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Two Popular Books for Quantitative Literacy: *What the Numbers Say*, and *The Numbers Game*

Abstract

Niederman, Derrick, and Boyum, David. *What the Numbers Say: A Field Guide to Mastering Our Numerical World*. (New York: Broadway Books/Random House, 2003). 288 pp. Hardcover, ISBN 978-0-7679-0998-3. Paperback, 978-0-7679-0999-0. Available as an eBook.

Blastland, Michael, and Dilnot, Andrew. *The Numbers Game: The Commonsense Guide to Understanding Numbers in the News, in Politics and in Life*. (New York: Gotham Books/Penguin, 2009). 192 pp. Hardcover, ISBN 978-1-5924-0423-0. Paperback, ISBN 978-1-5924-0485-8. Available as an eBook.

Popular books on quantitative literacy need to be easy to read, reasonably comprehensive in scope, and include examples that are thought-provoking and memorable. In contrast to textbooks, popular books can dispense with exercises and structure, and instead offer an informal voice and an inviting style. In this genre John Allen Paulos' *Innumeracy* is widely regarded as a classic. However, Paulos' book is out of date, and it takes a whimsical approach to many topics. The goal of this review is to acquaint the reader with two more recent entries into the genre. *What the Numbers Say* by Derrick Niederman and David Boyum takes an expansive view of quantitative literacy. *The Numbers Game* by Michael Blastland and Andrew Dilnot, on the other hand, focuses on reasoning surrounding statistics and uncertainty in contemporary society. *The Numbers Game* is a revised American edition of *The Tiger That Isn't*, which grew out of a BBC radio program, *More or Less*.

Keywords

Book Review, Quantitative Reasoning, Statistical Literacy, Derrick Neiderman, David Boyum, Michael Blastland, Andrew Dilnot

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Introduction

There are several textbooks currently on the market designed to assist students with developing their quantitative reasoning skills. The level and approach of these volumes vary widely, but they share features that make them familiar tools for teachers. They structure material in ways designed to assist in its development in class, and they facilitate assignment of readings and exercises for homework.

As valuable as these features are, sometimes what's called for is a more relaxed and subtle approach to aiding the reader in connecting elementary mathematics to everyday life. Like a good text, a book providing the more relaxed approach needs to be easy to read; it must be reasonably comprehensive in scope; and the examples in it should be thought-provoking and memorable. But, in contrast to texts, these books can dispense with exercises and structure, and instead offer an informal voice and an inviting style.

This genre of popular books about quantitative reasoning has a long pedigree, and John Allen Paulos' *Innumeracy* is widely regarded as a classic. In some ways *Innumeracy* is the archetype, having initiated a steady stream of books that share its goal of informing the reading public of the utility and fun of numerate thought. However, the timeliness of these books is critical. For example, when Paulos computes the volume of human blood in the world, he uses 5 billion as the global population, more than 25% short of the roughly 6.7 billion that currently inhabit our planet. Out-of-date figures rob these books of utility by misleading readers with inaccurate information. Further, although Paulos' whimsical appreciation for answers to questions that are of abstract interest (like the total volume of human blood) is part of the enchantment that the book has on many readers, other readers—especially students—seek more quotidian goals to motivate their investigation of quantitative reasoning.

The goal of this review is to acquaint the reader with two more recent entries into the genre that offer more utilitarian approaches, *What The Numbers Say* by Derrick Niederman and David Boyum and *The Numbers Game* by Michael Blastland and Andrew Dilnot. The latter is a revised American edition of *The Tiger That Isn't*, the original publication having been in Britain, and aimed at the British public.

The Breadth of Quantitative Reasoning

Neither of these books was written by a mathematician, which is a reassuring sign that others recognize the critical importance of developing quantitative literacy skills in the general public. Both are written for an educated and inquisitive audience with the maturity to appreciate the significance of social issues and their public debate, and both draw examples from these venues. While this

circumscribes the intent of *The Numbers Game*, *What the Numbers Say* has broader aspirations of developing numerate approaches and habits in the reader's life. In other words, *The Numbers Game* focuses on statistical literacy, while *What the Numbers Say* offers a more expansive definition of quantitative literacy.

Some examples from the latter will illustrate its larger scope: determining the five-year cost of ownership of a Kia Sephia relative to that of a Honda Accord (more despite the Kia's lower purchase price), and determining the number of usable and distinct gear combinations on a 27-speed bicycle (they say 15) indicate the power of quantitative reasoning for a consumer. The book also discusses gambling not as a public policy issue, but as a means of developing the reader's appreciation for chance and risk.

