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The Portrayal of Mathematicians and Mathematics in Popular Culture

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ABSTRACT Mathematicians are often inimically portrayed in popular culture, resulting in an abundance of non-mathematical identities in the classroom. Various tropes are propagated by the media that dominate our mental schemas of what makes a mathematician: the eccentric Einstein-like old man; the young, tortured genius; and the "genetically different" savant. However, these portrayals in popular culture can be used as a tool—rather than a hindrance—if teachers know how to present them properly in the classroom. Although the media often promotes mathematical myths, it can also be used to debunk them.

KEYWORDS *mathematics, mathematicians, media, popular culture, mathematical identities, mathematical myths*

What Makes a "Mathematician?"

There's a unique peculiarity to the mathematics profession, and it is contrary to what one might think. When asked what makes someone a physician we are devoid of hesitation, for certainly a physician has had many years of medical training. When asked what makes someone a beautician there is no palpable pause, for certainly a beautician is skilled in the art of hairdressing and other beauty treatments. In fact, we have carefully formed schemas of what it means to "be" various professions—teacher, social worker, policeman, taxi driver, politician, etc.—but what makes someone a mathematician?

According to English semantics, a mathematician is someone who practices mathematics, but the level of mathematics required is ambiguous. Is any level of mathematics study sufficient? Are those who teach mathematics considered mathematicians? And for that matter, do we include secondary school students in our definition? Or is the term reserved solely for those who have published results?

The uncertainty that surrounds the profession is troubling, and, unless a line is drawn delineating exactly how much practice qualifies someone to be a mathematician, the ambiguity will only continue to grow. Our hesitation to define "mathematician" contributes to the elusiveness of the subject. As a result, and in conjunction with the innate tendency to fear the unknown, we've placed mathematics on a pedestal reserved only for the intellectual elite. This absence of a sense of belonging to the subject bolsters the often-inimical image of the mathematician and mathematics as portrayed by popular culture.

Images of Mathematicians in the Media

The Eccentric Old Man

The media propagates our skewed perception of what it means to be a mathematician, and what it means to do mathematics. According to Epstein, Mendick, and Moreau (2010), "mathematics is represented [by the media] as a secret language, mystical, even magical, difficult and aesthetically satisfying to those (few) who understand it, while mathematicians are often mad, or at least eccentric and different, mostly male and almost invariably

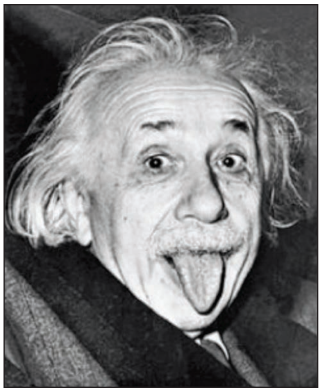

Figure 1. Sasse, A. (1951). Albert Einstein with his tongue out.

white" (p. 47). In their research, Epstein et al. (2010) came across a peculiar constant in perception: extraordinarily, we share similar mental portraits of what a mathematician should look like. In fact, the image of a mathematician is most popularly associated with that of Einstein—an old, white male with unruly white hair and overt quirks (e.g. Einstein is known for sticking out his tongue in photographs).

Such an image is disseminated consistently in film; for example, via the peculiar Doc Brown from the film franchise *Back to the Future* (Gale, Canton, & Zemeckis, 1985) or Dr. Nefario from *Despicable Me* (Meledandri, Cohen, Healy, Coffin & Renaud, 2010). However, literature is not to be judged with impunity. For instance, Yoko Ogawa's memory-addled Professor in the novel *The Housekeeper and the Professor* (2009) promulgates the stereotype:

> He was sixty-four, but he looked older and somewhat haggard, as though he did not eat properly. He was barely more than five feet tall, and his back so badly hunched that he seemed even shorter. The wrinkles on his bony neck looked a little grimy, and his wispy, snow-white hair fell in all directions, half-concealing his plump, Buddhalike ears. (Ogawa, 2009, p. 8)

The Young, Tortured Genius

Although the tendency is to perceive mathematicians as old, historically, mathematicians have published their most seminal works in their youth. As G. H. Hardy (2012) so bluntly put it,

> No mathematician should ever allow him to forget that mathematics, more than any other art or science, is a young man's game.…Galois died at twenty-one, Abel at twenty-seven, Ramanujan at thirty-three, Riemann at forty. There have been men who have done great work later;… [but] I do not know of a single instance of a major mathematical advance initiated by a man past fifty.…A mathematician may still be competent enough at sixty, but it is useless to expect him to have original ideas. (p. 70-71)

