Rationally Speaking #197: Doug Hubbard on “Why people think some things can’t be quantified (and why they’re wrong)”

Julia: Welcome to Rationally Speaking, the podcast where we explore the borderlands between reason and nonsense. I'm your host Julia Galef, and with me is today's guest Douglas Hubbard. Doug is a consultant and author of several books, including one of my favorites, *How to Measure Anything: finding the value of intangibles in business*. Doug, welcome to the show!

Doug: Thanks for having me, Julia.

Julia: So one of the reasons I think that I've ended up recommending your book to many people over the years is that it's this neat hybrid between being, on the one hand, very practical advice driven -- and that's sort of how it's packaged… But on the other hand, underlying all that advice is this idea that I think is actually very important and quite deep once you get it -- which is that you *can* measure anything. And this is an idea that is kind of counterintuitive, and that as you describe in the book a lot of people instinctively resist.

Doug: Right.

Julia: And one of the things I'm hoping to focus on today with you is, why is that? Why do we resist the idea that we can measure things and quantify things, quantify our uncertainty? And what are some of the ways to do that.

Doug: Yeah.

Julia: Let's jump in. What are some examples of the kinds of things that people tend to say are, "Oh, that's impossible to quantify, to put a number on,” or to measure, that you would disagree?"

Doug: Oh, sure. Well, I can give you some real examples we've actually done. People are asking us to measure the value of information governance, or measuring drought resilience in Horn of Africa, or the impact of dams on the Mekong River, or the effect of some new environmental policy, or how much fuel the marines are going to use on the battle field, forecasting it 60 days in advance.

Now some of those seem like better units of measure -- I mean obviously, fuel we can measure in gallons.

Julia: Yeah, that one seems -- as an outsider, like, “Oh, sure you should be able to measure that.”

Doug: Right, it's hard, but I mean. There's a lot of uncertainty to it, but things like drought resilience or collaboration or governance, those are much more ambiguous terms. And those are the sorts of things that people really think of when they say that's immeasurable. Not just hard to measure, but *immeasurable*.

There are several examples like that. Even sometimes people include risk in that, because it seems ambiguous to them, right? Even though there's whole industries around measuring risk.

Julia: You had this funny anecdote in the book about someone, I guess it was an actuary and you were talking to him about risk, and he insisted that some risk couldn't be quantified. And you were like, isn't that what you literally do for your career?

Doug: No, right. That was actually, I remember, it was someone high up in an IT organization, not quite the CIO, but direct report I think to the CIO. Who said, "IT is impossible to measure because IT is risky, and there's no way to measure risk." And I told him… you work in an insurance company.

Julia: Got it. That's one tiny bit more forgivable, given that he wasn't an actuary.

Doug: But it's interesting, because a lot of my original clients 20 years ago were IT in insurance companies, and you would think maybe they'd be ahead of IT and other areas in terms of measuring value and the effectiveness of measuring risk and so forth, but in fact no. They were coming at it just as new as anybody else.

Julia: So one of the themes that I'm picking up on is that there are these two big reasons why people feel like some risk or some quantity can't be measured. Where one is just uncertainty, unwillingness to make a forecast about something that isn't certain. And the other is ambiguity.

Doug: Right, sure.

Julia: Where like, "governance" is this nebulous thing, so we can't put a number on a nebulous thing. Does that seem right?

Doug: Yeah. I mentioned there were three reasons why anybody ever perceives something to be immeasurable, and they're all three illusions. I refer to them as dot com. C-O-M: Concept, object, and method. So if you want a mnemonic, you can just think of dot com. C-O-M.

Concept has to do with the definition of measurement itself. People might misunderstand that measurement is merely a reduction in uncertainty, quantitatively expressed based on observations. It's not an exact number. Sometimes somebody will say, "I can't put a number on that." Well, that's not what measurement means in a scientific sense. It's not what it really means in a practical decision making sense. It may mean that pretty much just to accounting. That's just about the only area where it meets that. Even in engineering they use words like "tolerance" to represent room for uncertainty.

Julia: What does tolerance mean here?

Doug: Oh, tolerance, is the way an engineer describes uncertainty. So the tolerance on the diameter of a bolt, they might say it has to be one inch diameter with a tolerance of

.01 in, .001 inches, right? That means that's how much the variation can be in a manufacturing process. That's what they call tolerance.

So that's room for uncertainty, variation and uncertainty, in even what seems like an engineering context. But most people ... certainly all scientists, and in practical decision making where you make decisions under uncertainty, measurement really means a quantitatively expressed reduction in uncertainty based on observation. So not necessarily an *elimination* of uncertainty. Rarely an elimination. If that were a prerequisite, then most things in physics couldn't be measured.

Julia: So if I'm trying to estimate some property of a population, like the average height or something… and I take a sample of ten people from the population and measure their height, then I have a better guess about the average height of the whole population – like, the whole state -- than I did before. But still I can't be *certain* about what the average height is.

