

(ACOUSTIC GUITAR THEME MUSIC)

JONATHAN ROGERS, HOST: Welcome to The Habit Podcast:
Conversations with Writers about Writing. I'm Jonathan Rogers, your host.

(THEME MUSIC CONTINUES)

JR: Francis Su is the Benediktsson-Karwa Professor of Mathematics at Harvey Mudd College, and former president of the Mathematical Association of America. He brings a whole lot of heart to his work as a mathematician. He has written, "grace centers me, and it's a reflection of a divine love that grounds human dignity in a source distinct from anything we do. This love also calls me to defend the dignity of others, which I strive to do through my teaching and my writing." Francis Su is the author of *Mathematics for Human Flourishing*, of which one reviewer has said, "This is perhaps the most important mathematics book of our time. Francis Su shows mathematics is an experience of the mind, and, most importantly, of the heart."

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JR: Francis Su, thank you so much for being on The Habit podcast!

FRANCIS SU: Thank you for having me!

JR: I am excited about your book *Mathematics for Human Flourishing*. I have to say, among my listeners, you may have a bit of an uphill battle of making the case for mathematics as being important. So uh... so, the floor is open. Convince my writer friends that math is important.

FS: Sure, yeah! I guess one way that I like to think of mathematics is as a way of seeing the hidden structures that lie beneath a lot of the things we see in the world. I mean, some people like to talk about math as, uh you know, playing with numbers, but numbers aren't the only kinds of patterns that exist in the world, and math is really more about understanding

patterns. And that's uh... it's sort of like a little hidden superpower you have if you are able to see the unseen, and that's one way of thinking about it.

JR: Yeah. Which is what writers are trying to do all the time, right?

FS: Yes! In fact, I like to think of really good writing in the same way. Like, it illuminates truths that are otherwise sometimes hard to say if you just wanna say them. But if you say them through a good metaphor or an analogy, it can often be more illuminating.

JR: Yeah. And you teach basic composition, right?

FS: Yeah, so we have a— so, I teach at Harvey Mudd College, I'm a math professor here, but we have a college-wide writing course in the freshman year that every student takes and every department here at the college teaches. Basically, in this class, I'm teaching students to craft an evidence- based essay based on some readings.

JR: Uh huh. And do you have... are there ways you approach that discipline that are different because you're a mathematician?

FS: Yeah, that's a great question. So, in terms of what the college expects, we all have a common set of goals for the course, which is basically helping students craft a thesis and defend it. But in terms of the content, I like to choose writings that at least have some kind of connection to mathematical themes. The first time I taught this course, I had students read short stories by Jorge Luis Borges, who often writes with very mathematical themes. So we explore some of those themes in the class, but the class is really about writing.

JR: Uh huh. Um... so you speak of mathematics as geared toward human flourishing.

FS: Mmhmm.

JR: What do you mean by that? And by the way, that's a phrase that I think will make a lot of sense to the listeners of this podcast.

FS: Yeah... yeah, I mean, I guess one thing I'm doing in this book that I just completed called *Mathematics for Human Flourishing* is making an argument that math is more than just knowing how to calculate things. And sometimes people even think math is about calculating things quickly. Which, you know, I press back a lot in this book by trying to give people better reasons... uh, better answers to the question "why study math?" than just because it helps you get a good job sometime down the road.

One of the things that of course makes math frustrating and full of anxiety for people is that it's often taught in a way that removes all of the joy and the wonder and the surprise and the enchantment that is often there for people who do... you know, who do math for a living. And there's delayed gratification, right? There's the idea that okay, learn all this stuff now that seems really boring and tedious, and sometime down the road you're gonna get a good job!

JR: Yeah. yeah.

FS: And I push back on that by saying, you know what? Math actually, when it's practiced properly, builds all kinds of virtues that serve us well right now, and serve us well throughout our lives. Virtues like persistence. Virtues like curiosity. Virtues like the expectation of enchantment when you see something delightful, and you expect delight out of what you're learning.

JR: Sure!

FS: And so it's maybe a different view than what most people have of what math is for.

JR: Tell me something that would re-enchant math for the disenchanted.

FS: Yeah, that's uh... that's a good question. Uh, some of the things that of course that I think are really amazing and enchanting— well, just take the — here's a good example — take the iPhone that's sitting in your pocket.

JR: Uh huh.

