The Mathematics Enthusiast

Manuscript 1588

A Math Ed Take on Humble Humour A Review of Matt Parker's Humble Pi: When Math Goes Wrong in the Real World

Alayne Armstrong

A Math Ed Take on Humble Humour
A Review of Matt Parker's *Humble Pi: When Math Goes Wrong in the Real World*

Alayne Armstrong[1]
University of Regina

If anything, it was a few years of teaching grade eight home economics classes that made the situation very clear to me. There were the spectacular cooking disasters, like the group that while making a chocolate cake from scratch somehow switched the measurements for the salt and the sugar. Not only did they end up with a product that even a growing grade eight boy wouldn't eat, but the cake actually erupted in the oven while it was baking. But there were also the smaller, more telling moments. I'd see a group from across the room that had come to a standstill. I'd approach and discover that kids who had been acing their math tests all year long found themselves unable to agree on the result of halving 1¾ cups of flour and were now all staring at their measuring cups in silence. Put a fraction calculation out of context on a piece of paper, these students were golden; faced with actual ingredients and tools under the flickering fluorescent lights of our home economics lab, they were flummoxed. While the Great Cake Explosion was a once-in-a-career lowlight (although it's a good story, I ended up being the one who had to clean that oven), unfortunately, the measuring cup situation happened at least once each term, where it was apparent the students had little feel for the math they were doing back in math class.

This is certainly a situation to which Matt Parker, author of *Humble Pi: When Math Goes Wrong in the Real World,* could relate. An Australian stand-up comedian now settled in the United Kingdom, Parker is a man with a mission, striving to educate the masses about mathematical mayhem through his Stand-up Maths YouTube channel, his comedy tours, and his appearances on various BBC shows. In *Humble Pi*, he has compiled a collection of tales about times when the math has gone wrong, and the unexpected (or, sadly, expected) results. But don't be fooled. While *Humble Pi* may seem at first to be a light

[1] alayne.armstrong@uregina.ca

The Mathematics Enthusiast, **ISSN 1551-3440**, vol. 20, nos. 1, 2 & 3, pp. 39-44.

book, the kind one can dip into anywhere for a good story or two, its underlying tone is surprisingly serious.

There is a popular educational saying that "math is everywhere," bringing to mind images of little kids discovering the patterns in pinecones or pointing out the shapes they see in the playground. But math is very much embedded into many structural components in our society, physical and technological, and throughout *Humble Pi*, Parker argues that as adults we ignore the math working behind the scenes to our peril. In this book it is not the math itself that's going wrong, but the people who are unsuccessfully managing it, or just plain misusing it, with results ranging from silly mistakes to catastrophic destruction. As Parker writes, "When we are operating beyond intuition, we can do the most interesting things, but this is also where we are at our most vulnerable. A simple mistake can slip by unnoticed but then have terrifying consequences" (2020, p. 306).

Some of the errors Parker describes in this book are of the "math is not important enough to sweat the details" variety. For instance, there were the officials at the UK Royal Mint who wanted to improve the aesthetics of the new two £ coin that had a design featuring a series of cog. They ended up removing three cogs leaving 19 cogs which, were they to run in real life, would completely lock up (as a number of people on the internet were more than happy to point out when the coin was issued).

Then there's the Pepsi Points debacle, a situation I can remember hearing about in the news at the time. For a promotion in 1995, Pepsi officials lightheartedly offered an AV-8 Harrier II Jump Jet as the top item in their Pepsi Stuff catalogue, believing the seven million Pepsi Point "cost" was so large it would dissuade anyone from actually being able to collect enough points to trade in for it. But the joke was ultimately on the officials; as Parker puts it, they didn't do the math. Customer John Leonard did, calculating that it would cost roughly $700,000 to buy the Harrier jet through Pepsi points, which was much less than the $20 million the jet was actually worth, and he put enough money in escrow to be able to send the company a $700,008.50 cheque. The situation ended up in court, and although Leonard ultimately lost, the folks at Pepsi found themselves trying to explain why the commercial mentioning the Harrier jet was meant to be a joke. Errors

like these are the amusing "they should have known better" types of errors that tend to be brushed aside by a majority of the population as being not important. Not by Parker though, who jumps into crusader mode by starting a UK parliamentary petition to correct the geometrically unfeasible illustration of a soccer ball found on street signs for a soccer stadium. Ultimately, his request is denied, leaving him with "a framed letter from the UK government saying that they don't think accurate math is important and they don't believe street signs should have to follow the laws of geometry" (Parker, 2020, p. 232).

Despite examples like these, Parker strikes a serious tone early on in the book when he notes that while people may be born with a variety of basic number and spatial abilities, they are ill-equipped to deal with formal mathematics, needing study and practice to be able to deal with mathematical concepts like fractions, never mind logarithms. Even those who have extensive mathematical training still find themselves dealing with mathematics that's hard to handle. In describing such events, Parker develops weighty themes about the unwieldy relationship between humans and the technology that is no longer easily controlled when numbers are too large, and when calculations are too complicated or when they are buried in coding. For instance, a rollover error in software's 8-digit binary storage system (256 error) can result in situations ranging from the bizarre behavior of mutant fruit in the upper levels of Pac-Man, to a Therac-25 radiation therapy machine in Washington State dosing a patient with 8,000 – 10,000 rads of radiation rather than the 86 rads required, ultimately killing him.