Doug: Yeah, that's right. Until you do a complete census, you're not going to know the actual height. And it has to be an instantaneous census, because you know some of them are kids and growing while you're doing the sampling, so yeah. Unless you're talking about an instantaneous census, you won't know the exact average, but you can estimate better. In fact, there's surprisingly few samples that you might need to drastically reduce uncertainty. That's the point of one of the other items in this list.

The second item in the list is the "object of measurement." The object of measurement has to do with defining the thing that you're trying to measure.

Julia: That's where the ambiguity comes in?

Doug: That's where the ambiguity comes in. So if you name something, anything, something that seems impossible to measure -- what do you think it is?

Julia: How about ... quality of life?

Doug: Quality of life, fantastic. So give me examples of what you see when you see better quality of life. You must have seen it vary, right?

Julia: Yeah.

Doug: You see variation in qualities of life, so what did you see when you saw those variations?

Julia: I guess I see people's mood varying ...

Doug: Okay.

Julia: ... Like they will seem happier or more enthusiastic or energetic.

Doug: So specific expressions. The frequency of those specific expressions, in other words.

Julia: Yeah. If I could just watch people, you know, on a surveillance camera over several days in their life, I could theoretically count the number of times they smile or something ...

Doug: Sure, and then ...

Julia: ... which would be like an indirect way to get at their quality of life. Surely, there would be some people who are happy, but just never smile.

Doug: Yeah, sure. Well, how would you have known that? How would you know some people are happier than others and just don't smile?

Julia: Oh, well, there are people I know well. I have a friend who ... I thought he hated me for years, literally, because he just never smiled when we hung out and yet somehow inexplicably he kept wanting to hang out with me. And eventually friends of his were like, “You realize you need to smile when you like people, right?” And he was like, “Oh.” So he learned to smile.

Doug: Oh, I see.

Julia: So he's sort of an exception, but that's like an extreme on a spectrum where I think there is a fair amount of variation. If you know someone well and they can talk to you about how much they enjoy their life or not, then ...

Doug: Sure, I mean one indicator of quality of life is what people are willing to say. That's ...

Julia: Right.

Doug: That is not zero information. Even though you can imagine situations where someone might have a reason to be dishonest. Generally, if someone is telling you that their quality of life is terrible, you should probably take their word for it. It's probably more likely that their quality of life ... they're not happy with it. Right?

Julia: Right.

Doug: If they're telling you that ...

Julia: That's true. That is a more direct ... it's funny when I think about ways to measure things, I think my instinct is maybe to get too clever, and try to find clever indirect measurements instead of ...

Doug: And those aren't bad.

Julia: But sometimes you just want to ask people about the thing.

Doug: Those aren't bad, looking for frequency of specific expressions is not a bad thing. That's just coming up with the right sampling method, then.

But I think often when people talk about quality of life, they also mean other indicators that should lead to the perception of better quality of life, like low crime rates, decent income, longevity, things like this. So all of those are indicators of something else and often what we're asking people to do is unpack all of these things that they had under this one big ambiguous umbrella before, right?

Julia: Right.

Doug: So when people say I want to measure innovation or I want to measure collaboration, I ask them for examples of it. What do you see when you see more of it? And they inevitably identify multiple things, that's the source of the ambiguities. They meant multiple things to begin with. If they only ever meant exactly one thing, they probably would've used a different word, I guess.

Julia: That's a good point.

Doug: But you have to unpack these things and the other thing you ask is why do you care? What information, what decisions are you going to make based on a reduced uncertainty about this state of nature or this forecast that you're making?

So “concept” is what measurement means. The “object” of measurement is unpacking these ambiguous terms, defining what we mean by them, describing them in terms of their observable consequences.

And then finally the “methods” of measurement -- that's the one thing you alluded to earlier, that understanding how sampling works. People are often surprised what inferences you can make from relatively simple samples, when you do the math.

Three weeks ago I was at a symposium, the Symposium for Statistical Inference, that was organized by the ASA, I was one of the organizing committee members. The American Statistical Association, it is. I can tell that they're dealing with a variety of misconceptions about statistics, even among published scientists, who kind of get certain things wrong when they do their work. They're consistently misinterpreting certain key concepts.

Julia: Like what?

Doug: Well, have you ever heard the phrase ... I'm not saying that published scientists will say some of these things, but have you heard “statistically significant sample size”? Have you heard somebody say that?

Julia: I'm not sure I've actually heard that phrase, but I guess they must mean a sample ...

Doug: Somebody might say-

Julia: But how could you know if your results would be statistically significant just based on your sample size?

Doug: That's a great point. See, I realize it from your webpage, it said you got a BA in Statistics from Columbia, so I-

Julia: Yeah, so I'm not exactly your target. Although, I don't know, they're professional scientists, so they should probably have a handle on this.

