

Numberphile Podcast Transcript

Episode: The Third Cornet - with Katie Steckles

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Dr Katie Steckles is a mainstay of the mathematics communications scene and a regular in our videos. Here she discusses her life at school, university, and now as a freelance maths communicator. Plus life as a pirate.

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Apologies for the change in audio quality part way through - we had technical issues!

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[gentle piano music]

Brady Haran [BH]: Today I'm talking to Dr. Katie Steckles, a mainstay of the UK maths communication scene. Katie's involved in more projects than I could possibly name. Numberphile viewers may recognize her from videos about Rubik's Cubes, Pancake Numbers, the Poincaré Conjecture, and Langton's Ant, plus a bunch of others. [chuckles] Her journey's been an interesting one full of lots of useful lessons, but beware there may be pirates ahead.

[gentle violin music]

BH: Katie, I was looking at your website earlier this morning. You do so many things.

Katie Steckles [KS]: [laughs]

BH: You have your fingers in so many pies. What do you put on like a passport form when you've gotta put like occupation?

KS: Uh... I tend to just put mathematician.

BH: Mathematician?

KS: Yeah and hope nobody asks any further questions. [laugh] I guess, I mean there's probably some people who would claim that I'm not really allowed to call myself a mathematician because I'm not actively doing research in maths at a university but I kind of feel like it's more a state of mind... [laughs] than a job title. So, you know, if you think like a mathematician then you are a mathematician. I dunno.

BH: What do you think your family says, like at Christmas gatherings when someone says, oh what's Katie doing these days? How do you think, you know, they would describe your job?

KS: I have no idea. [laughs] You could sort of describe me as a presenter I guess because like most of the work that I do and get paid for is kind of communicating presenting maths.

BH: Hmm.

KS: But I guess I'm very keen to present myself as being a mathematician 'cause if I stand up in front of a room full of people and say, I'm a mathematician, if I can do something to kind of nudge their perception of what a mathematician

is or what a mathematician looks like... I'd much rather do that and if I stand up and I'm just another person who's like a teacher, you know that doesn't necessarily help with that sort of stereotype, so...

BH: Yeah. Well alright let me decide if you're a mathematician.

KS: [laughs]

BH: ...by hearing a little bit more of your story. Let's go to the very beginning. Where were you born and were you born into a very mathematical family?

KS: I'm not... I don't know actually. I think, I mean it was definitely a very kind of supportive and... you know, pro-learning family, I guess, so... both my parents had the willingness to learn and go to school and very kind of grateful for the opportunity to go to school, like my mum did the exam and got into the local grammar school and was over the moon with herself.

BH: Hmm.

KS: And they both actually work in the NHS, or worked, they're both retired now.

BH: Right?

KS: So my mum was an occupational therapist, did a big long sort of training for that and my dad was a chiropodist, who also had previously worked as a technical illustrator and towards the end of his career he went into sort of IT within the NHS type stuff.

BH: Okay.

KS: So there was always a very supportive home environment with like my

dad buying far too many computers and leaving them lying around and my mum studied, I think while we were kids, she kind of stopped working in order to have kids but then just did an Open University degree in her spare time. [laughs] So she kind of continued learning and training so it was always that kind of vibe.

BH: And whereabouts is this? Is this like Manchester way or...?

KS: Yeah just outside of Manchester.

BH: Were you like, you know... nerdy, mathy, computers?

KS: Yeah, I was the worst. I was an awful nerd. [laughs]

BH: Yeah?

KS: As a kid I was just that person who's always super keen and turns up and answers all the questions very quickly.

BH: [laughs]

KS: I felt like I maybe just had a lot of different interests. So there wasn't any one particular subject that jumped out as being my favorite subject when I was at school. Like I was definitely into computers a lot. Definitely kind of good at maths, science, interested in things, you know keen to have a go at everything.

BH: Hmm.

KS: But I think it was maybe when I got to A level that I started thinking about what I actually wanted to focus on.

BH: So when you were younger than A levels, like when you were a little girl,

where you more likely to be playing with dinosaurs and things like that or what would have been your toys and things?

KS: I think a mixture I think, so there's a lot of Lego.

BH: Right.

KS: A decent amount of Meccano.

BH: Right. A decent amount... right. [laughs]

KS: Yeah. Not too much just the right amount.

BH: [laughs]

KS: But like Lego, but Lego Technic as well, so like the, you know, the stuff you can make cars and things out of.

BH: Ah, you put me back in my place. [laughs]

KS: [laughs] I was very into making things, so there was always a very strong kind of, you know, don't through away yoghurt pots or toilet rolls, put them in that box that Katie's gonna use to make something out of.

