar to that of Orrill’s (2001) preface to *Mathematics and Democracy* and adds to the growing list of texts aimed at lay audiences concerning the supposed dangers of ignorance as we find ourselves in the milieu of a data-driven society. Given that it took about three hours for me to savor an initial pass at reading the text, I do not believe that it would overburden

students if they were assigned the text as part of a course that is already brimming with material. To boot, the book does make for a fun read. I hope O'Neil writes a follow-up that includes more of the mathematical "meat" behind her argument; nevertheless, for the time-being, she has already given the *Numeracy* audience plenty to chew on.

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