Doug: Yeah, people do use the phrase ... They'll object to a measurement, saying that's not a statistically significant sample size. Well, there is no such thing, and I explain that to people. I say, "Well there is no universal magic number of samples that you have to get to, where if you're one short of it, you can make no inferences at all, and once you reach it, all of a sudden you can start making inferences. There is no such number."

Julia: Right.

Doug: You can't tell by that alone. So I explain statistical significance to them, and how they actually compute this. And how it depends on more than just the sample size. Then, I explain to them, "Hey, it probably doesn't even really mean what you think it means, and you want something else anyway." Because it doesn't tell you whether or not you learned anything, right? You could have a lot of uncertainty reduction, and that has statistical significance, and you could have no uncertainty reduction, and have statistical significance.

Julia: Right.

Doug: So those three reasons together are the reasons why people might think that something's immeasurable. They're all three illusions, they always were.

I'm not sure if people come to the conclusion that things are immeasurable because they believe those things in advance, or if they constructed those beliefs as a defense mechanism for not being able to measure things.

Julia: Oh, interesting. I'd come up with a list of possible reasons why people resisted measurement, but that hadn't been on it -- compensating for inability, or perceived inability, wasn't on my list.

Doug: That actually turns out to be a big one.

Julia: Interesting.

Doug: We did a survey in my fourth book. My fourth book was a spin-off of my first book, it was called, *How to Measure Anything in Cybersecurity Risk*. So our plan is to do a few spin-off books like that. Like, how to measure anything in healthcare, or how to measure anything in project management, etc.

Julia: Cool.

Doug: So we wrote that one, that one came out a year ago. We did a survey, my co-author and I -- it was the first book I co-authored, so I had to get a real cybersecurity person

on there. Not just a third party quant guy who's trying to give you his opinion about cybersecurity risk. So he's a real cybersecurity risk guy.

Richard and I conducted this 173 person survey. It was 173 participants from across the many parts of the field of cybersecurity. In that survey, it was a red alarm survey, in that survey were questions regarding opinions and attitudes towards quantitative methods in risk assessment in cybersecurity. Then, there were also 10 questions that had to do with statistical literacy.

What we found, this may not be surprising, is that the people with higher statistical literacy tended to be much more accepting of quantitative methods, and much more excited about the use of them. People much more resistant and skeptical, tended to score much lower in statistical literacy.

But it was actually more specific than that. On all of the statistical literacy questions, one of the choices was, I don't know. The people who said "I don't know" a lot, weren't necessarily the ones that were resisting the use of quantitative methods. It was the ones who thought they did know, and were wrong.

Julia: Interesting.

Doug: It's not just the lack of knowledge, it's profound misconceptions about statistics that's keeping people from actually using it. In fact, there's been a lot of research on this. Daniel Kahneman, you know him, right?

Julia: Oh yeah, big fan.

Doug: Nobel Prize in Economics, 2002, I think it was. He was a psychologist, said he'd never took an econ course in his life, by the way.

Julia: Despite having won the Nobel Prize in Economics.

Doug: Yeah, exactly. I interviewed him for my second book. So I was talking to him, and we talked about a lot of different research, a lot of different areas of research that he was working in.

But one of the papers that I had studied up in advance of my interview with him, was one about inferences from samples, even by trained scientists, as well as naive subjects. He called them naïve subjects -- the nonscientists, I guess. His point was that there are fundamental misconceptions about sampling methods, random sampling, and that everybody gets this all wrong, and it has a big impact on actual research.

So he surveyed a bunch of published scientists, and people who weren't published scientists, just students and so forth. And the fact is, that there are profound persistent misconceptions about how sampling actually works, and what it tell us. What people do is, they kind of remember some things and they'll throw out words like, "That's not statistically significant," and they didn't really do any math to make that claim.

Julia: It's just a fancy way to say, “I disbelieve that result,” or something?

Doug: Yeah, I disbelieve, and I'm telling you that I vaguely remember some statistics.

Julia: Right. Those are the two things conveyed by that statement.

Doug: Right, yeah. Depending on who they're talking to, they will also convey that they didn't remember anything correctly about it. But they'll also say something like, “Well, correlation is not evidence of causation, right?”

And I'll say, well, actually that's not quite true. Correlation isn't *proof* of it, but I can show you a Bayesian proof that says it is *evidence* of it. And I show that in the third edition of my first book, the Bayesian proof for it.

I mean things like that, people are just winging it all the time. They'll say, well, there's this potential bias in this survey, and because this bias exists, that means that no inference can be made. I recently came across someone who said ... They were talking about my calibration training, where we train people to subjectively assess probabilities. He said, "Well, have you broken this down into age groups? Because if you haven't broken it down into how well people do by age groups, you can't make any extrapolations from this."

I said, "Well, we don't ask people their age when we test them. I'm telling you the results of the test, as they are produced, the population tends to represent the population of people that make up my clients, and that's who we're forecasting for." I said, "Are you saying that there's some variation, randomly assigned variation even, in the population, and that unless we account for all possible variations, you can't make inferences?" He said, "No, you can't."

