The Mathematics Enthusiast

Manuscript 1606

Thinking Essays A Review of Daniel Tammet's Thinking in Numbers: On Life, Love, Meaning, and Math

Ann Arden

Thinking Essays
A Review of Daniel Tammet's *Thinking in Numbers: On Life, Love, Meaning, and Math*

Ann Arden[1]
Ottawa-Carleton District School Board

Daniel Tammet's *Thinking in Numbers: On Life, Love, Meaning, and Math* (2012) is composed of 25 essays that share his views and experiences of mathematics, connections he makes between mathematics and poetry, and biographical stories. He is a writer, a linguist and a tutor who was born in London, England and lives in Paris, France.

Tammet describes himself as a "high functioning autistic savant" [p. xvi] and takes readers through his "difference" (p. xvi) and process of diagnosis in the preface to the book. Tammet can recall long patterns of numbers (forward and backward), and deftly perform the trick of telling someone what day of the week they were born based on their birthdate. He can perform complicated numeric operations quickly in his head. His two previous books, *Born on a blue day: Inside the extraordinary mind of an autistic savant* (2007) and *Embracing the wide sky: A tour across the horizons of the mind* (2009) are autobiographical, and it is clear that this aspect of his identity is important to reading his work.

Another aspect of this "difference" is that Tammet has synesthesia, which means he experiences numbers as colours, shapes, textures, and landscapes. In the book's preface, Tammet notes that readers of his past work have sent him messages wondering what this must be like:

> They wonder how it must be to perceive words and numbers in different color, shapes, and textures. They try to picture solving a sum in their mind using these multidimensional colored shapes. They seek the same beauty and emotion that I find in both a poem and a prime number. What can I tell them? Imagine. (p. xvi)

[1] ann.arden@ocdsb.ca

The Mathematics Enthusiast, **ISSN 1551-3440**, vol. 20, nos. 1, 2 & 3, pp. 207-216.

Tammet describes the essays in *Thinking in Numbers* as having some autobiographical elements but more outward looking than his previous work. He describes the 25 essays as entertaining "pure possibilities" (p. xvii) by which he means that through imagining situations such as reading an endless book or making contact with extraterrestrial life, we can ask the question, "what if?" (p. xvii).

Tammet has had several public experiences that have brought him attention and acclaim. One of these occurred at the University of Oxford in 2004 where he recited pi to 22,514 digits which was a European record at the time and took 5 hours and 9 minutes. Tammet documents this in the chapter *The Admirable Number Pi*. Tammet was inspired by his love of the number pi to pursue the feat: he describes pi as "beautiful" and "almost magical" (p. 135). His fascination with pi is grounded in the idea that it has no final digit, no pattern within the digits and cannot be accurately represented by a fraction or a drawing. He marvels at the possibilities in the infinite for patterns such as the digit 5 repeating a hundred times in a row or the digits 0 and 1 alternating a thousand times.

Tammet contrasts the view of mathematicians that the "circle that pi describes is perfect, belonging exclusively to the realm of the imagination" (p. 136) with the engineer's view of pi as "simply a measurement between three and four, albeit fiddlier than either of these whole numbers" (p. 135). Describing a schoolmate's view of numbers, which was decidedly closer to the latter, he was amazed that she did not see any notable difference between the characters of the numbers 333 and fourteen. Tammet argues that mathematicians "know the number pi differently, more intimately" (p. 136) than engineers.

Tammet describes how he came to memorize over 22,000 digits in just three months. He printed out the digits a thousand to a page:

> I gazed on them as a painter gazes on a favorite landscape. The painter's eye receives a near infinite number of light particles to interpret, which he sifts by intuitive meaning and personal taste… In a similar fashion, I waited for each sequence in the digits to move me - for some attractive feature, or pleasing coincidence of "bright" (Like 1 or 5) and "dark" (like 6 or 9) digits…a numerical landscape gradually emerged. (p. 138)

Noting that painters exhibit their artwork, he decided to recite the number as a performance in Oxford on March 14, 2004 (Pi Day). He describes the process of reciting the digits to be very physically gruelling and lonely.

Connected to his interest in pi, a theme Tammet comes back to in several essays is infinity. In *Talking Chess*, Tammet (2012) describes chess as a perfect arena for "an exerted exploration of the possible" (p. 220). After each player has completed one move, there are four hundred legal positions. After two moves each, seventy-two thousand. After three moves nine million and after four moves 288 billion. He expresses wonder in the immensity of the "Shannon Number" which is the number of distinct forty-move chess games. This number is larger than the number of atoms in the "observable universe" (p.220) and would be written as a 1 followed by 120 zeroes. Despite the sheer possibility of moves and outcomes, Tammet has a simple view of winning in chess: "victory belongs to the player who makes the next-to-last mistake" (p. 219).