BH: Right.

KS: And I would always go and see my granddad and hang out in his shed and hammer nails into bits of wood for no reason.

BH: Right.

KS: I just enjoyed kind of physical hands on making things.

BH: So when you're a little girl, if someone had said, oh Katie what do you wanna be when you grow up? And you're in that genre of the answer being, you know, fireman, ballerina, astronaut, that sort of stuff, what would little Katie have said?

KS: I think at one point it definitely was carpenter.

BH: Right?

KS: [laughs] That was definitely the answer to that question at one point and then it was journalist, I think.

BH: Oh yeah?

KS: For a little while.

BH: Alright, yeah.

KS: But it was kind of like as well as all of that I did also have loads of dolls...

BH: Right.

KS: ...but they were kind of like I'd kind of build like houses and like there was, you know, the upper shelves of my bedroom would have like a little pull system that you could use carry things up to the upper shelves and things like that.

BH: [laughs] Right.

KS: It was, you know, just everything all mashed in together and I think probably having an older brother meant that I was always like I wanna do the

things that Rick's doing so...

BH: Right.

KS: You know... I played football, I did, you know, a lot of things that maybe weren't expected of me but no one really cared so I just went for it.

BH: So like you might've had a Barbie but she would have an awesome Meccano car?

KS: Yeah exactly yeah.

BH: Right, yeah. [chuckles] So mathematics isn't at the forefront at this point? It's just in the mix, until a bit later.

KS: Yeah and I think... maybe in terms of early influences my second cousin once removed...

BH: Hmm.

KS: ...so my gran's husband's brother's son. [chuckles] You know...

BH: Oh okay I think I get that. You might need to draw me a diagram.

KS: Someone that I go and visit once every couple of months, basically...

BH: Yeah.

KS: ... in my family did maths at Cambridge.

BH: Okay.

KS: And it was probably when I was sort of at sort of high school age and we'd go round to visit and he would occasionally show me little things, like little maths tricks and puzzles and things.

BH: Yeah.

KS: And my parents definitely remember sort of long sessions where I would just sit there and be like show me some more stuff, what's this, tell me about this thing, and that was kind of a really nice sort of way to get excited about it, I think.

BH: Was there any extent to which like, you're impressed by... like by him? You thought that's the sort of person I wanna be like or was it purely just like the content? It wasn't like I wanna... he's cool and he's a mathematician? It was just... it was just the puzzles are cool, I wanna learn more about the puzzles.

KS: I think it was definitely the maths, yeah. It was the puzzles, I think. I mean he's a lovely guy. I'm not [laughs] doing him down at all [laughs].

BH: No.

KS: But he's like now an accountant which is a really aspirational thing to be when... [laughs] when you go do maths at uni.

BH: [laughs] Yeah.

KS: It's like the solid career that you get out of doing maths and I think like I'm now the person who's buying him like recreational popular maths books and he's really excited by those, so it's kind of... it goes both ways.

BH: The wheel has turned for circle, sort of thing. Okay, so this is in like high school, mathematics starts to catch you more and more. Do you then zero in on

that? At like at high school are you thinking... this is it? This is my career?

KS: Well I think, so I picked my A levels because at the time... post journalism phase I went through a being a doctor phase.

BH: Right.

KS: I think I was just watching a lot of ER at the time.

BH: Yeah? [laughs]

KS: And like genuinely that is literally what was happening and my brain just went, oh I can be a doctor, I can work in an ER or whatever.

BH: Yeah?

KS: And I talked to the career's advisor and this that and the other and they said okay if you want to go into medicine you need maths, biology, chemistry, and then I guess you could do physics but maybe don't because then you'll just be doing four sciences so maybe do something like a language with that.

BH: Yeah.

KS: And that's what I went for. I'm not sure whether that specific advice that I got was because I'm female... like... I definitely know that there were guys in my year who did chemistry, physics, maths, biology.

BH: Yeah?

KS: And I kind of always regretted not doing A level physics 'cause... it feels like there's just a chunk of my knowledge that's missing, but I've got some A level physics revision guides on the shelf that I keep meaning to go through and

kind of train myself up on. 'Cause you know there's a lot of cool stuff in there.

BH: What language did you do?

KS: I did French.

BH: Right.

KS: So it's kind of nice that I can speak a bit of French and I've got... I've still got most of the stuff in there but a lot of the vocab's disappeared so...

BH: Yeah.

KS: I would be vaguely useful at French right now, but I think it kind of broaden me a little bit.

BH: And then, did you go off being a doctor or...?