I said, "Well, then all science is wrong. Every controlled experiment in the world doesn't actually control for every varying factor. You misunderstand how it works."

Julia: Yeah. That's a particularly strong example, but I think you could say the same thing about the use of, really any experiment that wasn't done in the exact same context --

Doug: Yeah, I mean it is true that sometimes you have to be very careful with experiments and apply the exact same conditions to get the same outcomes. But because-

Julia: There's always a little bit of inference or extrapolation you're doing when you generalize the results of any one experiment. And sometimes it's a very reasonable extrapolation, where you should expect the results to carry over, and sometimes it's not a very reasonable extrapolation. And it actually seems a little difficult to me to put a principle on when it's fair to extrapolate from a given study.

Doug: Yeah. I think the problem that people run into though, is they hear or see, or they read about situations like that, where it was very difficult to replicate something. This actually happened once. One lab was trying to replicate the results of some study from another lab. And one of them used a different stirring method in a solution than another, and that actually changed the result.

But people conclude from that, “Therefore, unless you do all these things perfectly, which are extremely difficult to pull off, I can make no inference whatsoever from observations.”

Well, that's not how you live your life, what are you talking about? Of course you live your life making inferences from observations. If you can't make inferences using the scientific method in statistical inference, well, then how are you doing it with just your life observations? Because you're doing that with selective recall, and flawed inferences, right?

Julia: I was once teaching a class on, it wasn't exactly calibration, it was just estimating, or trying to quantify your own uncertainty. Put a probability on your beliefs or your predictions.

And someone in the class just kept insisting that you can't know what the “right” probability is. So I kept trying to get him in the mindset of how he actually makes decisions in real life. I'd be like, "Well, let's say you buy a sandwich and you eat the sandwich. If you eat it, that implies that you probably put a very low probability on it being poisoned." His response was, "No, no... I'm not *worried* about it being poisoned, but there's no way to know the *probability* of it being poisoned. "

And I've seen stuff like this many times, he's just one example. It suggests that people have this compartment that they put anything “quantitative” in, where there's a super high standard, and you're not allow to make any estimate unless it's completely rock solid.

Doug: Right.

Julia: Whereas, in your day-to-day life, you just do whatever seems sensible to you. And that's just a different magisterium or something.

Doug: Right. See, here's the way to refute that, is empirically. With studies that actually show that if you tracked all the times that, let's say, meteorologists said that precipitation was 80% likely, and there actually was precipitation about 80% of the time. And of all the times they said it was 90% likely, it was right about 90% of the time.

So there's another researcher, Paul Meehl, that I cite a lot in my research. Since the 1950s he was gathering studies and meta-studies, comparing human subject matter experts, in a variety of fields, to relatively simple statistical models. These statistical models were consistently outperforming the human experts in all these fields. Prognosis of liver disease, outcomes of sporting events, which small businesses were more likely to fail, etc, etc. In all these areas, the humans weren't doing as well as the statistical models.

So in fact, the claim that “We don't know an exact probability, therefore we can't put a probability on something”… Then I'd say, “Well if that were true, how come probabilistic models do better than you?” You're holding the incorrect standard, right?

As you said, they put a different standard on anything quantitative than they do on their own subjective decision making. The fact is, their subjective decision making is routinely outperformed by statistical models. And in areas that they would have insisted that only a human could possibly understand.

I did a model once in the movie industry for forecasting the box office receipts for new movies. So in other words, you have a movie script, you have a description of a movie project, a proposal for it, and you're going to investors, right? And these investors want to make good bets and they have to look at a lot of proposed movie projects. They get to read the script, sometimes they know who the actors are, or the director, etc, and they have to make a decision. Well, the people who do this are called, script readers, often. They read the script on behalf of the investors and they make an overall appraisal or an assessment of the viability of this movie project.

Well, they were convinced that there was no way you could quantify their sophisticated judgment process. Where they consider, according to their words, hundreds of variables in a holistic artistic network, right? They really had a very fancy, highfalutin image of their mental processes, far beyond what most people would think they're capable of doing.

I did a regression analysis on the last 310 movie projects where they made an assessment, and then somebody eventually made them, but maybe not that particular group of investors. When you look at the 310 movies, comparing actuals to original estimates, the correlation was zero.

Julia: Oh, wow.

Doug: So you and I, picking the industry average every time, would have done just as well as the experts, who were convinced, I'm telling you, they were convinced that they were considering all these fantastic interactions of hundreds of variables in their head, these subjective artistic things.

I came up with a really crappy model, probably the worst regression model I've made, right? That had a corelation of 0.3.

Julia: That's decent.

Doug: Yeah, and of course, it’s worth millions of dollars a year.

Julia: Wow.

Doug: By the way, the individual who says you can't put probability on things -- I know I can set up bar betting games that I'll play with him over and over again, until he runs out of money. I'm happy to do that, introduce me to him. You can do that until they run out of money or admit that they fundamentally misunderstood something.