In the essay *Eternity in an Hour*, Tammet plays more with ideas of infinity but based in the fantasy realm of fairy tales. He connects the Brothers Grimm story "The Magic Porridge Pot" with Hans Christian Andersen's "Princess and the Pea". In the former, Tammet (2012) wonders about the addition of more and more porridge flakes and their arrangements, and in the latter, he is entranced with the "infinity of fractions" (p. 12) spawned by dwelling on the possibilities beyond the twenty mattresses the fairy-tale princess slept upon: "[f]or the princess, even a pea felt infinitely big; for the poor daughter and her mother, even an avalanche of porridge reduced to the infinitesimally small" (p. 13).

What I found particularly compelling in this essay was how Tammet deftly and poetically connected his ideas on the beauty of infinity in these (and other) fairy-tale stories with an actual dinner party in his childhood home. His parents hosted the local librarian and his wife on a rare social occasion and Tammet describes a stilted dinner conversation where the librarian dominated the talk and his wife appeared to worry about his manners. Tammet's juxtaposition of the (ideal) realm of story and the reality of human communication was stark. As the awkward dinner drew to a close, Tammet "thought of the infinitely many points that can divide the space between two human hearts" (p. 20).

Throughout *Thinking in Numbers*, Tammet takes pleasure in telling stories of where he has found beauty, elegance, and surprise in mathematics. In the essay, *Einstein's Equations*, Tammet notes with admiration Albert Einstein's "belief in the primacy of the aesthetic" (p. 148). He cites Einstein's son as saying of his father: "The highest praise for a good theory or a good piece of work was not that it was correct nor that it was exact but that it was beautiful" (p. 148). Tammet goes on to argue that the beauty that mathematicians see can be understood by laymen in games, music, and magic. He gives examples of the game of cricket, the structure of musical composition and conjurer's tricks and states that the "truly beautiful are those that foster surprise" (p. 153).

Most of Tammet's essays focus on ideas, stories and experiences that are generally outside of school mathematics. I found it interesting that Tammet describes his own experiences in school mathematics as "bruising" and felt a "certain shame at my failure to comprehend" (p. 46). In the essay *Classroom Intuitions*, Tammet paints a picture of his middle school math teacher, Mr. Baxter, as stifling any free thinking and creativity. He describes his teacher as a "stickler for the textbook's methods" (p. 46) and states that he still has "no affinity with algebra. This discovery I owe to my middle school math teacher, Mr. Baxter." (p. 45). Using the example, $x^2 + 10x = 39$, Tammet (2012) writes,

> Such concoctions made me wince. I much preferred to word it out: a square number (1, or 4, or 9, etc.) plus a multiple of ten (10, 20, 30, etc.) equals thirty-nine; 9 (3x3) + 30 (3x10) = 39; three is the common factor; x = 3. (p. 46)

Having both read the book and listened to the audio book, this was a striking example of how listening to Tammet say the words above in the audio book made the problem seem so much simpler than the written algebraic equation and even the written words in the essay.

The focus on the author's experiences and thinking as a self described "autistic savant" is very compelling when this book is read autobiographically. As a high school math teacher for the past twenty years, I cannot help but to connect the essays to my own experiences in learning and teaching mathematics.

I attended elementary and high school in the 1980s and 90s in Ontario and had a very traditional education. Like most who end up as math teachers, I did well in my high school and university math classes. I was quite adept at playing the game of school, or "studenting"[2] (Liljedahl & Allen, 2013). It was only in the third year of my undergraduate studies at Queen's University in Kingston, Ontario that I was confronted with a different, deliberate and sustained dive into the beauty, wonder and surprise of mathematics. I had the opportunity to take an interdisciplinary course in Math & Poetry taught by Peter Taylor and Maggie Berg. This was the first time that I experienced sophisticated problems where algorithms and prior math curriculum knowledge were not terribly helpful. It was the first time that my previously successful strategy of "studenting" largely failed. It was the first time that I was given rich math problems to contemplate that were attached to stories, poetry and romance which Tammet describes in detail through his essays.