KS: I think, it was less that I went off the idea of being doctor and more that once I started doing A level maths I was like, oh this is good.

BH: Yeah.

KS: Like I started to see a bit more of where maths was going and what kind of stuff you can do with and... like our A level maths teacher was, I think it was the head of maths, 'cause we were taught by a few different people for different modules but the person who taught us mostly, basically just kept bringing in interesting stuff and giving us little puzzles to do and that kind of thing and it kind of grabbed my attention and I was like this subject is much bigger than I thought it was and there's a lot of cool stuff in here and this is now what I wanna do.

BH: Alright so then it was like all in on maths and that's what you aimed for at uni and stuff?

KS: Yeah and I think at the time there was also an aspect of kind of the realization that if I did go into medicine that would be very much locked in for the next sort of at least seven years for training plus probably a few years after that for actually working, like I would be stuck on that one path.

BH: Yeah.

KS: And I talked to a few people about, you know, the idea of what do I wanna be when I grow up and I think it was like our head of music at school was a former concert pianist who'd also been a postie, prior to that.

BH: Right?

KS: And like thinking about my dad who was like doing all these different roles within his job and doing, you know, other stuff before that, and thinking actually I don't need to just pick a lane, like I can do various different jobs in my life.

BH: Hmm.

KS: Like what's gonna set me up the best for that and I think a maths degree, you know, there are some things that naturally come out of that like maybe being an accountant but like you're not then tied into that in the same way that you would be with medicine, I guess.

BH: Okay. So 'cause my next question was going to be, and you've sort of preempted it but my next question was gonna be, when you chose to mathematics at university but before you got to university, what job did you imagine you were gonna end up doing but you were totally open minded at that

point?

KS: Yeah, I think I was deliberately trying not to think too hard about that question I guess.

BH: Right, right.

KS: You know, 'cause, you know it is a kind of degree that essentially just says to an employer, this person is quite switched on and is good at problem solving and is good at learning new stuff really quickly.

BH: Yeah.

KS: And it... you know there's a lot of like management roles at things where they'll just take a maths graduate because they know that they'll be a useful person. So I was sort of having that in mind and, you know, thinking about what kind of things do I wanna do with my life and I didn't really wanna pin myself down.

BH: You mentioned before at school you were wondering whether some of the advice you got was based on the fact that you were female. At high school were you in quite mixed classes or were you surrounded by boys or like when you were doing maths and that or...?

KS: It was a mixture. So that [laughs] that's not a simple question to answer so... I started at a mixed high school.

BH: Yeah.

KS: And because as mentioned I was an awful nerd, I was quite badly bullied in the first couple of years of high school.

BH: Okay.

KS: And so... we had a sort of family meeting discussion and we discussed whether it would be possible to move to a different school and there was a... a fee paying grammar school in the next town over.

BH: Right.

KS: And we kinda went to some open days and chatted around it and we decided to go there and like my mum started working again in order to pay for it, like it was a big decision and I went there and that was an all girl's school.

BH: Okay.

KS: So I kind of went out from this mixed environment to an all girl's environment and... but at the same time I had lots of hobbies, so I was in a brass band for twenty years or whatever...

BH: Yeah?

KS: ...with, you know, a mixed group, so all of my friends were kind of all over. And for Sixth Form I went back to the first school again. [chuckles] Partly just to be like, you know, I'll show them.

BH: Yeah.

KS: But also the people that were bullying me pretty much weren't going to stay on for A levels so...

BH: No? [laughs]

KS: ...I wasn't too worried. [laughs] So it was mixture of those two things.

And I think it was really nice to sort of go to a different school and be like, oh actually no people are horrible everywhere.

BH: [laughs]

KS: I just need to deal with this. Like that was the main lesson I learned was that, there are horrible people wherever you go and it's about your attitude more than anything else.

BH: I can imagine when you're getting bullied a bit and you're a bit... you've got like nerdy interests, you know, nerdy in quotation marks. It would be quite easy to turn your back on those interests or sort of, you know, go with the crowd and forsake them just for the sake of avoiding the hassle. That never came into you thinking, you never thought, oh maybe if I just quit the puzzles and the Meccano, and just, you know, go with the flow, it'll just make my life easier?

KS: Like with the support that I had from my family I never felt that was necessary.

BH: Right.

KS: And I think partly I kinda saw myself as being a rule breaker except that the rules I was breaking were the rules that my peers imposed on me, not the actual rules.

BH: [laughs]

KS: Like I was being a rebel in the sense that I was probably the only person to ever go into the school uniform shop and say, do you have a longer skirt?

BH: Right.

KS: And the person looked at me, was like, what are you?