There is a fundamental issue though, with the word “probability,” because even statisticians don't agree on it, as you know. But, most people, for practical decision

making, need to treat probability as a state of the observer. It's not an external thing that you're measuring. It's not a state of nature, it's your state.

Julia: Yeah, you have this great quote in the book, I don't have it on hand. It was something like, "If the topic is your own uncertainty, then you are the world expert in it."

Doug: Yes, right.

Julia: And that's, actually -- when you're trying to put a probability on something, the thing you're measuring is your own uncertainty.

Doug: That's right. Actually, when you take people through calibration training, I don't hear those objections, anymore.

Julia: Interesting.

Doug: They see themselves putting probabilities on things, and then going back and see how often they're right. Then, after the training they see that when they say they're 90% confident, they actually have a 90% chance of being right.

Julia: Yeah, interesting. Your point about how one of the causes of resistance to the idea of quantifying uncertainty, or making estimates, being that people think the uncertainty is the world, and not in their own perception… It reminds me of something called the “mind projection fallacy,” which I think was a term coined by a physicist named E. T. James. It's the phenomenon where someone will say, “broccoli is gross,” instead of “I dislike broccoli.”

Doug: Right.

Julia: And I think to some extent with broccoli, or other things that people understand are subjective, that's just a figure of speech, “broccoli is gross.” But often it's not. They might say “That painting is beautiful,” or “That person is beautiful” and they might actually stand by the claim that, no, the beauty is a property of the painting.

Doug: Right.

Julia: And that's my reaction to it. I think that's what's happening with uncertainty.

Doug: I think there's that misunderstanding, that miscommunication, about the concept. Edmund T. James, who you were referring to, he was a quantum physicist who was also a pretty devout Bayesian, he was for Bayesian approaches to things. Of course, there's a lot of physicists who really take a strong Bayesian approach. There's actually a whole group of them now that say Bayesian approaches to understanding probability are actually fundamental to physics itself.

Julia: Interesting.

Doug: It's called, Q-Bism, if you look it up.

Julia: Q-Bism, I've never heard of that, sounds up my alley.

Doug: Capital Q, hyphen, ism. Or Bism, I think.

Julia: Bism, right, right. So not the painting style! Okay, that's helpful.

Doug: I think that's true. If you believe that probability is the way that Fisher described it, well then, your classmate was probably right. Because the way that Ronald Fisher described it, it is a mathematical abstraction with no possible application in the real world. A probability, the way he described it, is a purely random, perfectly repeatable, process in an infinite number of trials. It's really an idealized frequency, is what it is.

Julia: Yeah, but then I guess we shouldn't be talking about ... I just want to have a word that people, like this student of mine with the sandwich, can just use to mean the thing that describes how I would behave in those situations under uncertainty.

Doug: Right. This was a student of yours, not a classmate?

Julia: It was a student, yeah.

Doug: Oh okay, all righty. Well, I guess I kind of go further, because when I'm trying to train people, I say, “You possess some profound misconceptions.”

Julia: Well, you're much more blunt than me! I just kept saying, "Oh, that's an interesting take… let me pose another thought experiment."

Doug: Yeah, I just say, "No, you have to imagine that you have some fundamental misconceptions." We should all be willing to accept that about things, right?

Julia: In the “should” world, yes. Yes, we do.

Doug: Yeah. It's not too much to ask of someone. It should be one of the epiphanies that students come across, is that they had profound misconceptions going into college, right?

So that person has profound misconceptions. And the best way to prove them, is set up these bar betting games. Just play over and over. There's a number of tests you can put together, where somebody would insist that you can't put a probability on something. But there is a method. They're called “proper scoring methods” for evaluating how well people put probabilities on things, and I describe a couple of them in my second book.

One of the proper scoring methods, I'll just describe mathematically, is you take the difference between the probability that someone put on something and the truth value of it. A “one” if it happened, a “zero” if it didn't. Take the difference and square that. You add those up over time, and you want to try to keep that score low for a given number of forecasts that someone's making.

The fact is that some people will perform much better than others at that. Clearly, if you can't put a probability at all on something, what's his explanation for saying that some people are better at putting odds on things, in repeated experiments?

Julia: Yeah.

Doug: Why would that be? That wouldn't make any sense.

In fact, you can make betting games out of that, where the people who are better at putting odds on things actually make more money. This person would apparently be indifferent between someone putting a 10% probability on something or an 80% probability or something. They would apparently have no preference at all. You could set up indifference bets along those lines and actually demonstrate that, "Hey, I'm losing money if I keep playing this game over and over. I must misunderstand something," or, "I'm going to keep playing because I'm sure I'm right."

Julia: Right. Well, either I would change his mind, or I would get a lot of money. Either way, I win.

Doug: Yeah, because at least you don't want that person to be in charge of a lot of resources.

Julia: Right. That's very pragmatic.