David Auburn reflects this looming pressure of time felt by mathematicians in his play, *Proof* (2012):

> HAL: Mathematicians are insane. I went to this conference in Toronto last fall. I'm young, right? I'm in shape, I thought I could hang with the big boys. Wrong. I've never been so exhausted in my life. Forty-eight straight hours of partying, drinking, drugs, papers, lectures…
>
> CATHERINE: Drugs?
>
> HAL: Yeah. Amphetamines mostly. I mean, I don't. Some of the older guys are really hooked.
>
> CATHERINE: Really?
>
> HAL: Yeah, they think they need it.
>
> CATHERINE: Why?
>
> HAL: They think math's a young man's game. Speed keeps them racing, makes them feel sharp. There's this fear that your creativity peaks around twenty-three and it's all downhill from there. Once you hit fifty it's over, you might as well teach high school. (p. 34)

Such a portrayal spawns the indelible image of the young, tortured mathematical genius that is propagated in films such as *Good Will Hunting* (Bender & Van Sant, 1997), *A Beautiful Mind* (Grazer, Howard & Howard, 2001), *The Theory of Everything* (Bevan, Fellner, Bruce, McCarten & Marsh, 2014), and *The Imitation Game* (Grossman, Ostrowsky, Schwarzman & Tyldum, 2014). Unfortunately, the exploitation of the role of the tortured genius has only contributed to the pervasive trope that there exists a "mathematics gene." For instance, with no formal mathematics schooling, Will Hunting possesses the innate ability to prove a theorem in the same manner that Beethoven could just look at a piano and play. Similarly, John Nash Jr., Stephen Hawking, and Alan Turing, the real-life protagonists of the remaining three films, respectively, have accomplished phenomenal feats under considerable duress to the extent that their accomplishments seem to liken mathematics to a preternatural entity far above the realm of what ordinary individuals could ever hope to grasp. As a result, we accept such illustrious minds as rare anomalies separate from the norm.

Mathematicians as Genetically Different

The belief that mathematicians are different is ubiquitous in popular culture. This perception of "otherness" is manifested in both their innate intelligence and presumed eccentricities and social awkwardness. Mathematics is perhaps least accessible when mathematical ability is perceived as a consequence of disability. For instance, in the film *Rain Man* (Johnson & Levinson, 1988) and the novel *The Curious Incident of the Dog in the Night-time* (Haddon, 2003), autistic protagonists Raymond Babbitt and Christopher Boone, respectively, are masters of recognizing patterns in numbers. With diagnoses not easily understood, mathematics acts as safe-havens for these characters. However, their mathematical prowess is deemed a byproduct of their unique mental profiles. These neural differences are exaggerated in the film *X+Y* (Thompson, Hastings-Smith & Matthews, 2014) when autistic mathematical prodigy Nathan Ellis exclaims, "I have magical powers." Thus, the media portrays those who are extraordinary at mathematics as being, literally, extra-ordinary—mentally and genetically different.

Not only is mathematical ability misunderstood, but the entire field of mathematics is often detrimentally portrayed. In the films *21* (Spacey, Ratner, Brunetti, DeLuca & Luketic, 2008), *The Hangover* (Goldberg, Phillips & Phillips, 2009), and *Matilda* (DeVito, Shamberg, Sher, Dahl & DeVito, 1996) mathematics is presented as magical. The enticing way in which mathematics is used in such films substantiates three popular myths concerning the subject: (1) mathematics problems are solved quickly; (2) mathematics is a solitary activity; and (3) only those with "super powers," (i.e., geniuses), can do mathematics.

Even the ways in which mathematics scenes are edited can be deceiving. A common production technique is to flash jumbled and complex mathematical symbols across the screen to signify the mental calculations that are being done. The effect is enchanting, but misleading. In most cases, the mathematical symbols presented on screen are not chosen for their relevance to the mathematics being used but, rather, for their aesthetic complexity. As a result, mathematics is presented as a mystical subject beyond the corporeal world and reserved for the enlightened few who can understand it.

Mathematics is used in memes on social media to create the same esoteric effect. For instance, the "confused lady" meme employs the images of trigonometric integration and the volume of a cone. However, the subject of the meme itself is often not mathematical; rather, mathematics is simply the conduit for the portrayal of significant bewilderment.

