Journal of Humanistic Mathematics

Volume 6 | Issue 1 January 2016

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Recommended Citation

Grawe, P. H. "A Meeting of Minds: An Alternate Humor for Teaching Mathematics to non-STEM Majors," *Journal of Humanistic Mathematics*, Volume 6 Issue 1 (January 2016), pages 220-234. DOI: 10.5642/jhummath.201601.14 . Available at: https://scholarship.claremont.edu/jhm/vol6/iss1/14

JHM is an open access bi-annual journal sponsored by the Claremont Center for the Mathematical Sciences and published by the Claremont Colleges Library | ISSN 2159-8118 | http://scholarship.claremont.edu/jhm/

A Meeting of Minds: An Alternate Humor for Teaching Mathematics to non-STEM Majors

Cover Page Footnote
My thanks to Bill Dunham for his personal inputs.

A Meeting of Minds: An Alternate Humor for Teaching Mathematics to non-STEM Majors

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Synopsis

John Allen Paulos argued essentially for three forms of humor dear to mathematics: Incongruity, Gotcha, and Word Play. Unfortunately, these three are often combative forms and easily drive non-STEM majors out of mathematics and statistics.

William Dunham in *The Mathematical Universe* shows how a fine mathematician can use humor to draw non-specialists in. Central to Dunham's success is his use of Sympathetic Pain humor, which creates softer synthetic Reconciler, Consoler, or Bridgebuilder humor styles.

Keywords: *pedagogy; mathematics; humor; sympathy; style*

1. Introduction

This essay champions teaching methods of William Dunham as embodied in *The Mathematical Universe* [1] as a major avenue for better teaching of mathematics to those outside the STEM disciplines. Dunham has been amply recognized and praised for his master teaching as Truman Koehler Professor of Mathematics at Muhlenberg College, as visiting professor at Bryn Mawr and Cornell University, as 1993 George Pólya Award recipient of the Mathematical Association of America, and even as recipient of National Endowment for the Humanities grants. He is specifically recognized for his humorous teaching style. This essay attempts to analyze that style as distinct from standard styles of humor in mathematical instruction.

2. Background

I recently wrote an article for *Numeracy*, the journal of the National Numeracy Network, reviewing John Allen Paulos' understanding of the relationship between Humor and Mathematics in *Mathematics and Humor* [5]. In that review, I suggested that the humor practices Paulos describes might not be very successful for non-mathematically-inclined students. An editor of the *Journal of Humanistic Mathematics* asked me to be more specific and also asked if I had anything more to say on the subject.

Asking an English professor if she or he has more to say is normally more of a challenge than a question.

There is more to say, and underlying the more is that, with C. P. Snow, I find that the world of Cambridge dons and the rest of academe has suffered in the last century or so a schizophrenic ripping of the educated mind into *The Two Cultures* [7]. (See also in fictive form *The Masters* [6].) Perhaps unlike Snow, I am entirely against this disaffection and entirely against any idea that one or the other of the two cultures is somehow right, superior, preferable, or the like. What is preferable is a whole mind that can move supply and if necessary subtlety between forms of thought in order to solve problems with appropriate intellectual tools.

I may be against the ripping of the academic mind, but I am realistic enough to realize that not all student or professorial minds act similarly and that minds that move toward the STEM disciplines are characteristically differently disposed than minds that move to the Humanities. Perhaps behavioral scientists are the balanced minds in between — though I have never heard anyone in STEM disciplines or anyone in the Humanities so argue.

3. The Problem

As a result of this difference of natural individual bents of mind, what may work admirably for teaching future scientists, engineers, and mathematicians may not work admirably in general education courses filled with students who eventually major in Economics, Psychology, History, English, or Physical Education.

If we start from that conclusion, then John Allen Paulos' observations about the idealized relationship between mathematics and humor may, however improbably, turn out to be a central clue to better teaching. Paulos seems to have humor for mathematicians down cold. But the humor he admires may leave non-STEM majors cold.