Both these books are carefully structured and well written. For three years, your reviewer has used *What the Numbers Say* for reading assignments in a writing course designed to investigate connections between quantitative literacy and social justice. The students consistently said that this book is the most enjoyable for the course. The class changed to *The Numbers Game* this year, and the students' reaction to it is also positive; it is another book that students willingly read beyond assigned page limits. This is a relief, since Niederman and Boyum have not come out with a new edition of *What the Numbers Say*, which is now getting long in the tooth. For example, the car comparison offered was for the 2001 model year—cars long vanished from new car showrooms, and now dwindling even in used car lots. Similarly, many other examples in the book are becoming dated. Another instance: the book describes the famous Olympic figure skating competition of the 2002 games in which the outcome between Karen Hughes and Michelle Kwan depended on the performance of Irina Slutskaya. However, it doesn't delve into the subsequent controversy that did not abate as a result of revisions in the scoring procedure instituted by the governing body.

Despite its lack of currency, the previous example highlights one of the strengths of *What the Numbers Say*, its breadth of coverage. Although the phrase "independent of irrelevant alternatives" (IIA) is never mentioned in the book, this example gives a cursory glance at Arrow's theorem and social choice theory, an example of quantitative knowledge with far-reaching practical applications that is rarely taught in the high school curriculum. What is more, the authors correctly cite John Nash as the first user of IIA, a concept widely attributed to Kenneth Arrow. But Nash used a fundamentally similar axiom in a game theory paper in 1948 that is not cited in Arrow's later dissertation and book. This speaks to the erudition and depth of knowledge these authors offer. Though not mathematicians, they are clearly mathematically knowledgeable and accomplished at conveying mathematically sophisticated ideas to a general audience.

Another idea exceptionally well conveyed is the importance of velocity in comparing the relative size of two dynamic groups. Using the example of hospital stays, with the groups being chronically ill and transient patients, the book points out that while at any moment in time the chronically ill might occupy a majority of the beds, over time the rapid turnover of transients allows the hospital to treat far more of them. Thus the large majority of the patients served by the hospital in a year could be transients, even though the majority in any snapshot of occupancy is chronically ill. This principle is applied to resolve apparently conflicting claims in the debate over welfare reform, and a novel related argument suggests that “white flight” does less to explain the diminution of white population in racially integrated neighborhoods than does “white avoidance.” (Apparently, whites are less likely than blacks to move out of many such neighborhoods, but also even less likely to move into them.)

The book moves easily from the appropriate winnings for a gambler who bet on the unlikely New England Patriots’ Super Bowl win in 2002, to the furor over the 1941 American League (baseball) MVP, to a thorough debunking of the possibility of ethanol replacing petroleum as an energy supply for the United States, to an explanation of the appropriateness of progressive structure in an income tax. The topics range in their weight and importance, but the quality of argument and the clarity of the prose are steadfastly high.

The final chapter of the book, entitled “A Peace Offering for the Math Wars” takes the reader in yet another direction unparalleled in *The Numbers Game*. The authors take a stand for teaching both mathematics and quantitative reasoning in high school. They speak out against the use of calculators in math classes, and advocate the value of a liberal arts education and the prominent role that mathematics ought to play in it. They hold that quantitative reasoning deserves a far larger role in high school, but not earlier, including more substantial use of quantitative argument in classes outside of mathematics.

The Centrality of Statistical Literacy

The Numbers Game, by contrast, is more narrowly focused on reasoning surrounding statistics and uncertainty in contemporary society. Where *What the Numbers Say* builds to a discussion of statistical inference in its penultimate chapter—with many detours away from statistical reasoning of the sort mentioned above—*The Numbers Game* expounds steadfastly on the pitfalls of understanding data, with chapters devoted to common mistakes, such as misinterpreting random variation over time with a trend, or relying too heavily on averages to characterize a wildly disparate population. It gets to inference around the middle of the book, and builds on this a more nuanced discussion of the use and abuse of statistics.

There are some topics that receive emphasis in both books. For example, they both discuss at length the importance of reflecting on the *relative* size of a number, pointing out that billions can be small and tiny fractions large in certain situations. They both emphasize the power and simplicity of the question “Is that a big number?” *The Numbers Game* devotes an entire chapter to developing the usefulness of this question, offering several examples of its application. For example, it investigates a proposal that the British government spend £300 million to create one million new openings for day care over the course of five years. The authors note that this amounts to £1.15 (about \$2.30) per week per opening. Thus this is judged to be a small number, since it could not possibly pay for the day care for the children.