I have been very fortunate to keep in touch with Dr. Taylor, a mathematician, which has included being part of one of his research projects focused on developing an engaging math curriculum for high school students (Taylor, 2021). I have been moved, as a student of mathematics, and changed, as a high school math teacher, by Taylor's deeply felt view that mathematics is about wonder, creativity and fun and that it should be taught that

[2] Liljedahl & Allen (2013) describe "studenting" as "comprised of the behaviours that students perform or exhibit in a learning situation, such as the classroom. Student actions that do not contribute to actual learning and that subvert the intentions of the teacher are a subset of studenting behaviours, that we call gaming behaviours." They attribute the original use of the term "studenting" to Gary Fenstermacher (1986).

way (Taylor, 2019). Taylor brings together the wonder of mathematics and a tremendous respect for school educators and our conversations are always rich with the delights of both mathematics and pedagogy. Taylor (2019) notes that unlike in most disciplines, there is a huge gulf between the activities of high school math students and mathematicians and in the way these groups describe math. Students tend to describe math as procedural and focused on calculations where mathematicians describe it as creative and beautiful. As a high school math teacher, I think I fall somewhere in between.

This gulf returns me to Tammet's essay *The Admirable Number Pi*. I cannot help but wonder, as an educator, where I am in Tammet's contrast between the mathematician and the engineer. I acknowledge that most of my students would likely identify pi as "simply a measurement between three and four, albeit fiddlier than either of these whole numbers" (p. 135). As a math teacher, I have been responsible for presenting the concept of pi to many students (I estimate over 2000 students in twenty years). In the early high school years, most students will say that "pi equals three point one four" and know it has something to do with circles. I have really enjoyed the activity of roughly measuring the circumference and diameter of circles of many sizes (using string, then straightening the string against a ruler), and then dividing these quantities (C/d).

In my experience, the vast majority of students are amazed that nearly all result in the quotient "three point one" (this activity is also rich for a discussion of outliers!). It is absolutely delightful to experience the wonder of thirteen- and fourteen-year-olds as they have a new understanding and physical experience of something they previously viewed as a memorisable fact. I think it would be really interesting to have students listen to Tammet's audio version of *The Admirable Number Pi* and get their reactions to how he clearly loves the number and sees it so differently from most people.

As I reflect on the *Talking Chess* essay, as a teacher, my most personal connection with Tammet's description of chess is as being a human game rather than a theoretical exercise: "chess would not be chess without its mystery or its players' mistakes" (p. 223). I could not help but extend that sentiment to "math would not be math without its mystery or its players' [students'] mistakes." I find the mathematics really interesting, but as a

high school teacher I have always found my centre in describing what I do as teaching students rather than teaching math. The relationships are what has kept me interested in school math for twenty years. No two classes have ever been the same and I usually leave a course with some new insight into a math concept or a representation that I have gleaned from students. It is in the back and forth of classroom conversations and banter that I connect to the complexity that Tammet describes in the human game of chess. There are infinite possibilities of questions, responses, and conversations in my classes; and in this age of social media, the anecdotes and questions that arise in classrooms all over the world are shared in conversations between teachers outside of their physical school buildings (Larsen & Liljedahl, 2017). Tammet notes, "Wittgenstein observed that language, like chess, is a game governed by rules… from a small number of rules, immense complexity is spawned" (p. 226). He also notes that a "skilled conversationalist has this knack for knowing which avenues to explore and which to avoid" (p. 227). For me, this is the art of teaching.

Reflecting on the whole of Tammet's book, I was struck by the book cover and testimonials which repeatedly emphasize his mind such as "*Thinking in Numbers* enlarges one's wonder at Tammet's mind and his all-embracing vision of the world as grounded in numbers" [Oliver Sacks] and "A fascinating, even dizzying series of fresh perspectives on things we thought we knew" [Billy Collins]. A quick internet search reveals many articles with this emphasis (e.g. CBC News, 2017; Johnson, 2005; Meyrick, 2013) and even an appearance on The Late Show with David Letterman in 2009. Tammet's intelligence is a focal point of a great deal of media on his writing, and certainly as one of a very few "autistic savants" in the world this focus is understandable. As I consider this book an example of the popularization of mathematics, I find the connections made in the media between his intelligence and his abilities in mathematics, and the reverence for his mental computational abilities a bit troubling.

This reminded me of some recent criticism about the field of mathematics and math education where despite calls for "mathematics for all", the school system still fails so many. Gutiérrez (2018a) makes the argument that people all over the world, from all groups and ethnicities, do mathematics in everyday ways but that "schooling often creates

structures, policies and rituals that can convince people they are no longer mathematical" (p. 2). She identifies some of the aspects of mathematics teaching and learning that can seem dehumanizing and these include speed valued over reflection, rule following as opposed to rule breaking and the myth that mathematics is objective and culture free. Gutiérrez (2018b) argues:

> We treat mathematics as if it is a natural reflection of the universe. When we identify mathematics in the world around us (e.g. Fibonacci sequence in pinecones, fractals in snowflakes), we convince ourselves that mathematics occurs outside of human influence. Rather than recognizing that we may see patterns we want to see (because we set the rules for finding them), we instead feel mathematics is a way of encoding the universe with eternal truth, a natural order of things that should not be questioned. And so mathematics is viewed as a version of the world that is proper, separate from humans, where no emotions or agendas take place. Because of its perceived purity, we assume mathematics should be the basis for how we think about the world and what is important. Currently, mathematics operates as a proxy for intelligence. Society perpetuates the myth that there are some people who are good at mathematics and some who are not. (p. 18)

When I consider the full list of mathematical topics covered in the twenty five essays in *Thinking in Numbers* and think of this book as an example of the popularization of mathematics, many do fall into Gutiérrez's idea of occurring outside of human influence and the review of the book listed earlier do emphasize the idea of mathematics as eternal truth.

I want to be careful to point out here that Tammet includes a blistering criticism of his own experiences in school mathematics where there was an emphasis on correct methods and rule following rather than creativity and creation. Tammet (2012) paraphrases the argument of mathematician and educator Paul Lockhart that "mathematics is misrepresented in our schools, with curricula that often favor dry, technical and repetitive tasks over any emphasis on the 'private, personal experience of being a struggling artist'" (p. 268).

Tammet himself clearly sees beauty and emotion in numbers and through the essays, he draws the reader into the way he experiences mathematics. Through the essays, it seems

evident to me that he is aware that his way of thinking is different from others, but his goal in the writing seems to be to share that joy and creativity of the mathematics he sees all around. Tammet (2012) points out that "Often we are barely aware of it, but the play between numerical concepts saturates the way we experience the world" (p. xvii). Rather than a technical view of mathematics, he sees artistry and argues that mathematical ideas, like literature, "help expand our circle of empathy, liberating us from the tyranny of a single, parochial point of view. Numbers, properly considered, make us better people" (p. 10).

References

Goldenthal, H. (2017, September 19). *Numbers 'were my mother tongue': How autistic savant Daniel Tammet sees language | CBC Radio*. CBCnews. Retrieved from https://www.cbc.ca/radio/thecurrent/the-current-for-september-18-2017-1.4292270/numbers-were-my-mother-tongue-how-autistic-savant-daniel-tammet-sees-language-1.4292279

Gutiérrez, R. (2018a). Why we need to rehumanize mathematics. In R. Gutiérrez & I. Goffney (Eds.), *Annual Perspectives in Mathematics Education: Rehumanizing mathematics for students who are Black, Latinx, and Indigenous* (pp. 1-10). Reston, VA: National Council of Teachers of Mathematics [NCTM].

Gutiérrez, R. (2018b). Political conocimiento for teaching mathematics. In S. Kastberg, A.. Tyminski, A. Lischka and W. Sanchez. (Eds.), *Building support for scholarly practices in mathematics methods.* (pp. 11-38). Charlotte, NC: Information Age.

Johnson, R. (2005, February 12). *A genius explains*. The Guardian. Retrieved from https://www.theguardian.com/theguardian/2005/feb/12/weekend7.weekend2

Larsen, J. & Liljedahl, P. (2017, July). Exploring *generative moments of interaction between mathematics teachers on social media*. 41st Annual Meeting of the International Group for the Psychology of Mathematics Education (PME41), Singapore.

Liljedahl, P. & Allen, D. (2013, November). Studenting: The case of homework. 35th Annual Meeting of the International Group for the Psychology of Mathematics Education (PME-NA), Chicago, IL. (pp.489-492) . www.pmena.org/pmenaproceedings/PMENA 35 2013 Proceedings.pdf

Meyrick, S. (2005, May 4). *Daniel Tammet: Inside the mind of a staggering genius*. The Independent. Retrieved from https://www.independent.co.uk/news/people/profiles/daniel-tammet-inside-the-mind-of-a-staggering-genius-236845.html

Tammet, D. (2007). *Born on a blue day: Inside the extraordinary mind of an autistic savant*. London: Hodder & Stoughton.

Tammet, D. (2009). *Embracing the wide sky: A tour across the horizons of the mind*. New York: Free Press.

Tammet, D. (2012). *Thinking in Numbers: On Life, Love, Meaning, and Math*. New York: Bay Back Books.

Taylor, P. (2019, July 17). *Mathematics is about wonder, creativity and fun, so let's teach it that way*. The Conversation. Retrieved from https://theconversation.com/mathematics-is-about-wonder-creativity-and-fun-so-lets-teach-it-that-way-120133

Taylor, P. (2021). *Rabbitmath*. RabbitMath. Retrieved January 15, 2021, from https://www.rabbitmath.ca/