Doug: I would rather have someone who understands these concepts be in charge of resources to allocate.

Yeah. That's true, and people hold this like you're talking about their religion or something. I mean, it's, "No, probability means this." No. No, you've had it wrong this whole time. No, sorry.

Julia: Just to round out our list of why people are resistant to the idea of quantifying uncertainty, we talked about ... Well, just now, we talked about people having a misconception of what probability means, and thinking it's an objective property of the world that we can't ever know. We talked about-

Doug: Well, that-

Julia: I'm sorry. Did I misstate it?

Doug: That's true. Yeah, no. You're correct, but that is the Bayesian view. Ronald Fisher, the frequentist view, actually said it is an objective feature of the universe.

Julia: I see, so in that case ... If we are charitable and assume that these people are sort of stalwart frequentists and they're resisting my use of the word probability, then the cause of resistance is them being unwilling to think in terms of what odds they would act on.

Doug: Yeah. That's right. You can explain, "Well ..." You say, "You might be closer to being right if you were a frequentist, but you were definitely wrong if you're a Bayesian." Actually, there are cases where you're wrong if you're a frequentist, too, so you're wrong either way in that case. I mean, if a person said, "If a coin flipped, there's no way to put a probability on it," they'd misunderstand even the frequentist definition of it.

Julia: Yeah. Well, couldn't I just ask ... Even for some one-off event, where there's not a meaningful frequency to “the probability that Russia invades Poland” or whatever ...

Doug: Right.

Julia: Even then, they should be willing to use the concept of, over the long run, out of the times that I put a probability of 90%, do 90% of those things actually come true?

Doug: Right. Yeah, exactly. You can set up a game where somebody says, "Look, would you rather spin a dial that gives you a 50% chance of winning $1,000 and a 50% chance you lose nothing, or win $1,000 if this prediction turns out." You can value adjust the two so they're equivalent.

If they really believe in this position, they would consistently have no preference between the two, regardless of what you set the payoff on the dial. Right? You could make the dial at 80% payoff, at 20% payoff. It wouldn't matter. They would be consistently indifferent. As soon as they start making preference choices, you say, "Well, apparently you believe that the probability is less than X and more than this other thing."

Julia: Nice.

Doug: So, you kind of got them in a trap.

Julia: I'll store that one up for future use. Go on.

Doug: Well, anyway, you were saying you were going through our list?

Julia: Yeah. We talked about the confusion over the notion of probability itself. We talked about people kind of worrying they're going to be held accountable, and so not wanting to make any estimate because it's not perfect. We talked about people compensating for their own inability to form estimates, by claiming that it's not possible to form estimates.

Doug: Uh-huh.

Julia: One that we didn't quite talk about but that seems important to me, in at least some cases, is maybe ... Tell me what you think about this. There's some cases where we are implicitly putting a value on something that we want to be able to say is immeasurable or invaluable, like the value of human life.

Doug: Sure.

Julia: We might say, like, "There's no limit to the value of human life. It's sort of immeasurable or infinite" -- but in fact, from our behavior, just like with the betting example or the eating the sandwich example, we don't actually believe that. Because if we did, we would set the speed limit to 15 miles per hour, or something that couldn't possibly kill people, or would be very unlikely to kill people. We don't do that because there's a trade-off there. It makes our lives slower and less efficient and gives us less autonomy.

We value those things against the risk of death to some degree. So, we set the speed limit somewhere in between no speed limit, and 15 miles per hour. We put it at 50 or 60 or something like that. That's an implicit sign of how we value human life.

Doug: Right.

Julia: And that's a measurement, but it's implicit. We don't have to talk about it. Once you start asking people to put a value, put a number on human life, then suddenly we're violating this sacred taboo.

Doug: Yeah. Actually, there's two problems with that position, I suppose. One is the belief that if the answer were infinity, that's not a measurement. Well, actually that's a possible answer to a measurement.

Julia: Right. It just implies a bunch of weird things.

Doug: Right. Sure, but you are correct. There actually is a whole school of thought around this. It's call the VSL, or Value of a Statistical Life. It was developed at the Harvard Center for Risk Management, I believe. I talk about it in one of the books. It's a value that's used by several government agencies, any government agency that has responsibility for human health and safety. I've used it in models that included things like human health and safety among other economic consequences, et cetera. When you look at how people actually spend their own time and money to just slightly reduce their chance of death each year ...

Julia: Yeah.

Doug: Like, right now, there are medical tests you could choose to take that might have some remote chance of detecting a condition that, if you intervene now, would save your life. Right?

Julia: Right.

Doug: But you choose not to do it because, like me, it's not worth your time and money, you don't think. Right?

Julia: Right.

Doug: Or, you could have spent more money on a safer car. Or, you could put a fourth smoke detector in your home.

Julia: Sure. Or, you could just drive less.

Doug: Or drive less, or drive much slower. Start earlier in the morning to get to work, and drive slower, right?

Julia: Right.

Doug: Or, take a big pay cut so you can commute less. Right?