Although *What the Numbers Say* has broader scope, *The Numbers Game* does offer some useful insights that are unique. For example, the topic of risk is treated extensively, with a chapter-long development of the importance of distinguishing between relative and absolute risks and the appropriate use of each. It is an original, though hardly unique, effort to debunk increasingly common obsessions about low-probability events. Though the examples are predominantly British, it is easy to find counterparts in the US press that have similar themes, expressing horror at large increases in relative risk while ignoring the tiny magnitude of absolute risk. While *What the Numbers Say* neglects this topic, it does devote an entire chapter to the topic of percentages, their proper use and common abuse. And this instance is an exception. Usually the difference in treatment of statistical topics between the two books is one of depth, not scope. For example, *The Numbers Game* devotes a chapter to the difficulty of establishing causation, and the treachery of assuming that association implies a causal relationship. The same topic gets a paragraph in *What the Numbers Say*.

The Numbers Game also offers valuable object lessons on the importance of facts in shaping public discourse, pointing out that data can change public opinion. On a related point, it devotes a chapter to the treacheries of using statistical measurements to design and assess policy. *What the Numbers Say* makes the more sweeping assertion that “measurement inevitably influences behavior in both desirable and undesirable ways,” but offers only a few pages to developing the idea.

Both books encourage a cautious approach to quantitative information. Each grounds its cautionary message in the origin of the information; in each, measurement is the first substantial topic, though with quite different tacks. *The Numbers Game* devotes its discussion of measurement, specifically counting, to exposing the difficulties associated with knowing what is actually being measured (or counted). The chapter opens by demonstrating how hard it is to determine how many centenarians (those older than 100 years) there are in the United States, but the most memorable example in the chapter investigates a newspaper article

entitled “Yob Britain! 1 in 4 Teen Boys Is a Criminal!” (Yob is slang for a rude and aggressive boy; it is boy spelled backwards.) The main thrust of the exposition is that, when the actual definition for “criminal” is unveiled, it is surprising that the fraction of teen boys so labeled is only a quarter. To be labeled a criminal, all a boy had to do was respond positively to this survey question: “Have you ever used force or violence on someone on purpose, for example by scratching, hitting, kicking, or throwing things, which you think injured them in some way? Please include your family and people you know as well as strangers.” Blastland and Dilnot go on to point out, “According to these definitions, the authors of this book must make their confession: both were serious or prolific offenders in their youth.” Their point, that the definitions used in counting must be considered carefully when interpreting data, is powerfully made. The reader is encouraged to consider this not just when reading tabloids, whose principal marketing strategy is shock and outrage, but also when approaching any study for policymaking or media consumption.

By contrast, *What the Numbers Say* offers a variety of insights associated with measurement, beginning with the importance of knowing and understanding units used in the measurement. It offers examples such as “The Metric Martyr,” a British grocer who was convicted of breaking the English “Weights and Measures Act” for selling bananas by the pound. The authors point out that the grocer was trapped between their two primary recommendations for dealing with units: (1) that “quantities should be expressed in units that can be easily grasped” and (2) that “units should simplify calculations and comparisons.” His customers thought in Imperial units, like pounds, but the law required him to measure in metric units, specifically designed for ease of calculation and comparison. There is no analog to the “yob” story, but there is a discussion of the difficulty of comparing the capacities of backpacks, because the manufacturers use quite different methods for measuring them. Niederman and Boyum also point out the peculiar difficulties associated with measuring fuel efficiency by miles per gallon rather than gallons per mile, and the appropriateness of measuring by weight rather than volume for baking. These lessons are transferable to the realm of polling and statistics more broadly, but it is characteristic of *What the Numbers Say* that they are taught in a context that is more personal than publicly useful.

What is more, this comparison gets at the main difference between these two books. While *What the Numbers Say* offers an exposition on quantitative reasoning broadly constructed, *The Numbers Game* maintains its focus on the use and abuse of statistics.

Comparing the Styles of the Two Books

The Numbers Game grew out of a BBC radio program, *More or Less*, originally hosted by the authors, that examines the use of numbers in the news and public discourse, and so this firmly delimits its scope—no discussion of the cost of cars or the merits of math education here. And, as its genesis suggests, even this “American” edition of the book leans heavily on examples drawn from Britain. The authors are careful to provide the readers with adequate context for the quantitative reasoning arguments, for example, reminding the reader of the conversion rate between pounds and dollars, and repeatedly glossing that the NHS is the National Health Service. And the lessons that they offer certainly transcend their context; however, the focus on British politics and public life is unmistakable, and make your reviewer wish that a book existed offering comparable breadth of attention to the creation, use, and abuse of statistics in the United States.