The question, however, is the reverse: what kind of humor does work for non-STEM majors. The simple answer, probably, is "Not Paulos'." But that is, of course, entirely negative and uninformative.

4. Humor Keys to Solution

4.1. Humor of the Mind

A little humor theory helps here. So briefly, let me reinterpret Paulos within four subtypes of humor that together form a set, Humor of the Mind, which we at Institute for Travesty, Comedy, and Humor Studies (ITCHS) have investigated with the help of better than 4000 respondents. The four major sub-forms of Humor of the Mind are Incongruity, Word Play, Gotcha, and Sympathetic Pain.

Paulos amply demonstrates that mathematics loves the first three of these forms. He evidently thinks that mathematicians are rather uniquely drawn to them. In fact, however, all three types have been extensively mentioned throughout the history of thinking about humor. George Meredith's misnamed discussion, "An Essay on Comedy," published in 1877 [4], coined the phrase Humor of the Mind and using exactly these three sub-forms argued that Molière is the greatest humorist of all times with Shakespeare at best running a very distant second.

Now telling an English professor that Shakespeare runs second to anyone is more of a challenge than an assertion. But let that go — with the brief aside that Shakespeare is only second because Meredith doesn't value the fourth form of Humor of the Mind, the Sympathetic Pain humor which is about to concern us here.

For our purposes, it is enough to note that heady types throughout history have been drawn to Incongruity, to Word Play, and to Gotcha. Mathematicians are heady people.

4.2. Lead Combinations

At ITCHS, we had to learn from mathematics, notably learning that four sub-forms taken two at a time result in six separate combinations. Since Paulos advocates three of the four, we note that three forms taken two at a time yields three combinations. With these observations we may have neared humanistic frontiers of understanding of combinational possibilities.

Happily, however, these are enough. Paulos' three mathematical humors result in three derivative combinations of two "leading" humors.

The emphasis on dominant or leading humors needs its own explanation. Humor is a pyrotechnic element in all rhetoric. It is the fireworks of most ordinary prose. And like fireworks, it leaves abiding impressions. However, most of us don't intently remember every joke as it goes by. Our lasting impression is a much vaguer, general sense of dominant or lead forms.

Thus, imagine that I tell you I have a friend with a very definite sense of humor. Even in mixed company, even when my wife is present, he loves to pull out a very explicit sex joke. If I tell you this, I expect you will think something like, "Oh, that must have been embarrassing on one or more occasions."

But then I follow up by saying that occasionally, my friend deviates from his explicit jokes on a limited number of body parts. Routinely then he pulls out some joke that, if I am fortunate with my wife present, is only a bathroom joke but unfortunately is almost certain not to consider the bathroom in general but instead to deal exclusively with material inside the toilet bowl, in short, pure excremental humor.

Again, one might think this is potentially embarrassing. But with two forms of humor mentioned as my friend's leads ("so why is he still your friend?" some may ask), it is more likely that we jump instead to an idea about my friend's psychology, character, or personality. Typically, we say something like, "Sounds like a smutty friend."

4.3. Lead Humor Personality

So two leads end up as personality — smutty. That seems to be generally true among perhaps thousands of sub-forms of humor. And it has proved empirically true for Paulos' mathematical forms. Put Incongruity and Word Play together as leads, and you have Intellectual humor — I told you they

were heady. Keep Incongruity and add Gotcha, and you have Crusader humor. Keep Gotcha and add Word Play, and you have Advocate humor. All three have a driving intensity. All three will challenge the best and the brightest to keep up. All three, in other words, are excellent choices for keeping Albert interested, on track, and keen — Albert Onebrewski, that is.

Oh sorry, that's just an example of multi-lingual Word Play. Make that Albert Einstein.

Albert Einstein can perhaps be made into a great STEM thinker by challenging him with Paulos' humors. But then Albert Einstein could probably make himself Albert Einstein simply by sitting in a patent office.

