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MATH GOES POP!

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Secondly, the farther I got along in my studies, the more I wanted an outlet to talk about mathematics and mathematicians to a general audience. When you study mathematics for a living, you very quickly see people's math phobias come to light. It's surprising how quickly someone will tell you how much they hate math upon hearing that math is what you do. I can't think of any other profession that inspires such vitriol (maybe dentistry). In any event, many people who I've talked to absolutely despise math, and as a result, they frequently have certain preconceived notions about what mathematics is, or what a mathematician should be.

These stereotypes are something I wanted to address, because they have a detrimental effect on the way mathematics is perceived. Not to be too general, but in popular culture it's usually a given that mathematics is nearly impossible to understand, it is boring, and it is lacking in innovation (in other words, all of the mathematics that humans might ever need has already been discovered). These negative portrayals carry over to mathematicians as well; if everything I knew about mathematicians was what I had learned from television and movies, I'd probably be discouraged from studying it because I didn't get my doctorate while still a teenager, I'm not socially awkward enough, and I don't want to go insane.

In other words, I wanted to create a space where I could both talk about math as it's portrayed in the news, and shed light on the way it's portrayed in popular culture. Math doesn't need to be impenetrable and dull (in fact, if it were, I doubt so many people would study it). Given the right perspective, math is elegant and simple, and it is as much of an art form as any of the mediums that frequently misrepresent it.

I started the blog on an impulse, and I wasn't sure that I'd be able to keep it going for that long. However, as the blog has forced me to think about the relationship between math and pop culture, I find that connections appear much more frequently than one might expect. While I still comment on articles involving math in the news, and I'll still happily rag on a film that plays to stereotypes about people who do math, the blog has grown to be a more general hub for the intersection of math and pop culture.

I should probably also say that I was somewhat influenced by my peers. For example, I have a friend from my days as an undergraduate (we were both math majors) who is now a grad student in linguistics at

UCSD. A year or so before me, he started a blog called *Motivated Grammar*, in which he engages the reader on all sorts of grammar related issues in a fun way. If he could do this for grammar (not exactly the most popular subject in school, either), I thought that perhaps I could do something similar for mathematics.

Who is your target audience? What have you learned about your readers since you've been writing for this site?

As a general rule, I try to keep the mathematics of my articles at the high school level. For the most part I'm able to stick to this, although occasionally there is a point I really want to make that is more advanced, in which case I usually err on the side of inclusion. This is not to say that I don't discuss topics for which the math involved is beyond the scope of a general audience, because I do, but in such cases I try to focus on the general ideas rather than the mathematical details, so that anyone reading can hopefully get something out of what I'm saying.

I try to avoid overly technical language because I don't want to just be preaching to the choir. Of course, I'm happy when people with strong math skills read what I write or are interested in my point of view, but I'm just as interested (if not more so) in getting readers who think that math isn't something they like, or that it's something they like but think they're no good at. My aim is to show people that mathematics is a vibrant and widely applicable field of study, so that if you hate math, maybe you'll find something interesting, and if you like math but lack confidence, maybe you can find something that piques your interest enough to motivate you to dig deeper and learn something new.

Probably the most surprising thing I've learned about my readers is that I actually have any. When I started this project I didn't know if anyone would share my interest in trying to cross-pollinate between these seemingly disparate fields, but for the most part, I've found that people really enjoy exploring the links between math and pop culture. From my own experience, these postings have opened the doors to conversations with people who otherwise wouldn't ever discuss mathematics, which I certainly think is a good thing.

One thing that helps is that I try to keep the tone of my articles relatively light, while not scrimping too much on the substance. In this way, I can try to reel in folks who might otherwise shy away from a blog that talks about math, but still give them something to think about. Overall, I'm happy with what I've done so

far. The best compliment I received was from someone who said that my blog made him want to go back and study math again.

Help us understand your writing process. What are your work habits? What factors helped you develop your amazing writing skills? How does your popular writing relate to or affect your academic work?

I don't consider myself an amazing writer by any means - I prefer to think that I've been fortunate enough to have found a niche that attracts my interest, and the interests of others too. As for the caliber of my writing, I attribute any success in that regard to a high school and college curriculum that demanded I write frequently. Of course, writing about something that excites you and piques your interest certainly helps.