BH: [laughs]

KS: Like no one's ever asked that question before.

BH: Yeah.

KS: But you know, I just I wasn't interested in following the sort of norms that people were presenting and I think having made that move and gone, oh actually no it's not me. [laughs] This is just how the world works, anyone who's slightly different is gonna get knocked around.

BH: Yeah.

KS: I was like, well you know what, I'm gonna double down. I'm just gonna be myself and I'm gonna decide what cool is and for me being cool is being a nice person and looking after your friends and being interested in things.

BH: Yeah.

KS: So.

BH: Doing loads of puzzles. [laughs]

KS: Yeah. [laughs] Yeah.

BH: Where did you get in and go to university?

KS: So I decided pretty quickly that I wanted to go to uni in Manchester.

BH: Yeah.

KS: Because I didn't wanna move to far away from home. There was also the option to live at home for the first year which would save quite a lot of money which is quite useful.

BH: Yeah.

KS: And in Manchester at the time there were two universities, there was Manchester and UMIST.

BH: Mhm.

KS: Where UMIST is essentially the nerd version of Manchester 'cause it had all the science and technology, traditional stuff.

BH: Okay.

KS: So I applied for UMIST and my UCAS form was literally just UMIST at the time and then I just made up five like random choices to go underneath it because I was definitely going to UMIST and there was no point in applying anywhere else.

BH: Okay.

KS: But I put like, you know, Manchester, I dunno, Leeds, Liverpool, Sheffield, like just some nearby places that I didn't care about. And they were all emailing me goin', come to an open day! I was like whatever. [laughs]

BH: [laughs] Yeah.

KS: Definitely going to UMIST.

BH: Okay.

KS: And I got a good offer from there and... I actually technically didn't make my offer for uni [laughs]

BH: 'Cause we obviously have a lot of like, you know, American listeners. Explain how the system works then, to get into university.

KS: Yeah, so you pick you A levels, I mean it's all changed very slightly since then as well 'cause...

BH: A levels is like your final year of high school.

KS: Yeah. So you kind of pick maybe three or four subjects to do there and then the university makes you an offer that will be, say for instance three As and a B or whatever.

BH: Yeah.

KS: And depending on the course and the university those offers might be higher or lower, if they like you and they want you to come they'll give you a lower offer so I got...

BH: So this is kind of like setting the bar, saying we'll take you but as long as you score these results and if you get lower than those results then your offer's off the table.

KS: Yeah or at least we'll have to talk, you know. [chuckles]

BH: Okay.

KS: Like we'll have a more serious conversation but yeah so my offer I think

was A in maths, B, D.

BH: Right.

KS: So they were like get an A in maths and then B and whatever, like we don't care.

BH: Yeah.

KS: Which was quite a nice sort of feeling that actually, you know, this was slightly lower, I think the standard offer was A, B, C or A, B, B.

BH: Yeah.

KS: And it was nice to know that they were keen enough to have we there, that they would offer it lower. Although I technically [laughs] for various logistical reasons didn't actually get an A in maths.

BH: Ooh!

KS: This is my secret... my secret shame.

BH: Yeah. [laughs]

KS: I mean... I don't care, I've got a PhD now.

BH: Yeah. [laughs]

KS: The way it fell out was, you kind of split it into different modules and there were a couple of modules... there were so few people taking A level maths at our school there were about six of us I think and there were a couple of modules where it was just me and one other guy who were doing those

particular topics and this other guy had basically given up on the idea of school. Like he's a lovely guy, so we're really good friends but he basically spent the whole time like looking on his phone and doing other things and not really paying attention and it was... I mean I'm not blaming this at all, obviously I've got my own... you know, I'm my own person, I'm not too influenced by this.

BH: Hmm. No.

KS: But it kind of threw the kind of teaching a little bit. You can imagine if you've only got two people in the room and one of them doesn't care...
[chuckles]

BH: Right.

KS: ...like, what ya gonna do? But it meant that for a couple of modules I didn't do as well as I should have so I think...

BH: Yeah.

KS: I'm gonna say the lowest mark I got in anything was like a fifty-two percent.

BH: Okay.

KS: So I'm not failing things but it was... it was basically numbers that you have to sort of shuffle around into different combinations...

BH: Yeah?

KS: And I remember my maths teacher sitting down with post-it notes trying to arrange this so that we could make it so that I could get an A overall and she was like I'm really sorry 'cause this has gotta go somewhere and I can't combine

with other things in the right kind of way.

BH: Ohh.

KS: There's rules about how it all...

BH: Yeah.