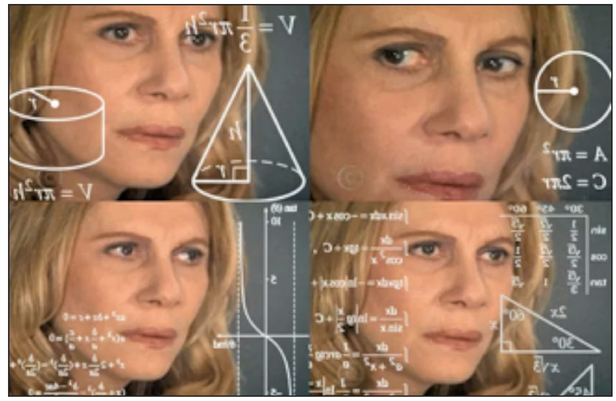

Figure 2. Confused Lady, 2016. Retrieved from https://boingboing.net/2016/11/08/heres-the-unexpected-origin.html

The Impact of Media Portrayals in Classrooms

Media portrayals pervade the minds of unwitting consumers. We are unable to define "mathematician" due to the inexplicable abilities that we associate with the subject. Furthermore, the imaged stereotypes hinder our ability to relate to mathematicians; if we do not qualify as either mad, old, white men or tortured geniuses on the verge of discovery, we begin to distance ourselves so that we are spared from our own inadequacies.

The effects that this mathematical propaganda has on the classroom are manifold, impacting both teachers and students. As a result, non-mathematical identities are abundant. For instance, in their study with teachers and students, Cirillo and Herbel-Eisenmann (2011) found that only teachers—and not students—made references to mathematicians in the classroom. However, even those teachers who did use the word did so with caution: the omnipresent stereotypes surrounding mathematicians manifested in their extreme hesitance. One teacher described the doubt felt when using the word "mathematician":

> I honestly have no idea what a mathematician does…I do not see myself as a mathematician because the word implies to me very complex problem solving. I do not feel that I have that ability or level of understanding of math to solve those types of problems. (Cirillo & Herbel-Eisenmann, 2011, p. 70)

Despite teaching mathematics, the teachers were reluctant to identify as mathematicians. At best they considered themselves "amateur mathematicians," compensating for their devalued status by stating that mathematicians are "too far gone to really try to relate to common people" (Cirillo & Herbel-Eisenmann, 2011, p.75-76).

According to Epstein et al. (2010), students hold contradictory beliefs concerning mathematics and mathematicians:

> Regardless of whether they have continued with mathematics or not, young people are aware of and embedded in notions of mathematicians as socially inept, obsessional, and definitely rather different from most people. The fact that they themselves identified their images as clichéd and stereotyped did not enable them to develop other, different images. (Epstein et al., 2010, p.54)

Additionally, some of those mathematics students in Epstein's (2010) study embraced the stereotypes, basking in the glory of being part of an esoteric group. However, the anxiety that comes from being excluded from such an elite club can be crippling for many students, to the extent that one student relished burning her mathematics textbooks at the termination of her study (Epstein et al., 2010). It is the misunderstanding of mathematics and mathematicians that obstructs the formation of positive mathematical identities and social experiences among students.

Using the Media to Promote Mathematics and Debunk Myths

According to Appelbaum (1995), "the influence of the public media on education is something mathematics educators need to seize as a tool rather than accept as an encroachment on their individual authority" (p.47). An educator well-versed in how mathematics and mathematicians are portrayed in the media can use such portrayals to his or her advantage. For instance, Benedict Cumberbatch's performance as Alan Turing in *The Imitation Game* (Grossman, Ostrowsky, Schwarzman & Tyldum, 2014) propagates the stereotype that mathematicians are socially awkward. In addition, the portrayed Turing is the epitome of the tortured genius trope, especially considering the extent to which he is ridiculed. However, the film should not be dismissed from the classroom. Despite the flagrant stereotypes, a major mathematical myth is refuted: problem solving is not instantaneous. It takes months for Turing to construct and finally break the Enigma code. Further, the film addresses and debunks stereotypes surrounding female mathematicians. Keira Knightley portrays real-life cryptanalyst Joan Clarke who completed Turing's incredibly complex crossword puzzle in record time, earning her a coveted spot on Turing's enigma team. Initially denied the chance to compete for the job because she was a woman, her incredible ability to crack codes defied the gender norms of the time.

Similarly, although *The Housekeeper and the Professor* (Ogawa, 2009) was previously discredited for its typical Einstein-like Professor, the novel does battle the myth concerning the emphasis on brevity in mathematical solutions:

> The Professor never really seemed to care whether we figured out the right answer to a problem. He preferred our wild, desperate guesses to silence, and he was even more delighted when those guesses led to new problems that took us beyond the original one. He had a specific feeling for what he called the "correct miscalculations," for he believed that mistakes were often as revealing as the right answers. This gave us confidence even when our best efforts came to nothing. (Ogawa, 2009, p. 2)

As educators, we can all learn a lot from the Professor. Cultivating student intuition, the Professor plants the seed of thought, and then steps back to watch it flourish. He nurtures the journey, not the destination. To deemphasize the importance of the efficient solution seems blasphemous, but the reward is everlasting; it is the trials and tribulations of struggling that inspire active cognition.