I get most of my ideas from simply consuming media. Math comes up much more frequently than one might expect - this goes for both news media and entertainment. For example, a few months ago I posted an [article](#) discussing a scene from the HBO biopic of Jack Kevorkian, titled *You Don't Know Jack*. On the face of it, this doesn't seem like a movie that would have anything to do with math (that's certainly what I assumed when I started watching it). However, there's a courtroom scene where Dr. Kevorkian is questioning a witness, and he tries to invoke principles of basic mathematical logic to make a point. Unfortunately, the careful viewer will observe that Kevorkian in fact applies the logic incorrectly. It's a fun way to introduce basic notions of logic, and it shows how easy it is to draw erroneous conclusions from simple premises.

Whenever I stumble across an idea that I think would make good fodder for a blog post, I make a note of it. Every week or so (sometimes every other week, although I try to keep myself on somewhat of a regular schedule) I take one of these ideas and expand it into an article. Sometimes I'll make an effort to create posts that are timely - for example, the [article](#) you mentioned in your first question, in which I discussed mathematical models of vampire populations, was something I had wanted to write about for some time, but I chose to write about it during the week that the most recent *Twilight* film came out. Other than that, though, I usually just follow my gut, and whatever seems the most interesting that week is what I'll write about.

The process of sitting and writing is usually fairly painless, although it can be time consuming, depending on the level of detail I want to include, and

whether or not I need to create other content (visual aids, for example, or the occasional visual math gag). Usually I can find an afternoon one day a week to write something up, but if my schedule is too busy, I may just wait for the next week.

As for how my work with Math Goes Pop affects my academic work, thus far there hasn't been much interaction. My academic work is fairly far removed from the realm of popular culture. What I will say is that working on the blog has certainly broadened my knowledge - if I find an idea I'd like to discuss, but am not entirely fluent in the relevant mathematical background, then I may need to do some research before I can discuss the concepts with some confidence. An example of this is the mathematics of voting, which I discussed in three articles around the time of the 2008 election.

There are times when my work on an article will lead me to questions that merit further investigation, but unfortunately there are only so many hours in the day. If I'm ever to graduate, I have to put a cap on the amount of time I can work on projects that spring up from my work on Math Goes Pop. Hopefully I can always return to such problems later.

Help us understand your media use preferences. What are some of your favorite recent movies, favorite musicians, etc? What TV shows do you try not to miss? What media texts were formative in your growing up?

I've enjoyed all of [Christopher Nolan's](#) efforts (although even after *Inception* and *The Dark Knight*, *Memento* is still my favorite). I loved *No Country for Old Men* and *Zodiac* (although I grew up in San Francisco, so I may be somewhat biased). I've enjoyed most of the films written by Charlie Kaufman (*Being John Malkovich*, *Adaptation*, and *Eternal Sunshine of the Spotless Mind* in particular). Among more comedic fare, I enjoyed *I Love You, Man*, (I'm a fan of both [Paul Rudd](#) and [Jason Segel](#)), *Away We Go*, *Role Models*, ... I could go on, but maybe it's best I stop there.

Also, although I'm not sure I should be broadcasting this, I do have a soft spot in my heart for movies that glorify the ridiculous. I think *Crank* is pretty fantastic, and *Shoot 'Em Up* is in that same vein. I think *Pootie Tang* is an under-appreciated gem. Watching these movies won't necessarily make you a better person, but if you're just looking to unplug your brain for an hour or two, I don't know if you can do any better.

I'm a sucker for well-produced, serialized television drama. Like most people who have seen *The Wire*, I loved it - especially season 4, which focused on the public education system in inner city Baltimore, and which I found to be particularly heart-wrenching. My fiancé and I just started watching *Breaking Bad*, and I am completely hooked. I never missed an episode of *Lost* when it was on the air. When it comes to comedy, I think *Parks and Recreation* is great, *30 Rock* too, and I thoroughly enjoyed *Flight of the Conchords*. These references are all relatively recent, though. I was a child of the 80's, though, so that should tell you something about my media consumption growing up. There was a lot of *Teenage Mutant Ninja Turtles*, a lot of *Ren & Stimpy*. I was a huge fan of *The Simpsons* from when it started up until around the ninth season. In high school I became a big fan of the work of Don Hertzfeldt. I went through a Spider-Man phase, but otherwise was never a huge comic book reader. I don't think my movie preferences were that different from other boys my age - I suppose I had a natural inclination towards action and adventure/science fiction movies, but certainly not to the exclusion of other genres. Regarding music, I listened to a lot of hip hop growing up, but I listened to other stuff too. I went through a big *Radiohead* phase. Probably my favorite album in high school was *Mos Def and Talib Kweli are Black Star*. Nowadays I still like the same music I did when I was younger, but I'm more likely to be listening to something like *Iron & Wine*, or older soul/R&B music like *Sam Cooke* or *Bill Withers*.