KS: Like these three modules make up your first year and these three modules make up your second year but you can kind of shuffle things around a bit and as it was I got technically a B... in maths at A levels.

BH: Tech... what'd you mean technically a B! You got a B.

KS: Literally a B.

BH: Yeah. [laughs]

KS: Yeah. And... it's 'cause I was also doing A S level which is like half an extra A level in further maths...

BH: Yeah.

KS: So it was between those three kind of chunks of maths I had to shuffle everything around. I remember on results kind of looking at this and going... okay... this is terrifying, have I not got into uni and ringing up the admissions office and UMIST and someone going, oh no no, don't be ridiculous, we definitely want you to come here, don't worry, you're fine.

BH: Ah. That was an ambit claim, asking for an A? They were gonna take you anyway.

KS: Yeah, and I think like if they've met you and they've had a chat with you and you're like this is an intelligent person they're gonna do well, you know, they can make notes to that effect and they'll know.

BH: Jumping forward a bit briefly, now that you're, you know, alpha math woman and like, you know, Ms. Mathematics. Do your friends who know you got a B in mathematics at school...

KS: [laughs]

BH: ...rib you about this all the time?

KS: Oh no one knows. No. [laughs]

BH: Oh. [laughs]

KS: No one I went to uni with knows. I mean they do now. But like it was... it is sort of irrelevant, right?

BH: Uh, yeah well... I'm still...

KS: It's just a number on a piece of paper.

BH: I'm still gonna give you a hard time about it. [laughs]

KS: [laughs] Hey! I got ninety-nine percent in one of those exams.

BH: Yeah?

KS: You're not getting ninety-nine percent if you're not, you know, at least...

BH: Yeah. God imagine what you would've got without that?

KS: I know.

BH: You would have been on like a D or a C.

[gentle violin music]

BH: [chuckles] So you end up at university. What was that experience like? Was it everything you dreamed?

KS: It was very cool. Yeah. So... UMIST as was merged with Manchester while I was still at uni, so there was a whole pile of kind of bureaucracy and temporary buildings and you know everything being changed but it... it was a lovely course and you know both UMIST and Manchester have some really nice lecturers. It was just wonderful to sort of discover all these aspects of this subject and loads of really good friends that I made there. I mean one of which I married, so, I can't really argue [chuckles] with the quality of friends that I got out of that.

BH: [laughs]

KS: But you know, I also took loads of opportunities to do loads of other things outside of the course so like I was in the trampolining club.

BH: Yeah?

KS: At one point I was Boatswain of the Pirate Society... which is a great thing to be able to say. [laughs]

BH: Oh my goodness. You've just thrown trampolines and pirates at me! Like my brain is jammed. [laughs] [stutters]

KS: We've already been over the fact that I do too many things, right?

BH: Yeah.

KS: This is essentially a brand that I have.

BH: Yeah.

KS: And I also... joined and at one point was president and secretary of the caving club. So I did speleology.

BH: Okay.

KS: For the whole time I was at uni.

BH: Alright, so. Caving club, cool. Trampolining, awesome. But I feel like I can imagine what you do in both of those. What does the Pirate Society do?

KS: Mainly, we dress up and go on pub crawls.

BH: Okay.

KS: And raise money for charity. 'Cause that sort of feels piratey, right? You know, taking money from people...

BH: Yeah.

KS: ...but in a very legal way. [chuckles]

BH: [laughs]

KS: And it...

BH: You realize piracy not's legal, don't you?

KS: Well yeah but it is if you're just asking for donations to the university charities.

BH: Okay. Alright.

KS: We did a bit of that, and we'd go to like the Freshers' Fair at the start of the year and we didn't actually sign up for our own stall, we just... you know stole things from other people's stalls. [laughs]

BH: Okay. Yeah.

KS: It was, you know... and just argued with the Royal Navy recruiters outside.

BH: Did you have a pirate name? Like a character name when you were in pirate mode?

KS: No. Just me.

BH: No?

KS: Just me dressed as a pirate. I won the award for best dressed pirate one year.

BH: Yeah? What's the key to a good pirate outfit?

KS: Just flair... I think. Just having, you know, having some piratey bits but just...

BH: Would you have a parrot or an eyepatch or...?

KS: Inflatable parrot.

BH: Right. Did you ever go the peg leg?

KS: I didn't go that far no. [chuckles]

BH: No? okay.

KS: No. But some good... some quality like faux-suede boots.

BH: I'm imagining at university like, you know, you would be... you are fitting in more. Now you're surrounded by, you know, people for whom being smart and interested is like, you know, a defining quality?