For non-STEM majors, mathematics is typically difficult stuff. It may seem that they need to be kept awake with jabbing humor. Instead, I'd argue, they need to be convinced that difficult mathematical thought can relate to their humanity and help in solving their problems.

5. Dunham's Achieved Solution Employing Sympathetic Pain Humor

And that is where William Dunham, his demand as a speaker and mathematical advocate on the country's best campuses, and the praise for his *Mathematical Universe* come in. Because characteristically, Dunham is not just amusing, funny, or light on his feet. He is first and foremost a darn good mathematician who knows his subject from A to Z (in *Mathematical Universe* his chapters are even numbered A through Z) and from the early Greeks to his present contemporaries. And he's doing a bang-up job of helping people from outside the STEM disciplines learn a lot more math than they thought they'd ever allow themselves.

It is not enough that Dunham is humorous. He is characteristically the right kind of humorous. Paulos emphasized three forms of Humor of the Mind which we can call SHIMI, Standard Humor in Mathematical Instruction. Dunham uses all three of the SHIMI humors (Gotcha, Word Play, Incongruity) himself. But the dominant impression of his humor comes from its dominant lead humor, the one Paulos neglects, Sympathetic Pain humor. As Dunham recently told me, mathematics is a difficult enough subject that it pays to lighten up the subject in ways his students can appreciate.

Combinations of individual SHIMI forms of humor with Sympathetic Pain create Bridgebuilder, Consoler, and Reconciler combinatorial leads. Students already challenged in STEM courses can appreciate and learn through these softer, less driving and jabbing combinations.

5.1. The Personal Touch

Now it helps that Dunham approaches mathematics from the standpoint of the history of mathematics. That is a first clue for teaching mathematics to non-STEM students. Non-STEM students typically remain human beings. They aren't so fascinated by mathematics that they can forget that status. But history is finally always about people, and people can make any subject more interesting.

There's a famous picture of Euler wearing a funny hat. Dunham reprints the picture in *Mathematical Universe*. If a student can't remember that Euler is probably the greatest mathematician of all time, he or she can at least remember that he's the guy in the funny hat. The right kind of humor has done its first job of teaching.

Unless, of course, the student is so obtuse that he confuses Euler with Euclid — Euclid has a famous picture in a funny hat, too, and Dunham bothers to reprint it as well. Annoying that Euclid also chose to begin his name with E. (Euler rather than Euclid gets to be "Chapter E" in *Mathematical Universe*, Euclid having to settle for "Chapter G: Greek Geometry.") For the confused and obtuse dunderhead, there is the intellectual thrill of distinguishing these two guys in funny hats by the time of the final examination.

As I said earlier, people in STEM disciplines and in the Humanities tend to think differently. As the difference between E and G illustrates, Dunham bothers to meet the non-STEM mind. And in the meeting, a good deal of mathematics can be got across.

5.2. Sympathetic Pain Humor

A people-orientation helps not just because people respond to people but because people-oriented humor easily allows Sympathetic Pain to predominate if the humorist stays on task. Sympathetic Pain humor is humor that shows us humanity and elicits from us a smiling or laughing response that more or less articulates, "That's okay, Buddy, we know exactly how you feel!"

An old joke provides a good example: a young woman with three very young children at a museum cafeteria says to the server, "Three Jell-os™ — and please, make them all the same color!" If you've had children, you know exactly how she feels. (For this and other examples, see *Humor Quotient Newsletter* [3] and "Humor Quotient Test" [2].

In ITCHS research with respondents at ages from 18 to 95, Sympathetic Pain is routinely the mature humor. Sympathetic Pain humor sky-rockets among the quite elderly, notably in nursing home residents. One of our associates, then in her late seventies or early eighties, first discovered this sky rocket among her bridge partners and other friends. Or rather, we discovered it in her gathered responses to our Humor Quotient Test (HQT). Confronted with the results, her response was, "Oh sure. When you get old that's what you have to talk about." With the slips and gaffes of old age, you either laugh with it or cry. (At the opposite extreme, with the slips and gaffes of old age, we evidently become less amused by Gotcha humor, having been got enough already.)