I also read a lot recreationally growing up, especially in high school (I spent a lot of time on the bus). Unfortunately, as my fiancé would quickly point out, the rate at which I acquire books is greater than the rate at which I'm able to go through them. If I had to pick just one book to mention, I think it would have to be *House of Leaves* by Mark Z. Danielewski.

How do mathematicians perceive your work?

My feedback from the mathematical community (by which I mean research mathematicians) hasn't been too significant as of yet, but I'm hopeful that will change. The reaction among fellow graduate students has been positive - while there may not be much I can offer them in the way of new knowledge, they enjoy seeing these connections between math and popular culture fleshed out. I doubt very much that I'm the first person to think about these things, I'm just devoting more time to it than others might.

I would hope that this work is perceived warmly by both the mathematical community specifically and the educational community at large. While my primary goal is just to have fun writing about math, I think there is some value to what I'm writing (if I didn't, I probably would've stopped doing it by now). I certainly wouldn't recommend my material in lieu of a standard curriculum, but I hope that linking math to popular culture makes the subject more palatable to students, and gives them some indication of the breadth of topics that mathematics can address. I'm not trying to reinvent the wheel here, but I am trying to put some nice rims on it.

One of the things I like about your website is that it takes advantage of popular culture to unpack and deepen people's understanding and appreciation of the beauty and elegance of math. You have a special talent for helping take readers from 0 to 60 with your clear and engaging prose. What other math scholars have addressed the intersection of the academic and the popular? Whose work do you admire?

There are a number of books about math aimed at a general audience, but I haven't read any that focus specifically on connections between math and pop culture. As far as popularizing math is concerned, *Martin Gardner* had a tremendous influence as the writer of the Mathematical Games column in *Scientific American* for 25 years. I've mentioned him frequently in my own work - unfortunately he passed away earlier this year, but *Scientific American* profiled a number of people in the mathematical community who cited Gardner's column as a major influence on them when they were younger.

I also know that there are people who focus on one piece of popular culture and investigate its relationship to mathematics. For example, *Dr. Andrew Nestler* of Santa Monica College and *Dr. Sarah Greenwald* of Appalachian State University have compiled what I believe to be an exhaustive list of math jokes that have appeared on *The Simpsons*. Greenwald has also explored the connections between mathematics and Matt Groening's other show, *Futurama* (some of the writers on this show have a surprisingly advanced mathematical background). Certainly their work was helpful in my decision to work on *Math Goes Pop*, because I knew I wasn't the only one interested in looking at these connections.

At the end of the day, though, writing about math and pop culture is kind of a niche. There are certainly people who have cataloged incidences of mathematics in different types of media (for example, Dr. Oliver Knill at Harvard keeps a [running list](#) of math references in film). Also, if you look on the internet you can find blogs written by folks with similar interests: for example, [360](#) is a math blog that frequently discusses math in the news or math in pop culture, and [Math with Primates](#) is a math podcast that's got a bit of a pop culture flair to it.

What advice could you offer to math teachers who might be interested in using some of your web posts with their students?

One of the best ways pop culture can help in math education is by motivating students. When you incorporate pop culture into lessons, it can help to motivate students in two ways: first, it gives them an anchor that helps them relate to the concept, and secondly, by phrasing math concepts in terms which are initially non-mathematical, it can help alleviate math anxiety. Not every student is confident about his or her skills in mathematics, but every student consumes media, whether it be movies, television, video games, or books, and so by framing the conversation in this context, it can help level the playing field for students who might otherwise think of themselves as poor math students. Moreover, by tapping into their natural preferences for media consumption, you can hopefully channel some of that enthusiasm into the realm of mathematics.

For example, suppose your students are learning about probability. The Monty Hall problem that I mentioned above could be easily adapted to the classroom, where it would make for a fun game that would help students explore some of the counter-intuitive ideas that come along with probability theory. Maybe I'd better say a bit about the actual statement of the problem. As on the game show *Let's Make a Deal*, suppose that a game show host presents you with three doors. Behind one door is a new car, and behind the other two doors are dud prizes. Your job is to pick whichever door you think has the good prize.