KS: I mean surprisingly there are still people there who think they're too cool and are just like, oh I'm here to get a good career what are you here for? So you kind of seek out the people that are on the same wavelength and make friends with them and you know I had a bunch of friends on my course and off my course from all these other activities that I was doing.

BH: Hmm.

KS: And yeah but it's really nice to sort of surrounded by people who agree with you about how cool maths is. It's a... I mean university is fantastic and I know that not everyone goes and not everyone gets the opportunity to go but it is such a really nice place to sort of be around people who are interested in the same things as you and are all working towards the same goal for a few years.

BH: Did your perception of mathematics change much when you made that jump from high school to, you know, mathematics and being lectured by professional mathematicians?

KS: Oh I think definitely, yeah. Like school maths is really just about methods, you know, it's about learning techniques that you can use to solve problems and you kind of start to get glimpses of what maths really is but it, you know, you're not really doing proper maths.

BH: Hmm.

KS: And at university it just totally flips on its head and it's like right, now we're proving things. Right? We're not just gonna take things for granted. We're gonna prove everything. We're gonna go strip it down, be rigorous about it and oh, by the way there's so many more things in maths than you ever possibly realized. Yes there are numbers, numbers still exist, but also there's these beautiful algebraic abstract structures that don't really exist that you can just build from definitions from the ground up and then use them to do things and oh look they pop up again over here and there's, you know, all these different branches and probability and operational research and applied maths and modeling and all of these things that... you know, cryptography and coding theory and things that just hadn't even occurred to you were maths and it's a really nice place to be.

BH: Yeah.

KS: To sort of be able to look across that vista but you're also at the same time aware suddenly of how much you don't know which you could take either way but I think I took it as being quite exciting.

BH: Did you excel as a student or were you a good student or was the... was the distraction of caves and trampolines and pirates...

KS: [laughs]

BH: ...like you know, nibbling into your study time or...?

KS: I think I did okay, yeah.

BH: Yeah?

KS: I wasn't top top but just, you know, did the stuff, got on with it, like it was one of these things that... I certainly now having kind of taught students at uni and things like that you get a lot of these people who are like, okay exactly how much work do I need to do in order to get a passing grade for this course?

BH: Yeah.

KS: Like to the point where they're kind of working out which questions they can afford to not revise for, and I'm like... hang on, why are you here? Like if you're not here to just absorb as much information as you possibly can and, you know, improve yourself and enjoy this subject, then... you know that feels a little bit wrong to me that you're not there to, you know, get really stuck into it, you're there to sort of do the absolute bare minimum. And I know for some people it's, you know, it's a lot of work and they've gotta, you know, gotta have a job and they've gotta do all these other things at the same time and they do have to kind of prioritize a little bit that way. But you get some people that are really kind of counting marks and going to the lecturer and complaining because they didn't get quite the mark they were expecting. It's like, well you shoulda done better on the assignment, you know?

BH: It sounds like it would almost be more work to manage...

KS: I know! [laughs]

BH: [chuckles] how to find out how little work you have to do like...

KS: Yeah, and I never really get that as an idea, 'cause you know it's obviously someone who thinks they're clever and they're applying their skills but to me it was just like stick my head in this big pile of cool interesting stuff and absorb as much of it as possible and I suspect that that is just as effective in terms of how well you do in the exams, so, that was my approach to it.

BH: As you go through these first years of university and you know, you start to see the whole world of mathematics open up before you, is it crystalizing at all in your mind about what your future could be? What career you might want? What your path is? Or is it still, I dunno, everything's an option?

KS: Yeah I think it was still steadfastly not making a decision yet for a good while and I kinda almost didn't decide what I wanted to do afterwards just at the end of undergrad. And this was a four year undergrad course, I came out of it with a Masters.

BH: Yeah.

KS: And at the end of undergrad I was sort of like, oh I don't really know what to do next, like is there anyway I can put off making a decision about what I wanna do with my life for a bit longer and I acknowledged that this is the worst possible reason to do a PhD but... a few of my friends were also doing a PhD. [laughs] I was like, oh maybe I could do that. [laughs]

BH: Okay.

KS: Like I was peer pressured into it 'cause they were all like, yeah of course you can do that, you'll be great. And I was genuinely partly like, are you sure that I would be good enough to do that? And I don't know if that's just Imposter Syndrome or whatever, I've always sort of had that as a constant companion.

BH: Yeah.

KS: But part of me was like, yeah but it sounds really hard. And they were like, yeah yeah, you'll be fine. You know, you're into maths, you'll love it. Yeah, so like... I'd went along with the cool kids and did a PhD straight off the back of my undergrad.

BH: Was your course... particularly male dominated? Was it a good mix of men and women, what was it like then?

