



A Mathematician in the Jury Box, or, “But how should we define ‘intoxicated?’”

James Propp, 16 May 2019

Back in the 1990s, when I was serving on a jury in a one-day trial, my mathematical temperament got me in hot water with my fellow jurors; fortunately, my outside-the-classroom mathematical training got me out of it. But that doesn’t come in until the end of the story.

The case featured a couple of surprising twists — which is in itself surprising, since even a single twist is unusual in a one-day trial. It had seemed at first like a very straightforward drunk-driving charge. The defendant went to a party, drank some alcohol, left the party feeling unwell, got into his car, drove off, and blacked out, though with enough advance warning of his impending unconsciousness that he was able to pull over to the side of the road and turn on his hazard lights before passing out. A police officer found him slumped over the wheel of his car. The officer smelled his breath and it smelled of alcohol. The District Attorney presented these facts confidently, as if this was going to be an open-and-shut case. But then, in the kind of surprise you see only on television, the defense attorney asserted (with medical records to support his assertion) that in fact the defendant was diabetic, that someone with diabetes can go into hypoglycemic shock if they ingest a little bit of alcohol on an empty stomach, that the breath of someone in hypoglycemic shock is often nearly indistinguishable from the breath of someone who is drunk, and that the amount of alcohol that the defendant had drunk at the party was, according to witnesses, well under the amount that would cause blood alcohol concentration to reach .08% (the legal definition of “too much”).

As I said, this kind of surprise reversal hardly ever happens in real-life trials. I think the district attorney must have been pretty inexperienced to get caught off-guard by the diabetes defense; surely that kind of information about a defendant wasn’t so hard to obtain, even back then. If the state had known that the defense would go down that road, they might have dropped the case, or they might have tried to prove that the defendant wasn’t really diabetic after all, but they did neither of these things. They just seemed totally unprepared for what happened in the courtroom that day.

THE SECOND TWIST

The first surprise was the diabetes; the second surprise was the holdout juror who insisted on the defendant’s guilt despite the diabetes. Reader, that juror was me. If anyone makes a movie version of this story, they can call it “Eleven Angry Jurors and One Stubborn Mathematician” — though this title omits the key role played by two incompetent lawyers who’d brought the twelve jurors together. I’ve already described the prosecutor’s inept handling of the case, but the defense attorney made a major blunder too; during jury selection we’d been asked “Which of you are members of Mothers Against Drunk Driving?” and I’d said I was. This should have led a competent defense lawyer to challenge me for cause and send me home. Instead, I’d been chosen as a juror in a drunk driving case. And wouldn’t you know, when the jurors began their deliberations, it was the Mothers Against Drunk Drivers juror who acted like the DA’s best friend.

Most of the jurors thought it was a slam-dunk for the defense. I didn't think so. I figured that if the defendant was diabetic and knew it, and if he knew when he left the party that the alcohol was having a bad effect on him, it was irresponsible of him to drive. Part of being a responsible operator of a motor vehicle is knowing what your limits are, and not getting behind the wheel when you've exceeded those limits.

"But this isn't a reckless endangerment charge", they fired back. "It's a DUI."

There followed some discussion of the phrase "driving under the influence", and I insisted that the phrase applied here, since the quality of the defendant's driving had been literally influenced — profoundly influenced! — by the alcohol he'd imbibed.

At my request, we sent a message to the judge, asking him to give us the governing statutory language. The phrase used in the legal code was "driving while intoxicated".

But what does — what *should* — the word "intoxicated" mean?

DEFINITIONS

The mathematician Richard Dedekind¹ wrote a famous essay called "Was sind und was sollen die Zahlen?", and I've always interpreted the title as "What are numbers, and what should they be?" I read the essay in college, and it has stayed with me. I like the title's dual emphasis on math as timeless truth (numbers are what they are) and math as human construct (what do we *want* numbers to be?).

Once upon a time, specifically back in ancient Greece, the number 1 wasn't considered an odd number, because it wasn't considered a number at all. Rather, 1 was the unit from which all numbers (meaning, positive integers from 2 on up) were built, by repeated addition; 1 didn't need building because it already *was*. Later on, when 1 was declared a counting number, it was pretty clear to everyone that 1 should be considered odd, not even, since it can't be evenly split into two equal pieces.

Later on, mathematicians realized that a zero is a good thing to have, because it's good for counting things that aren't there — which seems like a silly desideratum, but you might want to have a way to count the members of a collection without knowing in advance whether the collection has any members or not. Are there any diabetics who live on my block? I don't know, but I still might want to be able to say that the number of type I diabetics plus the number of type II diabetics equals the total number of diabetics, which means I might need to say " $0 + 0 = 0$ ", which means I'd better have 0 to kick around.