Parker does an effective job moving from one anecdote to another to illustrate an escalation in scale in terms of harm done. The description of the quest to fix the aforementioned soccer stadium signs leads to an examination of the geometrical issues involved when someone installs the mounting for a lock latch incorrectly - anyone who wants to enter does not need a key, just a screwdriver in order to quickly remove the screws and pull off the lock itself. This leads to a discussion of a related architectural situation where, when emergency doors are installed the wrong way, they open inwards instead of out. This is followed by a harrowing account of an 1883 children's event at the Victoria Hall theatre in Sunderland, England, where more than 1,000 children stampeded down a stairwell for the promise of free toys. The exit door was not only bolted partially

open, but it opened inward, meaning that rescuers were unable to push the door open any further against the press of children's bodies in order to let more of them escape. In the end, 183 children died of asphyxiation. Rather than leaving us with that number, Parker works from his earlier premise that people don't fully appreciate the meaning behind large numbers, even smaller ones, and pans in close to tell us a little about three of the casualties, 13 year old Amy Watson, 12 year old brother Robert, and 10 year old sister Annie, who had walked across town to go to the show that day for a treat, never to return home.

The far-reaching implications of situations that initially seem to be insignificant can be horrifying. Parker describes the very minute differences between two types of bolts. Yet when the wrong type of these bolts was mistakenly used to replace 90 bolts for the windscreen of a British Aircraft Corporation 1-11 jet airliner, the windscreen was unable withhold the air pressure conditions and failed 13 minutes into a flight. The windscreen exploded, and the pilot was almost sucked out of the window (members of the crew were able to hang onto his legs and keep him partially in the plane). Fortunately, the co-pilot was ultimately able to land the plane safely.

Seymour Papert has argued for educational potential of technology that provided us tools to think with (1980). *Humble Pi* raises the issue of what happens when we reach a point where we are not managing technology responsibly due to convenience (for instance using the widely available spreadsheet program Excel as a database, a task for which it was not adequately designed), time pressures (the selection of the wrong bolt for the airliner windscreen) or because the mathematics itself is too complicated and/or is on a scale too large (or too small) for us to notice the finer details (the Y2K bug). Technology is still doing exactly what it has been told to do, but it has evolved to a point where the people who are giving it the commands are no longer in a place where they have sufficient control over what happens, and any safeguards that may be in place are not always adequate.

Still, there are many aspects of the book that provide a helpful spoonful of sugar to help this rather frightening message go down. Parker plays with the numbering of the chapters, and of the pages of the book; he plays with the wording, delighting in puns; the index

includes entries for "lava lamps," "something else," and "functional sausage." He cites his research, notes where he got stuck and asks readers who might be able to fill in the blanks to contact him. And of course, there are an abundance of silly mistakes, one of my favorites being the Google search measurement of the height of former British Prime Minister Theresa Mays in picometers (for the record, 1.72 trillion) which left me pondering appropriate measurements for the hair of former British Prime Minister Boris Johnson (where would you even begin?).

When it comes to math and human shortcomings with it, fingers of blame seem to inevitably point at schools and what students are (or are not) being taught there. It seems to me that to learn how to think mathematically, students need opportunities to fully understand mathematics concepts. This is something that Parker himself implicitly models as he pursues the topics in this book: it takes time, exploration, observation, and careful and critical thought. In the case of those students in my home economics lab, invariably they would physically work out the new measurement by experimenting with the flour and various measuring cups and talking it out, sometimes under the guidance of a bemused classmate who had experience baking at home. They came out with a better feel for what it means to "half" a recipe, and they managed to create something tasty in the process, definitely a win-win situation.

But the situations that Parker describes are ones that are being handled by people who are not only supposed to be fully trained in math but whose livelihood as an engineer or a programmer depends on being able to apply the appropriate math and to manage the technology they're using. What is to be done when these people don't have a feel for the mathematics they're working with because the numbers are so large or so small, the programming is hidden, or the technology can only do what it's told, no more and no less? When I work with preservice teachers, there are often discussions about whether students should be using calculators in the classroom. Inevitably someone points out that students can only use calculators effectively if they know the math well enough to recognize when there's an issue with the answer the calculator gives them; beyond basic fact computations, in order to push the correct buttons in the first place, students need a feel for the mathematics.

Is our society beyond that now? What happens when those using technology cannot get a feel for the math the technology is performing? As Parker writes towards the end of the book, "it can be very dangerous when humans get complacent and think they know better than the math" (2020, p. 3). Perhaps that's why the humor that laces the book is a necessity. It's better to laugh than to cry.

References

Papert, S. (1980). *Mindstorms. Children, computers, and powerful ideas*. New York: Basic Books.

Parker, M. (2020). *Humble Pi: When math goes wrong in the real world*. New York: Riverhead Books.