KS: It was okay actually. Maths undergrad tends to be pretty evenly split. I don't know why that is. There's obviously something weird about maths that kind of... you do tend to get a reasonable number of women on the course.

BH: Right?

KS: It does drop off once you get to research level.

BH: Right.

KS: And so kind at PhD level it was me and the four other girls. [laughs] And... you know, that makes a big difference and I think also you don't see it represented in the lectures. There were maybe two female lecturers in our department.

BH: Having done it... having done... having walked the path... has it given you any insights as to why there's that sort of dropping away as you start moving into sort of PhD land and beyond?

KS: It's kind of hard to say, I guess, there's... there's a lot of personal decisions I guess that make a difference. To some extent it might be about why people are choosing to do a maths degree. One completely valid reason to do a maths degree is 'cause it sets you up for a good career in finance or accounting or...

BH: Hmm.

KS: You know, actuarial science or something that is well paid and solid and dependable and I sort of got a sense that the people who were... I mean it's... I'm not saying this is the only two types of people that do a maths degree but there are some people who enjoy maths and go do a maths degree because they want maths and there are some people who go and do a maths degree because they want a maths degree and I think maybe... maybe girls tend to be more in the second category... maybe they wanna go and teach maths or they wanna go and do something else with it.

BH: Yeah. Right.

KS: This is a massive generalization but it may be that's part of the reason. Also I mean, research is massively intimidating.

BH: Hmm.

KS: It's a competitive environment and it's widely acknowledged that it's basically horrific, in terms of how stressful it is and how much pressure there is to constantly be doing things and producing work and publishing and I think that, you know, there's this potential idea that women kind of take a look at that and go, actually you know what, no. [laughs]

BH: Yeah.

KS: And go and do something else, which is a completely sensible decision but I think, you know, in terms of how that environment works, there's a lot of improvement that could be made in terms of how well that as a career actually functions and how inviting that is to people. 'Cause they'll be a lot of people who get put off from that and not just women but people who could do a really good

maths research career who don't [laughs] because of that.

BH: How do you improve that? I imagine there is some benefit to, you know, the competitiveness and the ruthlessness of mathematics because like it drives the subject forward, that kind of you know, will to prove [chuckles] but... you're right it does create this intimidating atmosphere as well.

KS: Yeah.

BH: How would you start to think, I know it's not your job alone to like, you know...

KS: [laughs]

BH: ...change the culture of mathematics but do you have any thoughts about what can be done?

KS: It's part of the nature of it, right? If you wanna be the best university and get all the grants and get all of the prestige, you need people to be producing stuff but...

BH: Hmm.

KS: It's just about kind of what the job of a lecturer is. What the job of a research at uni is, because, yeah, there's the massive overlap with lecturing and depending on the university sometimes you get this sense that people are there to do their research and there's inconvenience of lecturing alongside that, that they occasionally have to, you know, lower themselves to. Obviously there are some absolute brilliant maths lecturers that put so much work into their teaching but at the same time it's not really considered a priority, which is weird because at the same time the university main priority is how many students can we get through? How much funding can we get in from students, so there's this weird

kind of mismatch with that.

BH: Yeah.

KS: But yeah if you're in a culture where the only thing that's considered to be a good output is how much, you know, research funding you've pulled in or whatever, then you do need to really work on publishing hard and it's whether if everyone else took the brakes off slightly, if the levels that people were working at were slightly lower, people could take a bit more time over things, be a bit more considered, but, you know game theoretically there's no incentive for anyone to do that. You know, you always gotta keep pushing, and...

BH: Hmm.

KS: ...it's just that's just kinda the nature of it. And I guess it's true in a lot of other subjects as well not just in maths.

[gentle violin music plays]

BH: You're starting a PhD so obviously by now you have some kind of specialization... what's your PhD... like what are you doing for your PhD? What's your area of expertise within mathematics? And what is the probability that I will understand it in anyway whatsoever? [laughs]

KS: [laughs] Well, this was interesting because I kind of didn't choose it... in some sense. I was sort of just like, yeah I'll do whatever, you know, some maths, it'll be great.

BH: You sound very easygoing, Katie. [laughs]

KS: Yeah I don't even remember being this easygoing but I was kinda like, I mean I think it's always a thing that I've done, so like when I was in the brass

band I was there from the age of about eight up to eighteen and had to leave then because it was a youth band and they don't let you carry on when you're not a child, it's annoying.

BH: [laughs]

KS: I started off as everyone does at the, you know, kind of the bottom end of the back row, as it's known.

BH: Yeah.