FS: If you had to predict that such a device would exist twenty, twenty-five years ago, I think most people would've said, "Whoooooa, this is kind of an amazing piece of technology!" It's almost magical, yes?

JR: Yeah.

FS: And the iPhone... I mean, its enchanting— it's enchantment comes from it, and the many applications on it, take advantage of the patterns we otherwise wouldn't be able to take advantage of. It's using a lot of mathematical ideas to, um... to bring... bring, uh, something unseen, and make them seen.

JR: (chuckles)

FS: So in some ways, this is an enchanting piece of technology that is made possible because of mathematics.

JR: Um... do you... is there something non-technical? Give me something else.

FS: Yeah, okay... walk into any cathedral, and look at the stained glass patterns that you are bathed in when you walk in there. And um... (pause) and you feel your soul move when you walk into a beautiful place. That's the same kind of enchantment that I think mathematicians experience when they see a beautiful idea.

JR: Ah, yes. That's good. Um, and then there's — I hope I'm saying it right

— Leibniz who said that “music is the pleasure of counting without knowing that you’re counting”?

FS: Mmm. Mmhmm. Mmm! I like that. I’m not familiar with that phrase.

JR: Oh yeah... yeah. Well, it’s a... the truth that math sees these underlying patterns that gives us hope that there’s order in this world that seems pretty disordered... there’s a lot to love about that.

FS: Yeah... yeah, I mean... I think, uh... (pause) You know, one way that mathematics and writing are allies is in this idea... I mean, mathematics is really also about telling stories. Instead of telling stories about hidden truths, about the way people live, mathematicians tell stories about ideas, underlying truths that maybe help us see the world in a slightly or completely different way than we’ve seen before. And so, I mean, I guess I see a lot of resonance between these kind of pursuits.

JR: Can I press ya for one example of what you just said, of how math gives us a way of seeing things in a different way?

FS: Yeah, um... when I’m teaching my writing class, one of the big ideas of writing, as any writers knows, is the idea that you improve your writing with repeated revision. It’s not just one and done and it comes out perfectly. It’s that you start with something, and then you think carefully and deeply about the ideas, and you revise and make it better.

And math is actually like that as well, although most people think of it as one and done, right? Most people think either I get the answer or don’t. And if I don’t get the answer I must be bad at it. And therefore it makes me anxious to even think about that.

JR: Yeah yeah yeah. That’s great.

FS: And if people would change, you know, the way they think about math as something, you know, they can also improve through constant revision,

I think they would think about math in a much more humane way, maybe even fun way. Like, you start with a draft — that's an idea — that may be not perfect, and may not be perfectly correct, but you can improve. It's kind of like, you know, estimating um... how many piano tuners there are in a city, right?

JR: (chuckles)

FS: You start with an estimate, and then you say, okay, wait a minute. Maybe not everybody in this town plays piano, and maybe... you know, you make assumptions and you change and tweak the model until the estimate becomes better.

JR: Yeah.

FS: And so... this is, I think, um... one way in which I think, you know, when I think about some of these connections between math and writing, that it sort of upends the way people should think about mathematics. And so... you know, if you think a little bit about how that works with what we see in the world, mathematicians often start off with models of the world, and the models aren't perfect.

JR: Mmhmm.

FS: I might say, heyyyy you know, if I'm going to, you know, talk about getting a spaceship to the moon, I have to talk about what it means to get there along the shortest path. But shortest path doesn't necessarily mean straight line. In fact, the shortest path might mean a curved path along which you travel the fastest.

But usually, the way things work in math is you start with approximations like a straight line, and then you start talking about modifying them. To think about, well, maybe straight is something different depending on the geometry you're thinking about. And so, you know, one of the great ideas of Einstein is sort of helping us see the universe as mathematical space-

time, as it was called, where the straight lines are not actually straight, and light follows these — they're called geodesics. And so, maybe that's an example of seeing the structures that underly the world. You start off with approximations, and you tweak them until they get better.

JR: Yeah, somebody the other day was saying, “If it hadn’t been for partial credit, I would’ve had a zero average in math.” (laughs)

FS: Yes.

JR: But we so often, as you said earlier, we think of it as a one and done thing, and if you get it wrong, you get it wrong.

FS: Yeah.

JR: But partial credit is perfectly appropriate. As you said, that's the way math actually gets done in real life. Approximations and getting better.

FS: Yes, that's right. And this, I think, would be a great encouragement for people, if they realize hey, you know what? If my students could give me a good strategy for solving a problem, I'd say that's worth partial credit, if not most of the credit.