Learning to Embrace the Struggle in Mathematics

In the United States, struggling is often regarded as an indicator of low intelligence and denigrated as a weakness (Spiegel, 2012). Many American students value innate ability and equate genius with low effort. According to Chu,

> In America we try to sell this idea that learning is fun and easy, but real learning is actually very difficult…it takes suffering and angst, and if you're not willing to go through that you're not going to learn deeply. The downside is that students often give up when something gets hard or when it's no longer fun. (Chu, 2017, p. 281)

The perseverance encouraged by the popular proverb, "If at first you don't succeed, try, try again," is used to motivate students in the face of setbacks. The relentless pursuit inherent in the phrase thrives in the athletic arena, in particular. The film *Miracle* (Ciardi et al., 2004) is just one of countless examples in which initial failure didn't result in ultimate defeat, but rather, consistent effort assured eventual success.

Unfortunately, the sentiment has yet to reach mathematics classrooms. Instead, this adaptable approach to failure is foiled by the popular mathematical misconception surrounding speed (with respect to recall of facts, the time it takes to solve a problem, and the general brevity of all mathematics solutions) that is propagated by the media. When classrooms equate skill with speed and value fast recall over deep conceptual understanding, mathematics anxiety—suffered by a third of all students—develops, and creative inquiry declines (Boaler & Zoido, 2016). Sadly, giving up on a mathematics problem is often not unexpected; to the contrary, it is relatable.

To combat the association that people make between mathematics and pace, teachers should encourage students to study the history of Fermat's Last Theorem. Pierre de Fermat, a French lawyer, was not classically trained in mathematics; rather, he studied the subject recreationally. Although Fermat is credited with developing many theorems in mathematics, his Last Theorem is most famous because of his omission of a proof. His conjecture was written in the margins of a book, and he claimed there was not enough room to write the proof. What was scribbled in the margins of a book became a 358-year struggle rife with mathematical toil for others in search of the solution.

Not only is Fermat a champion for the "regular person," but Andrew Wiles, the man who proved Fermat's Last Theorem, is a champion for mathematicians past their prime—he was 40 when he proved it. Additionally, the seven years it took Andrew Wiles to prove Fermat's Last Theorem is evidence that mathematics can be a time-consuming pursuit. Finally, the search for the proof confirms that mathematics can be a social endeavor. In an article published in *The New York Times,* James Gleick (1993) writes "not just mathematicians, but interested children and imaginative cranks have been plugging away…, no doubt realizing that if they didn't have Fermat's raw genius at their disposal, they nevertheless had more paper."

A Much-Needed Change in Perspective

In the words of a contemporary colloquialism, "The struggle is real." Mathematics is perceived as a magical art befit only to those with extraordinary talent. Popular culture exploits the eccentricities of mathematicians while at the same time lauding their significant achievements. As a result, we are made to believe that mathematicians are not regular people, doing mathematics is quick, and mathematics knowledge is obscure. To combat such inaccurate tropes, it is necessary to shift our emphasis away from the finished product. Rather, we need to applaud the struggle. As Einstein said, "a person who never made a mistake never tried anything new." The camaraderie found in making mistakes can inspire confidence. Failure is not devoid of meaning, but can instead be enlightening and produce new discoveries.

The cookie-cutter image of the mathematician needs to be recast. The perception of the designation must be remodeled to eliminate hesitation in using the word "mathematician" and make mathematical identities more abundant and diverse in the classroom. The engineering world reached a similar crossroads in 2015. When a young female engineer, Isis Anchalee, became the face for a new advertising campaign for her company, the image was ridiculed for not being a realistic representation of the field. To combat the sexist comments, the 22-year old posted her photo with the following hashtag on Twitter: #ILookLikeAnEngineer (vox.com, August 2015). Wildly popular, the trending tweet was answered by countless women who did not fit the gender stereotype.

Similarly, after Nobel Laureate Tim Hunt made chauvinistic remarks regarding female scientists and advocated single-sex labs during his address at a World Conference in 2015, another hashtag trended on Twitter: #distractinglysexy. The hashtag was a "call to arms" for female scientists to upload pictures of themselves at work.

Using popular culture to effect a positive change is precisely what needs to be done to redefine the mathematics profession. Instead of acting as a hindrance, the media can beneficially transform how the world views mathematics and its practitioners.

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