It is worth mentioning that the podcast version of *More or Less* is available over the Internet. The program, now hosted by Tim Harford, an economist with an excellent track record for reaching popular audiences, still focuses on the use of numbers in the news, including sports. The show’s focus on Britain and the interests of the British, makes your reviewer long for a comparable program that treats the role of numbers in public discourse in the United States. NPR’s *Planet Money* and *The Math Factor* both come close, but miss the breadth of numerate discourse on issues of social and political interest that characterize the British show. Carl Bialik’s column and blog, *The Numbers Guy*, published by *The Wall Street Journal*, is a closer analog to the BBC show, but so far it is only the written, and not the spoken word.

Both books offer memorable examples to aid in remembering the principles they offer, and my students have found that the lessons stay with them at least through the course of the semester that commences with reading one of these books. *What the Numbers Say* begins with a brief development of “The Ten Habits of Highly Effective Quantitative Thinkers,” and deserves credit for promoting Pareto’s Law (that 80% of costs or benefits are associated with 20% of sources), but the book doesn’t associate the law with a memory-catching description. The authors refer to “Pareto’s Law” throughout, assuming that the reader will recall from the economist’s name the nature of the result.

In contrast, *The Numbers Game* offers readers a wealth of clever taglines that offer the reader a conceptual summary of the topic. Some of these are better than others; your reviewer still puzzles over whether “the white rainbow” leaves a general reader with an honest conceptual understanding of the shortcomings of averages. (The average frequency of visible light falls near the color green, even though all frequencies combined—which might be thought of as summed, but not

in a strictly mathematical sense—are perceived as white.) Among the best of these is the phrase used as the title for the British version of the book, the tiger that isn't, as a description of the human tendency to discern patterns in randomness:

Some argue, plausibly, that we evolved to see a single cause even when there is none, on the basis that it is better to be safe than sorry, better to identify that pattern in the trees as a tiger, better to run—far better—than to assume that what we see is a chance effect of scattered light and shifting leaves in the breeze, creating the illusion of stripes. But this habit, ingrained, defiant, especially if indulged by a snap decision, makes us wretched natural statisticians. Most often the pattern *will be* a chance effect, but we will struggle to believe it. “Where’s the tiger?” we say. “No tiger,” says the statistician, just chance, the impostor, up to her callous old mischief.

Despite any shortcomings of these encapsulations, the authors deserve great credit for their creation, as they offer readers a genuinely useful way to carry difficult concepts from the book and into their daily lives. And that is the main benefit of both these books; they offer practical advice in ways that encourage its use beyond their covers.

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Your reviewer has a minor objection to the writing style in *The Numbers Game*: it occasionally lapses into awkwardness. Consider this unlovely passage:

All we seek to do is reconnect what anyone can know with what now seems mysterious, reconnect numbers with images and experience from life, such that, if we have done our job, what was once baffling or intimidating will become transparent.

Now, compare it with a comparable passage in *What the Numbers Say*:

... In showing you the ways of good quantitative thinkers, we are confident that you already know all the math you need. We may jog your memory from time to time, but we’re talking about the basics—arithmetic, percentages, fractions, decimals, square roots, and exponents. If you’re stumped every time you hear someone say, “That’s six of one, a half a dozen of the other,” then perhaps you do need a remedial math book. But otherwise you’ve come to the right place and we’re delighted to have you aboard. Be prepared to see numbers in a brand new light.

As this comparison suggests, *The Numbers Game* lapses into constructions that, while clever, seem needlessly obtuse. The prose of *What the Numbers Say* is no less clever, but its clarity and forthrightness is a strength, especially since the subject matter will seem daunting enough to many readers. This might be a cultural difference between Britain and the United States, but even so, the more convoluted British constructions may put off many American readers already intimidated by the topic.

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Unless Niederman and Boyum revise and update *What the Numbers Say*, it will join *Innumeracy* as a classic in the genre that lacks currency. Readers of

Numeracy will share your reviewer's hope that this does not happen, as the book fills a niche with very few competitors.

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These are both valuable books, and not just for pedagogical purposes. You might give friends either of these books without fear of reproach for foisting a quantitative reasoning course on the unenrolled, for instance. *The Numbers Game* ought to be considered a must-read for creators and readers of news in the United States or Britain. According to its jacket, the book is “now used for training all BBC journalists,” a development your reviewer applauds. *What the Numbers Say* is a book with broader scope and writing that is impressive on several levels. It substantiates the importance of quantitative reasoning in life beyond work and politics. It deserves the attention of the numerate and those who aspire to numeracy.