JR: Yeah.

FS: It's not just all about the answers. It's really about the process.

JR: Yeah. I ran across somewhere where you spoke of math as a “vehicle for love.” Am I quoting you properly?

FS: Yeah. (chuckles) Yeah, it's actually the last chapter of my book. It's appropriately the thirteenth chapter, the love chapter.

JR: Okay. (laughs) Spoiler alert. Sorry, I didn't mean to jump to the end of

the book.

FS: (laughs) No, no worries. No it's... basically, what I talk bout in this chapter is math as a way of experiencing love and loving other people. And I don't just mean... (pause) I mean, I guess what I'm thinking about here is loving people better through and because of mathematics. You know, it's kind of like if you play a sport with somebody you get to know them in a different way?

JR: Yeah.

FS: And if you do mathematics with someone — you know, work on a puzzle together with someone — and if you enjoy the community that forms because of that, that's one way to experience and give love. And it's getting to know somebody in a different way, by seeing how they think and how they reason. People often experience this by playing games together, right? Like, you know, games of strategy.

JR: Right.

FS: You know, I'm a very different person when you ask me to play a game. I become really competitive, right? That's a different side of me that you might see.

JR: (chuckles) I see. So when you speak of math as a vehicle for love, it's just one of many activities that you can love people in.

FS: Yes, yes... it's one of many activities, but it's unique and sublime, and it's something that I think everybody should have a chance to experience.

JR: When you say "sublime," can you say more about that word?

FS: Yeah... gosh, it's hard to say.

JR: (chuckles) Uh huh.

FS: I guess if I think about walking through a beautiful forest... if you asked me to describe the forest, I could talk about the wind rustling through the leaves, and that being somehow beautiful. I might talk about the colors and the patterns that I see in the streaming light. I might talk about the sounds that I hear from nature. And though I've just described all these things to you... it doesn't quite capture that whole experience.

JR: Uh huh.

FS: But if I... attempt to, um... tell a story about that experience? And use metaphors that you might never imagine I would use about a forest... then somehow, you've just elevated that experience for me by telling me something sublime. And I guess I see math in the same way, right? Like, if you just gave me a bunch of results of computations, you know? If I were trying to describe what was going on in the universe by just showing you various orbits of planets, that's somehow missing gate point. but if I talk about the planets as dancing through the heavens, I think I'm capturing more of the sublime or ethereal nature of mathematics.

And it's really hard to put your finger on it. It's hard for me to say, "Hey, you really should check this out and experience it!" It's kind of like saying somebody should, you know, go do the rides at Disney Land because they're really awesome, you know?

JR: Yeah, or trying to describe what honey tastes like to somebody who's never had honey.

FS: That's right. That's right. That's right.

JR: Sorry for putting you on the spot on that one. But one reason I was wondering if you were using "sublime" the way, um... I guess it was Edmund Burke in his Aesthetics that talks about the sublime as being tied in with fear. So that when you're faced with the power of a waterfall, it's

beautiful but it's also a little scary.

FS: Mmm. Mmhmm.

JR: But you talking about the planets makes me think about a time in the world when math and humanities were two different things. When the um... “the music of the spheres,” you know, was something we took seriously.

FS: Yeah.

JR: And I think we would really benefit from a re-integration.

FS: Yeah... and you know there was a time that... several centuries ago, when it was possible to be a Renaissance person. I guess that's why they call it a Renaissance person, right?

JR: Yeah, right.

FS: Be at the forefront of knowledge in many different fields. And now we've become a society full of specialists. And I think we tend to compartmentalize our lives. We tend to think of each of these areas of specialty as one dimensional... um... (pause) As one dimensional, rather than as multi-dimensional ways that we can grow who we are. And you know that's part of what I'm trying to help people to see... is that math is not divorced from what it means to be human, but actually part of what it means to flourish, then maybe everybody would feel more of a fascination to try it out.

You know, we think of music — it's funny — we think of music as something everybody can do and enjoy.

JR: Right.

FS: And we don't just say, hey, you have to be Beethoven or Beyoncé in

order to enjoy it and participate in it.

JR: Yeah.

FS: But for some reason in math we say oh, you know, if I can't perform at the highest levels, then it's not for me.

JR: How does one participate in math at a not high level?

FS: You can participate in math anytime you, uh... you know, experience a beautiful pattern, and start questioning why that pattern is wonderful and glorious.

