Why I Believe People Need *Painting By Numbers*

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Abstract

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This piece briefly introduces my *Painting By Numbers*, which aims to take the core messages of the QL/QR community from academic and professional circles to the rest of the citizenry. I describe the book in the context of the critical need for the most basic numeracy tools to help consumers of news, information, and analysis—delivered through traditional and contemporary social media outlets—determine where a reported numerical result lies on the scale from utter nonsense to a widely established and accepted "fact."

Keywords

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Cover Page Footnote

Jason Makansi earned his BS in Chemical Engineering from Columbia University, is an Independent Consultant in the Electricity Industry, and is the author of three professional and technical books, hundreds of articles in professional and academic journals, numerous short stories, and a debut novel (available in early 2018).

Introduction

My goal was simple. Emulate Darrell Huff's classic[1] *How to Lie with Statistics* (Huff 1954), but update it to go beyond statistics and add some math, computer models, and algorithms. It had to be a book *anyone* could read, appreciate, and learn from – no political or cultural ax to grind, and no need for background or experience in math or science. It had to appeal to people who "don't do math" as well as math experts who are far removed from everyday numerical BS and need a refresher on how the public engages with numbers. It had to entertain and educate, like Huff did.

I had been thinking about such a book for more than decade. I wrote the first draft in February 2016. The strategy and format were also simple. I outlined twelve commandments (see Table 1), each a few words only, rules to apply when confronted with a numerical result. Then I used as examples numerical results which confronted me over the two-week period I sat down to write the book. Some were torn from the headlines of a local newspaper, and some from the articles in a national paper of record. One example poked fun at my mother's devotion to vitamins, another at my father's devotion to doctors. One came from a consulting project I was working on at that time.

The impetus to finish and get the book published came the morning after the presidential election in November. The inability of polling to predict voting outcomes was, in the words in my book, "the gift that kept on giving" with respect to critical numerical concepts. We were facing what I considered that morning to be the "mother of all outliers."

It should be noted that my education and career pushed me towards such a book. First, the most valuable technical course I took in engineering school at Columbia University was an engineering lab. Most of the equipment was antiquated and didn't work well. The professor required that every lab report be accompanied by a thorough error analysis of the experimental methods and measurements, a formal and rigorous process for understanding the quality of the results. Because of the poor

Table 1.

Twelve Commandments for a Numerical Skeptic

1	Acknowledge Error
2	Identify Assumptions
3	Find the Weakest Link
4	Separate Past Performance from Future Results
5	Question the Picture
6	Understand the Business Model
7	Don't Confuse Feelings with Measurements
8	Suspect the (Co)mpany They Keep
9	Hold Credentials at Arm's Length
10	Respect the Human Condition
11	Don't Start with the Answer
12	Don't Confuse Human Systems with Physical Systems

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[1] See Steele 2005.

condition of the lab equipment, the error analysis was far more instructive than the results of the experiments.

Second, though I worked as an engineer for three years after college, I took a job as an editor for a business/industry magazine owned by McGraw Hill and worked my way up to Chief Editor of the publication. In this role, I often had to play the role of a skeptic investigating new technologies and systems and how well they performed in the field. Thus, I became an analyst and communicator of science and technology more than a practicing engineer – an armchair engineer, as I like to say. From there, I launched a very successful independent consulting business. Oh, and in the meantime, I wrote and published three books of non-fiction (Makansi 1985, 2002, 2007) and launched numerous businesses, ventures, and big ideas for my consulting practice and my clients.

In short, I spent a career *converting technical and numerical results into words and vice versa*. And I have observed how people – academic, professional, and lay – respond when numerical results are presented to them. Usually, that response is timid at best, and ignores the *quality* of said results, *unless there is a political or cultural reason or personal gain to be had* for questioning them.

On Quantitative Reasoning / Quantitative Literacy

QR/QL tools, such as those offered in *Painting By Numbers*, are more critical today because reported numerical results come from computer models and algorithms that are often vaguely described, proprietary, opaque, or otherwise not well explained as critical context around the results.

Others have recently taken notice as well of this need to distinguish numerical BS, from a very similar angle. For example, Professors Carl Bergstrom[2] and Jevin West[3] created a new course at the University of Washington, "Calling Bullshit in the Age of Big Data,"[4] a one-credit seminar through the UW Information School. Professor Charles Wheelan,[5] of Dartmouth College, best-selling author of *Naked Economics* (Wheelan 2002, 2010), published *Naked Statistics* in 2014,[6] where he also notes (in the acknowledgment front matter), "This book was conceived as an homage to an earlier W. W. Norton classic, *How to Lie with Statistics* by Darrell Huff….that book, like this one, was written to demystify statistics and persuade everyday readers that what they don't

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[2] http://octavia.zoology.washington.edu/people/people.html;
https://www.biology.washington.edu/people/profile/carl-bergstrom
[3] http://www.jevinwest.org/; http://escience.washington.edu/people/jevin-west/
[4] http://callingbullshit.org/
[5] http://home.dartmouth.edu/faculty-directory/charles-j-wheelan;
http://www.nakedeconomics.com/
[6] See Catalano 2015.

understand about the numbers behind the headlines *can* hurt them" (Wheelan 2014)

One of the examples I use in my speeches and presentations about my book (an example not included in it) is the "social cost of carbon." This cost is a number that has the potential to affect the entire economy. Under the Obama Environmental Protection Administration (EPA), this number was pegged at $40/ton of CO_2. Recently, the Trump administration EPA indicated it is on a path to reduce the number to $5/ton. That's an 87.5% reduction!