So Sympathetic Pain humor transmutes true sympathy — which taken literally is painful and not something most of us volunteer for most of the time — into a communal laughter and smiles.

Sympathetic Pain comes in three "numbers": first, second, and third person. I can tell a joke on myself and ask you to laugh sympathetically. I can tell a joke about you and ask you to laugh sympathetically. (A friend of mine the other day said, "Your hair keeps marching backward." It stung a little, but he laughed, and I laughed. It's better to sympathize with yourself.) And I can tell a joke about a presidential candidate we both back, and we can both laugh sympathetically with that candidate and with ourselves for supporting him or her.

Now the Euler funny hat has a strong humorous component of Sympathetic Pain in the first person with reference to a third person. A mathematician is "telling" the joke about a mathematical genius (and thus on her or himself in disguise). He's recognizing that there are occupational hazards, and he is sympathetically presenting Euler as someone we can sympathize with instead of just admire. Ditto for Euclid.

5.3. Practice

So my recommendation if you teach mathematics and want non-STEM students to actually care and to learn, focus on Sympathetic Pain and read *Mathematical Universe* for a wide variety of Sympathetic Pain techniques. Practice knowing why something is Sympathetic Pain.

For example, numbering chapters A to Z has a strong Sympathetic Pain component. As I described it in conversation with Dunham, "You number your chapters with letters. That is just like a mathematician: they're always inventing names for things, and the names are always letters as in naming an angle EOG." Again, lettering is something of an occupational hazard in math. Letting people see that hazard and respond to it in a friendly way goes a long way to the middle ground where minds meet.

I'd like to focus on a single chapter in Dunham, Chapter T: Trisection, because, unlike the chapters on Euler and Euclid, it is entirely centered on an ultimately highly intricate problem of mathematics that has concerned both the worst and best of minds for millennia.

Putting it in Dunham's words:

> "*The befuddlement persisted through the Renaissance and into the modern era. With each passing century, with each failed attempt, the trisection problem grew in stature*" (page 244).

Note here the mathematical-historian approach. The personal dynamic creates personal interest for your non-STEM students. This isn't Sympathetic Pain on any grand scale. It is just the personal — the person-describing — touch.

Of course, some of your students will have already worked on the trisection problem — I worked on it once myself — and for them, there is likely to be a Sympathetic Pain component that forces a smile of remembrance at least. "That's okay, Buddy, I know exactly how you feel!"

And then Dunham goes on:

> "*Like an outlaw with a large bounty on his head, trisection was hotly pursued by a posse of mathematicians*" [That's okay, Buddy . . . .] (page 244).

The joke is now out in the open, at least for those cinematic types who can imagine Hollywood trying to film this chase scene across a boulder-strewn Western set. That joke is largely preposterous, but you've got to sympathize with people who get their kicks mounting up for such an expedition. If you want, you can even sympathize with wily but heavily outnumbered and outgunned Trisection.

And still continuing:

> "*Scholars and pseudo-scholars devised trisection procedures and announced them to the world amid great fanfare. Then, without exception, these unfortunate scholars watched as others found flaws in their reasoning. The flood of incorrect proofs got so bad that the Paris Academy declared in 1775 that it would no longer accept trisection arguments*" (page 244).

Note here how rapidly Dunham shifts the scene and shifts the sympathy now to the distraught members of the Paris Academy finally putting their exasperated collective foot down.

In short, look at what Dunham does, and ask yourself how much of what he does can be interpreted as first, second, or third person Sympathetic Pain humor.

It helps in such an exercise to recognize that what we think of as one joke can often be two jokes told simultaneously. For example, there is a certain playing with words and certainly incongruity in calling trisection an outlaw "with a large bounty on his head." So don't be surprised in analyzing Dunham to find him engaging in one or more of Paulos' SHIMI humors (Gotcha, Word Play, Incongruity) in a joke that also has a substantial Sympathetic Pain component. But remember that a joke that seems equally Sympathetic Pain and Incongruity has a *synthetic* character, in this case Reconciler character.