JR: Yeah.

FS: I think you participate in math when you think about the rhythms of the world. Maybe even the rhythms of the way you write, the way you structure your thoughts or sentences. I think math is... you know, it's gonna be able to help you see things you couldn't see before. And who doesn't wanna do that, right? Who doesn't wanna try something different?

JR: Sure.

FS: You participate in math you play a game of strategy with your kids or your friends.

JR: Yeah. Yeah. Um, so... I love what you say when you talk about math being “the mind at play”? I think that’s a great insight. And so we’ve talked about beauty and truth — you know, math as a way of accessing beauty and truth. I wanna hear more about how math gives us access to justice.

FS: Mmm. Yeah. One of the things that’s an important question in mathematics is who is currently doing mathematics, and um... you know, if you look at the demographics of STEM professions as they’re called —

science, technology, engineering, and mathematics — the demographics are basically overwhelmingly white and overwhelmingly male. And... you know, of course a lot of people devoted attention to trying to increase participation in mathematics among many groups, underrepresented groups. But part of what I'd like people... it's hard to actually address that question until you answer the question "What is math for?" Why do we do mathematics? Cause if math just exists to get a good job, or to produce, um... PhDs, then that's one thing. But if you say math is something that every human being should experience because it's beautiful and wonderful, and you're missing out if you don't see it or have access to it, then that's another motivation entirely.

So I guess part of what I'm trying to help people see is that if math exists for human flourishing, it's actually a big injustice if we're preventing people from access to mathematics. Either blatantly, or because we're not aware of it.

JR: Yeah. And so we certainly don't want artsy people to be deprived of math.

FS: No! In fact, artistic... artistry and mathematics have so much in common that it's actually really amazing when you can see the synergy between the two.

JR: (chuckles) Yes. I always end with the question "Who are the writers who make you want to write?" So Francis, who are the writers who make you want to write?

FS: Yeah, um... I guess one of my favorite writers is Victor Hugo.

JR: Yeah.

FS: And one of the things I appreciate about Hugo is his way of writing about sweeping, um, human themes. Justice versus mercy. The redemptive thread that runs throughout his writing. Um, I think on the more

technical side, I appreciate Steven Strogatz, who is able to talk about complex mathematical ideas in, I think, poetic ways.

JR: Where would one find his work?

FS: You could find... his most recent book is a book about the his— sort of a book about what calculus is without going into anything technical. Um, so I think the title of the book — *Infinite Powers*. But he's also written several books for the popular press.

Yeahhh, so those are probably two things. Uh, C.S. Lewis of course is a huge favorite of mine. One thing I appreciate about Lewis is his ability to think clearly and describe clearly, um... complicated philosophical ideas.

JR: Yeah. That's a very appropriate writer for a mathematician to be a fan of. These huge ideas become accessible.

FS: Yes, that's right. That's right.

JR: And do you read more of his fiction or his nonfiction?

FS: Nonfiction. Although I've appreciated his fiction, I think it's the nonfiction that has sort of helped me... (pause) I mean, the mark of a good writer is somebody when they say something, you're like yeah, you gave me words for describing something that I, until now, haven't been able to articulate.

JR: Yeah.

FS: And I think Lewis is really good at that. I think Hugo is really good at that as well.

JR: Yeah. Well, Francis Su, thank you so much for taking the time to be on The Habit podcast. I'm really looking forward to getting hold of

Mathematics for Human Flourishing.

FS: Thank you!

JR: And I hope we can have another conversation soon.

(THEME MUSIC)

FS: Thank you! Yeah, I appreciate the conversation as well. Thank you for elevating writing. I love writing.

JR: (laughs) Me too. Alright. See ya later.

FS: Okay, yep! Bye bye.

DREW MILLER: The Rabbit Room is partnered with Lipscomb University to make this podcast possible. Lipscomb has graciously given us access to their recording studio in the Center for Entertainment and Arts Building. We're so grateful for their sponsorship, their encouragement, and the good work they do in Nashville.

Special shout-out as well to Jess Ray for letting us use her song "Too Good" as part of this podcast. Visit jessraymusic.com to hear more of her beautiful songs.

JR: The Habit Membership is a library of resources for writers by me, Jonathan Rogers. More importantly, The Habit is a hub of community where like-minded writers gather to discuss their work and give each other a little more courage. Find out more at TheHabit.co.

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