But zero is still weird, and maybe you don't really like it, so you might want to express the way you feel by decreeing that *zero is odd*. So now zero is the only odd number that gives another odd number when you add 1 to it. That's really strange! And maybe you take some satisfaction in the strangeness of it; it confirms zero's status as a pariah among the counting numbers. But now your choice causes problems: certain propositions that were universally true before ("The sum of two odd numbers must be even", "An odd number times an even number must be even") may now fail when one of the numbers is zero. So the price of your stigmatization of the number zero is that the facts of arithmetic become more complicated ("The sum of two odd numbers must be even, as long as neither of them is zero", "An odd number times an even number must be even, as long as the odd number isn't zero"). Don't you see that by punishing zero, you're really punishing yourself?

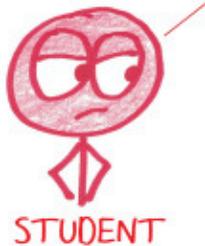
Once upon a different time, specifically in post-Renaissance Europe, the number 1 was considered prime. Later on, mathematicians decided that this wasn't such a good idea. Instead, positive integers should come in three flavors: prime numbers (2, 3, 5, 7, ...), composite numbers (4,

¹ https://en.wikipedia.org/wiki/Richard_Dedekind

6, 8, 9, ...) (also called “secondary numbers”, though nobody calls them that nowadays), and units (of which there is only one, namely the number 1). That’s right, 1 is now once again considered a unit! I guess those ancient Greeks were onto something. But now the building blocks aren’t the units; they’re the primes, because now we’re talking about building numbers up by multiplying them rather than by adding them. To learn more about this story, check out Evelyn Lamb’s essay “Why isn’t 1 a prime number”.² For a preview, check out Ben Orlin’s cartoon.

WHY ISN'T 1 A PRIME NUMBER?

Because the definition says so, and that's sacrosanct.



Oh, it's prime all right. Can't trust the mainstream texts.



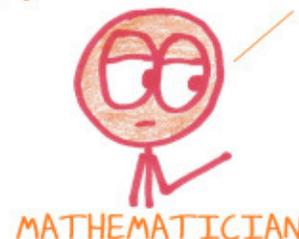
Because "prime" means "first," and... um, wait...



Because it's the loneliest number! Although, as the only even prime, 2 can be as bad as 1. It's the loneliest number since the number 1.



Because the definition says so, and that's convenient.



Cartoon by Ben “Math with Bad Drawings” Orlin.³ Support him on Patreon; I do! ... Oh no wait, you can't; he's just stopped supporting his work using Patreon. So just buy his 2018 book and pre-order his 2019 book!

Another good essay to read is Art Duval’s “What is 0^0 , and who decides, and why does it matter?”⁴ Duval points out that sometimes we look ahead at the theorems we want to prove, and the arguments we want to prove them with, before we settle the finer points of our definition. “At research-level mathematics, we might even modify our definitions substantially to make our theorems stronger, or to deal with potential counterexamples.” So in a way my training in research-level mathematics reinforced my natural tendencies towards asking questions of the form “What does X really mean?” The mathematician/engineer Oliver Heaviside⁵ put it well when he wrote:

² <http://www.evelynlamb.com/why-isnt-1-a-prime-number/> [JOS: Also see Nakul Dawra’s Youtube site GoldPlatedGoof and the September 2018 video “Why Can’t 1 Be Prime” (<https://www.youtube.com/watch?v=alprjOchyEY>)]

³ <https://mathenchant.files.wordpress.com/2019/05/048-orlin.jpg>

⁴ <https://blogs.ams.org/matheducation/2018/11/01/what-is-00-and-who-decides-and-why-does-it-matter-definitions-in-mathematics/>

⁵ https://en.wikipedia.org/wiki/Oliver_Heaviside

“Mathematics is an experimental science, and definitions do not come first, but later on.” It’s the mathematical community’s job to adjust definitions as needed from time to time.

But (getting back to my jury-duty story) is adjusting definitions the jury’s job? Or are jurors supposed to use the commonly accepted meanings of words, since those are likely to have been the meanings in the minds of the people who wrote the laws that the juror is charged with enforcing?

With that rhetorical question, let’s return to the 1990s.

THE VERDICT

Once the judge had made it clear that the charge was driving-while-intoxicated, I raised the question of whether, under the proper definition of the word, the defendant might have indeed been intoxicated, even if his blood alcohol concentration was effectively zero. “Let’s take the word ‘intoxicated’ apart. The Latin root means ‘poison’, so the word has to do with a person being poisoned. That’s relative; what’s poisonous to one person may not be poisonous to another. For a diabetic with an empty stomach, even a small amount of alcohol can be extremely toxic.”

At this point, the forewoman couldn’t take any more. “I’ve been a nurse for twenty years,” she said, “and I don’t need a Latin dictionary to tell me what ‘intoxicated’ means; it means having too much alcohol in your blood and in your brain. This man was not intoxicated.”