Once you've selected the door, the host will open one of the doors you did not select, showing you one of the duds. With two doors now remaining closed, the host asks you if you'd like to swap your choice for the other door. The question is whether or not you should switch.

Most people, upon hearing this problem, think that it shouldn't matter whether you switch or not - the odds are 50/50 either way. However, the truth is that you double your chances of winning the car by switching! This comes as quite a surprise to people who have not studied this problem before. Essentially the reason why this is true is because in this particular formulation of the problem, the host is restricted in the choice of door he chooses to open, because he can't open the door containing the good prize.

Now, how one could explore this game in the classroom depends somewhat on the curriculum. For younger students, you could simply construct your own version of the game to play in class, and you could keep track of wins and losses of the students depending on whether or not they decided to switch. You will see from the numbers that switching has an advantage, so even without getting into too much of the theory you can show the students something surprising, all while playing a game with them. For more advanced classes, you could get into more of the theory, try to formulate alternatives where switching really wouldn't give an advantage, ask what would happen if you vary the number of doors, and so on.

Of course, I understand that for many teachers, there is a set curriculum, and it can be hard even to cover all the assigned material, let alone veer off into these other directions. But combining pop culture with assigned curriculum is possible. Even if there's not a lot of time in class, you can always look for ways to integrate pop culture in other aspects (for example, in homework problems). Even tests can be a good place for it - there was a physics teacher in our high school who designed a whole test around a storyline inspired from *The Matrix*. Not only were students being tested on their knowledge of the material, but they were being engaged in a fun way with problems that had a running storyline with characters and situations from a popular movie that they were interested in. It made test taking, dare I say it, fun.

If teachers want to use my material specifically, I'd be more than honored. Given what I've said above, I think that pop culture is best used as a way to introduce students to new concepts, to help garner enthusiasm and level the playing field. Trying to derive problems from pop culture is also good, because you can create situations that students are immediately invested in. By contrast, most word problems in textbooks are beyond tedious, and students are smart enough to sense that many of the problems are contrived, even if they

don't fully realize it. Also, I think it's entirely possible to cater a pop culture example to a particular level of mathematical sophistication. If you see something on Math Goes Pop (or anywhere else, for that matter) that you think would interest your students, but it seems either too advanced or too remedial for them, think about how the source material could be made more or less advanced. Since the starting point is presumably a piece of pop culture, which students at all levels can grasp, I don't see why one shouldn't be able to adapt the mathematics to suit the grade level.

Many of our readers, based in the humanities, will feel anxiety even about the idea of exploring your website, as their math phobia runs deep. Even many people who have math skills may not have appreciation for mathematics as the art form that it is. Could increased efforts to popularize and make accessible key ideas in mathematics, as your website does, really make a difference? Why? What do you think is needed to improve the state of math education in the US?

I absolutely believe that efforts to popularize and make accessible key ideas in mathematics can make a difference. I say this mostly because mathematics has been marketed horribly for years, and so I don't think I have to do much for my work to be even incrementally beneficial. What I mean by this is that a great deal of what is taught in math classes isn't really mathematics, especially at the younger levels. Instead, students are taught algorithms to be used to solve specific classes of problems. They are rarely, however, given insights into the history or context behind the development of the relevant algorithms. Not only does this rob students of the beautiful ideas secretly at work, but it also hinders their problem solving capabilities, because they don't think of mathematics as a subject that requires creativity in problem solving. This means that when they get stuck on a problem, they are more likely to throw their hands up in despair because their black box doesn't work, rather than try to think through what's really going on. To put it another way, much of the way mathematics is taught nearly forces students to lose the forest for the trees.

You can see this everywhere in the way mathematics is presented in media. Math textbooks, for example, play into this lie by focusing on drills of problems that are nearly identical. A student may solve the same problem 30 times, where the values are different each time but the technique is identical. I don't mean

to suggest that practice isn't necessary to master concepts, because it is, but major advances in mathematics come from new ideas, not from repeated application of the same algorithm to solve nearly identical problems. Not only does this give a distorted impression of what doing mathematics is really like, but it's also just plain boring.

This twisted perception of mathematics even presents itself when we try to put the subject in a positive light. For example, in recent years [Pi Day](#) (celebrated on March 14th, or 3/14) has gained some traction as a fun math themed holiday in honor of the mathematical constant pi, whose decimal representation begins with 3.14159... . But despite its best intentions, how is this day typically celebrated? Aside from eating pie, the most common festivity is a competition in which people recite as many digits of pi as possible. Can you think of anything more tiresome than being a spectator at such an event? No wonder people hate math!