How could such an important "numerical result" be changed so dramatically? According to an account in a national newspaper of record, it depends on what number you choose in the methodology for the "discount rate," which is used to calculate net present value when doing a discounted cash flow analysis. If there's nearly an order of magnitude difference in the calculated result, then the suspicion should be that the selection of a discount rate may be close to arbitrary. Such is true with many models; one or more parameters are likely to be highly subjective.

The political implications of the social cost of carbon are legion with respect to global climate change and the carbon footprint. From a QR/QL perspective, the example illustrates a critical need for citizens, the voting public, and advocacy groups to have a deeper understanding of the limitations in the construction and use of models and numerical methodologies that have such huge consequences for our futures.

For those teaching math, science, QR/QL, social sciences, or advocating for better science, technical, and numerical literacy, the heart of *Painting By Numbers* comprises twelve commandments, each distilled to its essence (recall Table 1). Every student leaving high school and certainly college should have proficiency in applying these commandments when confronted with a numerical result – or so goes the book's thesis.

In the example of the social cost of carbon, the selection of the discount rate could certainly be considered an assumption and a "weak link" in the calculation chain. You would certainly want to understand the "business model" (in this case, the political objectives) of those developing the methodologies. You may even suspect that, in one case, those who developed the method were diametrically opposed in starting with an answer, or at least a premise as to the need to address carbon footprint immediately – or not. Other commandments probably apply as well.

In the QL/QR context, Robert Orrill in his Foreword (Orrill 2003) to *Quantitative Literacy: Why Numeracy Matters for Schools and Colleges* (Madison and Steen 2003), explains in the simplest terms why this particular example and its implications are vital: "Increasingly, numbers do our thinking for us. They tell us which medication to take, which policy to support, and why one

course of action is better than another" (Orrill 2003, vii). To Orrill's point, the social cost of carbon is a number that tells us "which policy to support."

Concluding Remarks

As books proliferate, every author should be able to answer the question, why another book on this subject and why should you have written it? MY answer is that none of the books I was familiar with, and inspired by, achieved the simplicity and power of Huff's classic. I wrote *Painting By Numbers* because in many ways I built a career, and a consulting business, explaining highly complex engineered systems to people who, in effect, had no clue about them – politicians, MBAs, managers and directors promoted beyond their level of technical proficiency, sales and marketing teams, and even the general public.

What is the role of *Painting By Numbers* in school and college curricula? Obviously, it can play different roles for different programs, different students, and different readers. A reader who regarded Huff's classic very highly told me she had to read *How to Lie with Statistics* for a stats class in college and was interested in an author who was striving for the same effect.

For those with no math or science training or experience, or desire, I believe *Painting By Numbers* could serve as a primer, something a student or reader keeps at their side as a key reference. For those in math, science, and social sciences, any discipline that requires numerical proficiency, I see *Painting By Numbers* as the "warmup book," the intro to the introductory textbook, even part of the summer or vacation reading list.

Indeed, I point readers to the many fine books written by academics and professionals that inspired my effort over the years. All of them could be considered for Numeracy and QL/QR reading lists. The list includes *The Signal and the Noise* (Silver 2012), *Mindware* (Nisbett 2015), *Models Behaving Badly* (Derman 2011), *Weapons of Math Destruction* (O'Neil 2016), and several others. All of them, however, come from a limited perspective: an academic angle (Nisbett); a limited professional perspective, such as the failure of financial models in the 2007-2008 economic meltdown (Derman); a social justice angle (O'Neil); and a predicting-the-future angle (Silver).

As I write in my introduction to the book, "*Painting By Numbers* does not pretend to be an academic treatise or scholarly work. Think of it as your basic tool kit, adequate for performing home repairs, or at least staunching an emergency until professionals arrive. You should consider *Painting By Numbers* a prelude to the more thorough books listed in the Appendix 1."

Who knows? Maybe it's just a Swiss Army Knife. But everyone knows how handy one of those can be.

In conclusion, the real value of *Painting By Numbers* to the numeracy community is that it is a contemporary, entertaining, and educational book pushing QR/QL messages beyond the academic and professional orbits. It's a book "for the rest of us" as someone outside the community might describe it.

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