And here is where my outside-the-classroom training as a mathematician helped me — because in addition to spending time in lecture halls learning advanced mathematics, I’d spent time hanging out in the computer room reading posts on the USENET bulletin boards sci.math and sci.math.research. On these forums I’d encountered some people who were kind of like us math grad students and kind of different. They shared many of our interests and desires; they were people who wanted to make useful and/or beautiful mathematical discoveries that would make the world stop and take notice. But by and large the people I’m talking about were solitary thinkers rather than social thinkers like me and my classmates, and their milieu hadn’t led them to develop the habits of course-correction that make progress possible. Whether you call these individuals crackpots or cranks, their signal attribute was their utter confidence that they were right, even if everybody disagreed with them.

A milder version of the crackpot condition is smartypants syndrome (the tendency of some people of above-average intelligence to believe that they’re smarter than everybody else). And I didn’t want to be That Guy. So in that jury room I decided that if everybody else in that room thought that I was overstepping the bounds of what a juror is supposed to do, that I was trying to do the lawyers’ work for them, that I was playing games with language, that I was being That Guy, they were probably right. And so I voted for acquittal.

Call it intellectual humility or intellectual cowardice, but it was a response that fits in with my experience in math classes, exam preparation sessions, and coffee hour conversations. This kind of modesty is something you learn by thinking out loud with other people and sometimes being wrong. This sort of experience encourages the habit of doubt, and gives rise to a broad conviction that if everybody else says you’re wrong, you probably are.

I never followed up to see what happened to the defendant after we acquitted him. It’s possible that he learned his lesson and took more responsibility for his actions after that. Or it’s possible that he didn’t learn his lesson, that he had a similar incident a few years later, and that he killed someone. Would my view of my actions change if I learned that the latter was the case? Or, waxing even more hypothetical, what if I learned that this sort of incident — diabetic drivers killing people and “getting away with it” — was more commonplace than anyone guessed? (See Endnote #1) Would my present-day verdict of my 1990s verdict change? Maybe. But it’s possible that I’d stand by what we jurors decided. There’s an argument to be made that when laws are suboptimal, it’s the role of legislatures to change the laws, and the role of citizens to advocate for those changes, but not the role of juries to fail

to enforce the existing laws. Nullification by jury has its place in the arc of humanity's ethical evolution, but it's probably a more effective tool when the case is a massive class-action suit that will directly affect many people, or a high-profile case whose outcome will be noted by the public — not a one-day trial that won't even be reported in the newspapers.

This brings me to one last point: although I don't think that a training in mathematics gives a juror any special advantage, I do think that when it comes to drafting the wording of statutes, the kind of training that a mathematician or a lawyer gets is a big help. Both kinds of training encourage trainees to attend to borderline cases, niceties, ambiguous wording, etc. So if anybody reading this is involved with drafting new motor-vehicle regulations and wants someone of a nitpicky cast of mind to look it over for loopholes, send it my way. But my degree is in math, not jurisprudence, so I don't expect my off-the-cuff judgments to be reliable; I know my limits.

Thanks to Sandi Gubin, David Jacobi, Joe Malkevitch, and Evan Romer. Thanks also to the Black Bear Cafe in Belmont, MA (associated with Belmont Books⁶), where parts of this essay were written. Support your local independent bookseller, especially if they make good coffee!

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ENDNOTES

#1. According to the web article “Diabetes and Driving”:⁷

Some states and local jurisdictions impose no special requirements for people with diabetes. Other jurisdictions ask drivers with diabetes various questions about their condition, including their management regimen and whether they have experienced any diabetes-related problems that could affect their ability to safely operate a motor vehicle. In some instances, answers to these questions result in restrictions being placed on a person's license, including restrictions on the type of vehicle they may operate and/or where they may operate that vehicle.

So it seems to me that the problem of hypoglycemic episodes in diabetic drivers is being adequately addressed in 2019 in some states. In fact, it's possible that in some states the pendulum has swung too far and diabetics are being unfairly prevented from getting driver's licenses. It's possible that every state is doing it wrong but that each of them is doing it wrong in its own way. If any of you know anything about this, please post a Comment!

#2. Joe Malkevitch, an early reader of this essay (whose essay “Are Precise Definitions a Good Idea?”⁸ has some points of overlap with mine) writes:

Many years ago I served on a jury involving a claim from a person who had been hit by a driver who allegedly had been driving at excessive speed. After the case was closed, I was told that I had been chosen to serve on the jury because being a mathematician I would be able to “understand” some of the technical issues involved in the case. But perhaps in this there was a miscalculation. The chief witness admitted that the accident had been a bit far from where she was but said that she had heard the impact and the car had seemed to be speeding. Numbers involving stopping distances calculated to 5 or 6 significant figures were generated to argue that excessive speed was involved. In the end the jury was not required to reach a decision because the case “magically” got settled out of court but in a “debriefing” after the case was settled I made the point that all that my mathematical training did was to make me skeptical of calculations purporting such accuracy when the input data was so inaccurate! The prosecutor seemed rather startled.

⁶ <https://www.belmontbooks.com/>

⁷ http://care.diabetesjournals.org/content/35/Supplement_1/S81

⁸ <http://www.ams.org/publicoutreach/feature-column/fc-2016-01>