There are a number of interesting questions one can ask about pi, and any of these questions could lead to interesting conversations rich with mathematical content (how was pi discovered? Why does its decimal representation never terminate? What does it mean for pi to be transcendental? This is just the tip of the iceberg). Moreover, these conversations could be had, with varying levels of detail, at any level of mathematical sophistication. But instead, we satisfy ourselves with a digit recitation contest - how dull. I've suggested [some alternative ways to celebrate the day](#), if one feels compelled to do so, in the hopes that we can use the day to capture some of the heart of mathematics.

This may seem like a minor quibble, but I think it has far-reaching consequences. By way of analogy, think about kids playing sports. Every kid knows that to get really good at a sport requires practice, including drills that can be tiring and tedious. On the other hand, they also see the benefits that practice brings: as they master the fundamentals of any sport they can enjoy themselves more when playing with their friends, and they can improve the chances of winning if they're playing on a team. Our culture also makes it clear what happens to those of them who are willing to practice harder than the rest, by showing them that if they work very hard, there is a small chance that they will have the opportunity to play their sport of choice professionally. Furthermore, for many sports, kids see that such a path, while extremely narrow, also leads to considerable reward. And even for kids who don't aspire for a

professional sports career, many still play sports recreationally with their friends because they have a good time doing it.

Contrast this with what happens in math education. In math education, ALL students get are the drills. They see no benefits to what they are doing - this is why teachers are so frequently inundated with questions like, "Why do I have to learn this? When will I ever have to use this in the real world?" Ironically, this is happening at a time where children are increasingly surrounded by technology that uses mathematics! But because we focus so much on drilling and standardized testing, students rarely catch a glimpse of what makes mathematics so appealing to those who do it for a living. They don't get to enjoy themselves doing math with a group, and they aren't often exposed to the paths that are open to them if they work hard at developing their math skills. It's not at all uncommon for me to run into an adult who tells me that he wishes he had learned more math, because without strong math skills certain career options are simply closed off. But often times students don't realize this until it's too late.

We are turning many students away from mathematics because we're failing to capture their imaginations. I'm not blaming any one piece of our educational system for this, because the problem is complex. However, if I can use Math Goes Pop to inspire students to think about mathematical content, I feel like I should certainly do so. There are undoubtedly other ways to get students excited about mathematics, but pop culture seems like an easy target because students of all ages consume media. Of course, applying math to pop culture won't get isn't as important as applying it to physics or biology, but the point is to show students that critical mathematical thinking can be useful even in unexpected places. If students begin to think of mathematics as a creative discipline about problem solving, and understand the kind of work they'll be able to do with a solid understanding of mathematics, they will be more willing to tolerate the sometimes tedious drilling that is necessary (of course, this is true any discipline). I'd like to point out that I'm certainly not the only person thinking about these issues. Paul Lockhart wrote a fantastic essay in 2002 called *A Mathematician's Lament*, which addresses the problems with math education much better than I have here. There are also plenty of teachers out there who have good ideas about how to get students to think about mathematical problem solving in the right way. For example, [Dan Meyer](#) gave a [TED](#) talk earlier this year about the problems he faced

as a high school math teacher, and he offers some great solutions of his own.

I don't think that talking about the intersection between math and pop culture is the only way to get students more involved, nor do I think it's even necessarily the best way. But it is a fun way, and amidst everything in the current math curriculum, what is lost is that doing math should be fun, in the same way that solving puzzles is fun.

What's your grand plan for life post-PhD? Might you have designs on being the next Carl Sagan for math and media? What possibilities have you been dreaming of?

I don't necessarily have a grand plan, per se. I certainly plan on writing for Math Goes Pop as long as it interests me and as long as I keep finding things worth writing about. My career aspirations vacillate on a somewhat regular basis - I enjoy teaching and enjoy research, but as you know, academic jobs are highly competitive, so I don't know if that's in the cards. Your comparison to Carl Sagan is quite flattering, although I don't consider myself nearly as smart or as good a writer, but for now I'm enjoying the opportunities Math Goes Pop has brought me. I don't know how one might spin the type of work I've been doing for the blog into an actual career, but I'd definitely be open to such a possibility. Blog writing is nice because it's very easy to integrate different types of media into the discussion - you can't put movie clips in a book, for instance. For now I have an open mind, and I'm always looking for opportunities to help inspire students to study mathematics!

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