6. A Fly in the Ointment — Getting Back to Work

I'd love to leave the essay right there. But. . . .

Sympathetic Pain humor combines easily with the SHIMI humor forms to build teaching moments. Equally, abandoning the Sympathetic Pain component immediately reverts to the hard-driving SHIMI possibilities (Intellectual, Crusader, and Advocate) any of which can put a damper on any meeting of the minds.

And, unfortunately, abandoning Sympathetic Pain humor is easily and sub-consciously done in moving from fuzzy, touchy-feely introductory stuff to the tough stuff of mathematics proper. Sympathetic Pain humor is easily thrown overboard with the thought, "Now, enough funny stuff; let's get down to business."

And when that happens, it is not that we always get down to the serious business. Instead, we often move back to SHIMI. And this can be the deathblow to a meeting of minds with the non-STEM student.

I hope Bill Dunham won't mind if I use his own discussion to illustrate. He's already covered the subject in the abstract and made the great point that trisection is a game with certain very definite rules, and therefore, many will think they have an answer, only to find out that they weren't even in the right ballpark. He has given a great example of Archimedes' proof, which Archimedes himself knew had "cheated" at the game, essentially proposing a measuring straightedge be used when the rule is for exactly the opposite.

Dunham has also given a sophisticated approximation scheme with its full mathematical defense, a defense which must finally admit that it is only an approximation dependent on infinite repetition. Dunham's lightly humorous and sympathetic summation is "which exceeds our finite life span."

So from a non-STEM perspective he has already made the point. If we think we've trisected, we probably don't know the game. But then Dunham continues with the truly heady stuff that eventually someone, namely Pierre Laurent Wantzel in 1837, proved that trisection was impossible.

Dunham shortens Wantzel's deep seven-page argument, and I will shorten Dunham's, hopefully without too much distortion. Wantzel took the question outside geometry. He asked himself which magnitudes could be constructed with a straightedge and compass. Thereafter, he showed through trigonometry that, if a 60° angle could be trisected, then the formula $x^3 - 3x - 1 = 0$ would have to have constructible solution, which turns out to also be a rational solution.

Now this is deep stuff, and one can assume that non-STEM majors will characteristically be ready to move on to some other class. For mathematics, of course, this is just a warm-up to a three-part argument showing that none of three possible solutions to the cubic equation will be rational. Thus, there is no rational solution of the cubic and thus, QED, there is no possibility of trisection.

So that settled it

> "*for serious mathematicians. But strangely, a collection of quasi-serious, misguided, or just plain kooky individuals have persisted in looking for trisections anyway*" (page 247).

Please notice what has happened to the humor. There is still a humorous component. But the humor is now heavily barbed. It is inviting certain people to leave mathematical thinking not just today but forever.

Be a serious mathematician or — .

My point is not that Wantzel is incorrect. My point is that, with the tough-stuff mathematical discussion, the humor has become stridently exclusive rather than inclusive. And worse yet, it is not a meeting of the minds; it is a bludgeoning into submission.

One can easily argue that bludgeoning into truth was exactly what Wantzel was about. It can also be easily argued as Dunham does, "In the words of Underwood Dudley, one might as well try to find two even integers whose sum is odd"' (page 247).

And this comment then leads into more deprecatory humor:

> "*Yet committed trisectors are not easily discouraged. As Robert Yates observed, Once the virus of this fantastic disease gets into the brain, if proper antiseptics are not immediately applied, the victim begins a vicious circle that leads . . . from one outrage of logic to another*"' (page 247).