Julia: Right.

Doug: These are all things that people are ... They're only willing to do so much to even reduce their own risk of death. The VSL, the Value of a Statistical Life series of surveys, shows that most people behave as if they value their lives at somewhere around 11 million dollars or so. We usually put a range of two million to 20 million on it. Of course, it varies from person to person, but averaged across many people, it looks like it's about 11 million dollars.

Julia: It feels so vulgar to say that. To say any number.

Doug: Yeah. It does, it feels vulgar -- until you realize that people have to make practical decisions about the allocation of limited resources, because we could all save more lives right now by doubling our taxes. We could pay twice as much in taxes and fund more basic research on fighting disease, et cetera. Right? People are only willing to do so much of that. They've already behaved in a way that puts a limit on the value of a human life. They do not behave in a way that indicates that they believe life is priceless or infinitely priced. Right? As soon as someone says life is priceless, they immediately become hypocritical by virtue of their daily activities.

Julia: Yeah. I suspect we want ... The ideal would be, if we could choose and not have to acknowledge that we were choosing, would be to act in one way and espouse values that contradict that. That's what actually serves our goals.

Doug: Yeah. I think the problem is is that somehow, people have this negative connotation to just quantifying things to begin with.

Julia: That's a whole other category that we actually didn't talk about.

Doug: Right. I mean, I think if somebody wrote ... If this friend of yours who it turned out liked you all all along --

Julia: The non-smiler, yes.

Doug: Suppose he wrote a poem about how much he cared for you. Right? Would you say-

Julia: It would be really surreal to have him deliver that heartfelt poem with a complete deadpan, frowning face.

Doug: Yeah. This isn't a great example. But if somebody did, was seeking your affection, and they wrote this poem about you, you wouldn't say, "You can't reduce my life to words. How dare you reduce me to words, to the English language." Well, that seems odd, but we say things like that when we talk about reducing people to numbers. Right? We never say we've reduced someone to language or words, but we say we've reduced someone to a statistic. It's a descriptive thing. You can describe-

Julia: I mean, maybe if we felt as passionately about numbers as we felt about words, then we'd be fine with reducing someone to numbers.

Doug: Yes.

Julia: I think it's not quite a fair comparison because we have so much more ... Words have so much more emotional valence for us, so it feels less vulgar or trivializing to, quote, "reduce someone to words."

Doug: Yeah. I mean, I think that is an odd difference. In a way, we abstract our environment all the time. We reduce things to words. We reduce profound experiences to words. We reduce them to pictures. We reduce them to our emotions. Our emotions are abstractions, right?

Julia: Yeah.

Doug: We reduce things, complex situations to much more primitive emotions all the time. Right? So, we don't have to think of ... Quantifying things is a really interesting human ... I don't know if we can call it a human invention, but it's a method of looking at the world that seems to be rare among species. Right?

But language may not be that rare among species. There's some communication methods, but math does seem to be really rare among species. So maybe we should think of this as an intrinsically human thing. This is a fundamentally human thing, that we can do this.

Julia: That's a nice reframing. This is what makes us ... Yeah.

Doug: Yeah. This is one of the things that makes us human. So, it's not reducing someone to a number. You can *elevate* someone to a number, too.

Julia: Great. Make it happen!

Doug: Right. Some poets are better than other poets, and likewise, some quantitative models are better than other quantitative models. Yeah, so I think part of it's ... I think it's partly a defense mechanism because maybe people are insecure about their abilities to do some of these things. I take a tongue-in-cheek, cynical approach, I suppose, sometimes to teaching people quantitative methods.

I'll say, "Well, actually it's kind of fortunate for some of us that so many of you have these profound misconceptions. Because my clients are making lots of money

because they're outperforming others who have these perceptions. So, in a way, I'm kind of glad that a lot of you can't do this."

On the other hand, to be serious for a moment, I know that their choices, the choices they make, the policies they support, public policies they support, and the products they consume, and the actions they have, have external consequences. They do affect me, actually.

Julia: Yeah.

Doug: To be serious about it, it does matter to all of us that other people get this stuff straight. The fact is, this is culturally different, too. If you look at John Allen Paulos's book, *Innumeracy*, which has been out for ... It's getting close to 30 years now. He talked about how it's almost a little bit more unique in certain Western cultures, and especially the United States. You don't hear these objections to being quantified in, say, India or China. It's less common there. It's perceived differently, it's perceived as a natural human expression. Right? Here, somebody will say, "Well, I'm more of a people's person. I'm not a numbers person," as if they were mutually exclusive. Right? In India, that might be perceived more, and this is John Allen Paulos's book saying this ... In India, that might be perceived more as, "I'm a people person, not a literate person." Right?

Julia: And that people might be likely to react similarly to our statement the way they would a statement about someone saying they're not literate.

Doug: Yeah. "I'm not a numbers person. I can't read. I'm a people person," you know?

Julia: Right.