Dunham laconically adds

> "*One explanation for such behavior is a misunderstanding of the word impossible — to some people, impossible sounds more like a challenge than a conclusion.* [Please note that earlier in this discussion, I have been at pains to show an English professorial

> mind bent toward taking words as challenges.] *After all, it was once deemed impossible for humans to fly . . . . Mathematicians know better. As shown in Chapter J, mathematicians can prove negatives in a final, decisive sense. In this case, impossible means, literally, impossible*" (page 247).

I hope even novices in humor analysis can read this and recognize that the Sympathetic Pain component has disappeared.

And with that disappearance, imagine the benighted soul from the Humanities who just wanted to shut the book and move on to another class. He's not a great brain in science and mathematics, and he knows it.

He also remembers that he had a certain joy and wonder when clandestinely he made his own attempt to find the Perpetual Motion Machine. And yes, the same joy and wonder, even delight, have accompanied him on the one or two occasions when he applied what geometry he knew to trying to solve the trisection problem. He would have loved to have met someone with similar emotions from mathematics in a meeting of two minds across the barriers between two cultures.

But now it is obvious that to be a real mathematician, you can't entertain such joy, wonder, and delight. You are probably damned to have put any time into such experiments at all.

The Deadly Sin, and you've committed it.

Ever met such people? I have.

Met them but not recognized what turns out to be a pure inquisitive impulse, perhaps a particularly American impulse not just to accept authority but to see for oneself?

Now I know that mathematicians can object, "But come on, stupid, it's been proved!"

Yes, I heard that, and so did the student.

But what if it just happens that Wantzel didn't realize one of the magnitudes that a straightedge and a compass could create? I've repeated what is in *Mathematical Universe*. Dunham didn't say which magnitudes were and weren't recognized by Wantzel or how one could prove exhaustively which were legitimate.

6.1. What if?

So, what if?

And of course, for every trisector in history, that has always been the essential "what if?" What if there's something people never dreamed of before. Dunham mentions Gauss' 1796 proof that one could create a 17-gon using only a straightedge and compass. No one had ever thought it possible before.

Again, I am not arguing that Wantzel is wrong. How would I, an intellectual pygmy from the Humanities, know? But as someone in the Humanities, I know something of the human argument that discovery wouldn't be discovery if someone didn't dare to think what everyone thought couldn't be thought.

6.2. Time Well Spent

And as someone with an interest in pedagogy, I have never regretted in myself or in anyone else the time taken to play with things like trisection for one's own enlightenment. It taught me a lot. Teaching yourself, which is what every teacher needs to do to teach a class, is always the greatest of academic learnings.

6.3. Wantzel's Model

Come to think of it, didn't Dunham's discussion start with a commendation of Wantzel for doing what perhaps no one had thought to do before, to take the question of trisection out of geometry?

6.4. Euclid to Euler

And wasn't there some statement, too, about how the greatest minds in mathematics over a couple of millennia chose to sharpen their mathematical intelligence by wrestling with the trisection problem? If they could be educated by attempting the impossible, why can't the poor soul from the Humanities be instructed in the same school of hard knocks?

6.5. Dunham and Games

And anyway, Dunham says it is all a game. If people from STEM disciplines have gotten to play the game throughout the ages, how about they let others on the field of play?

7. Conclusion

In closing, then, if you teach math, I hope you'd like accolades like the following (all taken from the back cover of *The Mathematical Universe*):

"Dunham writes for nonspecialists, and they will enjoy his piquant anecdotes and amusing asides." — Booklist

"Artfully, Dunham conducts a tour of the mathematical universe . . . he believes these ideas to be accessible to the audience he wants to reach, and he writes so that they are." — Nature

"If you want to encourage anyone's interest in math, get them *The Mathematical Universe*." — New Scientist.

Note the consistent combined emphases: a meeting of minds, generating enthusiasm, an engaging and humorous approach to nonspecialists.

You can be much more worthy of such accolades if you practice using Sympathetic Pain humor approaches (see Dunham for a very great range of these) and if you bear down on teaching the tough stuff honestly but without deserting sympathy and the meeting of minds both within and beyond the STEM disciplines.

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