Doug: That sounds incongruous.

Julia: Like, not something you would brag about at a cocktail party.

Doug: Yeah, exactly. Was there anything else? Any other questions?

Julia: Oh, yeah, I'll let you go, but before you do, I wanted to invite you to give the Rationally Speaking pick of the episode. This is a book, or a paper, or a blog, or anything that has influenced your thinking on some way. What would your pick be?

Doug: Well, actually, the book I mentioned earlier, *Innumeracy* by John Allen Paulos, I think the first edition was early '90s, late '80s or something ... That's really important. It talks about mathematical illiteracy in the Western cultures and America, in particular, and how that's hurting us. Also, another one ... You know, the book where I first heard about calibration, calibrated probability assessments, was called *Decision Traps*, by Russo and Shoemaker.

Julia: Oh, nice.

Doug: That was also about 30 years ago or something, the first edition.

Julia: Has it stood the test of time?

Doug: Well, yeah. I mean, I think it first introduced me to this concept of calibration. Then, I came across Daniel Kahneman's work. It was shortly after graduate school for me. I was still in management consulting at Coopers & Lybrand, and I was coming across these books about this. Because my experience in management consulting at Coopers & Lybrand was really some of my early inspiration for my current work because I would work with clients.

I was the guy doing more quantitative models on the team, only because I had a little bit more stats and quant stuff than a couple of my peers. It just barely tipped the needle in my favor, so I got to take on that work. Right? I would run into clients once in a while that said that something was immeasurable. At first, I would just take their word for it. I mean, I didn't know. I'm brand new to this stuff, but later on, I would hear people say that in regards to things I knew I had just measured at another client.

Julia: Interesting.

Doug: I said, "Well, I know it can't always be right," so I started doubting if it was ever right. Then, I started keeping notes, and that's why I wrote my first book 10 years ago is I ... I was really writing it for a few years before that. I was keeping notes on it for many years prior to that. It was really based on these series of interactions I've had with people about why they felt certain things were immeasurable. And even debates I've seen among others, other people at management level, why things were immeasurable. I would see these fundamental philosophical misconceptions being invoked -- that something is immeasurable because it would be offensive if it were measurable. Right?

Julia: Yeah.

Doug: Things like that. There's a series of bizarre arguments. My staff and I have joked that we should make an app that lists all of the standard objections and arguments and has standardized refutations of them because they're almost scripted now.

Julia: Nice.

Doug: We feel like we've got this down pat. Somebody says a particular weird objection we've heard, "Well, that's number 72." We'll just cite that one. Both those books actually helped set me off on this direction while I was reading that at Coopers & Lybrand.

Julia: Nice. Well, we'll link to both *Innumeracy* and *Decision Traps*, as well as to your own book, *How to Measure Anything*, that I read years ago.

Just a last word on the book and this whole body of work, I think one of the things that I really like about it is that it presents this constructive side of rationality and skepticism and critical thinking, where ... On the one hand, I think people are really used to the idea that rationalists or skeptics or scientists or self-professed critical

thinkers keep telling them, "You don't know as much as you think you know. You are over confident. You have all these unjustified beliefs," et cetera.

And that is true. There is a lot of that.

But then there's this flip side that doesn't quite get as much play, that's a little more uplifting. Which is that you also know more than you think you know. In the sense that we have this instinct to say, "Well, I have no idea how to measure that," or, "We can't possibly estimate that. That's immeasurable," et cetera. But actually, no, you can reduce your uncertainty significantly just using some basic tools of introspection, or thinking tools, or thought experiments.

That's a cool counterbalancing message.

Doug: Sure. Yeah, no. I think there's ways to demonstrate this practically. I think, in a way, people come to these conclusions because they're not really dealing with real decisions. They're kind of thinking of them as abstractions. As an abstraction, you can have lots of beliefs about it --

Julia: Totally.

Doug: As long as something like probability seems like such an abstraction to people, and it's not actually informing repeated bets, that's before it starts to get real. Right?

Julia: Yeah. I think that's a really good way to sum it up. It's weird how decisions -- I'm doing a terrible job of wrapping up the episode here, but -- it's weird how decisions that are actually real decisions can feel abstract. You can end up thinking about them in abstract mode and end up feeling like there's ... End up concluding false or absurd things that you wouldn't conclude if you were really thinking about the decision in concrete terms and asking yourself, "How would I actually bet on this?" or, "How would I actually behave if the chips were down?" When push comes to shove.

Doug: That's right. Exactly. As long as it's at arm's length, you can have lots of weird beliefs, I suppose. Right? Yeah. Well, thanks for your time.

Julia: Thank you. It's been great having you on the show.

Doug: Yeah, absolutely.

Julia: Thanks for helping me end the episode since I was failing to do that! But there's just always more to say…

Doug: Yeah, no problem. That's always a good thing.

Julia: This concludes another episode of Rationally Speaking. Join us next time for more explorations on the borderlands between reason and nonsense.