KS: And a lot of people kind of worked their way up so as they get older and they get better they sort of progress upwards.

BH: Yeah.

KS: And I was a third coronet to start with and... for ages I was just like, no it's alright I'll stay on third coronet 'cause, you know, it's important that there's someone here that's good that's doing a solid job of playing the third coronet part.

BH: Well, someone's gotta do it.

KS: Yeah, and people around me were like... but do you not wanna be second coronet, or first coronet? And I was like, no, no, I'm happy, I'm fine here.

BH: Yeah?

KS: And I wonder if I've got this sort of sense of not prioritizing my own...

BH: [laughs]

KS: ...you know, achievement or whatever and I'm just happy to be doing a thing that's going well.

BH: So when you left the youth band at age eighteen, were you still third coronet?

KS: Uh. No I was on the front row by then. I did [laughs] eventually progress, it was someone was just like no this is ridiculous get off third coronet.

BH: Okay. [laughs]

KS: But like, I never pushed for it, I guess. And I dunno if it was sort of a fear of wanting to stay doing the thing that I know I can do and not trying something new and you know, to some extent I've tried to counter that in my adult life by always kind of pushing myself and making myself do things that I'm not completely sure I'm ready for yet. With a slight awareness that that's something that people don't do enough of. But also not doing it too much. [laughs]

BH: Yeah.

KS: Yeah, but I kind of... I wanted to do a PhD, I'd made this decision and I wasn't really sure what to do it in but there was a lecturer in... I guess in dynamical systems.

BH: Hmm.

KS: So kind of studying the motions of things that evolve over time. He was stealing PhD students from topology. So topology was the topic that I'd done for my... kind of final year project in fourth year. I'd done a thing on... oh what was it called... it was kind of a topology geometry thing and I'd started to get into this idea of topology, 'cause it's not a subject you necessarily even cover even in a maths degree unless you get the right combination of lecturers. Some maths

degree don't even cover it much at all.

BH: Right.

KS: But I'd gotten kind of into it, so it's this idea of sort of shapes and thinking about things in different numbers of dimensions and ways to categorize and describe shapes and things like that and essentially this dynamical systems lecturer was stealing ideas from topology and stealing PhD students as well.

BH: [laughs] Right.

KS: So he [laughs]... I mean there are valid crossovers. So Moore's Theory is a nice sort of crossover between dynamical systems and topology.

BH: Okay.

KS: And there are various other things that you can do to connect them and he just basically went, do you wanna do this? [laughs] Like a friend of mine was doing a project in the year above. So she was already on a PhD doing a similar kind of thing and he's like, yeah I've got space for another PhD student doing this slightly different aspect to the same topic. And I was like, yeah, okay.

BH: Hmm.

KS: Because it was sort of related to this stuff that I already knew. Sort of something a bit new that I hadn't done much on, so I had to kind of learn a lot of the dynamics stuff from scratch at that point. Having not done that much applied maths in my undergrad. Technically my PhD certificate says PhD in applied maths on it which is completely nonsense 'cause I'm not an applied mathematician.

BH: Right.

KS: It's one of the many contradictions about my existence. And... it was looking at N-body problems, so thinking about... you know, groups of particles moving around in space.

BH: Yeah?

KS: And trying to apply ideas from topology so thinking about the shapes that they're drawing and thinking about how to categorize the shapes, how to look at the symmetries of them, look at the, you know, the ways that you can simplify stuff to try and get some kind of classification and in particular we were looking at a thing called choreographies.

BH: Hmm.

KS: Which as you can probably guess from the name involve things that are sort of dancing in a very nice pattern.

BH: Yeah.

KS: So it's if you imagine, you know, a set of particles orbiting but they're all following the same path, one after the other, and if you take the whole system and time delay it, you get the same thing but the particles have moved round one.

BH: Hmm.

KS: So there's like... there's various different symmetries in this, 'cause there might be symmetries in the shape of the path that they're moving around on but there'll also be kind of time symmetries that you can kind of push it forward in time and get to the same spot except all the... the particles have moved round one, and then there's also kind of permutation in there as well 'cause you can

move the particles around in a cyclic permutation, so that's... there's that aspect of symmetry as well. So it was kind of a project about sort of looking at these choreographies and saying okay what possible things are there, given this set of rules that they have to all do the same thing, how do we describe them all?

BH: Was it hard doing a PhD?

KS: Yeah. [laughs]

BH: Yeah?

KS: It should be, yeah.

BH: Yeah?

KS: It was... a kind of alternating nightmare of not having any idea what I was doing and then having loads of stuff to do and then suddenly not knowing what I was doing again. People say that doing a PhD is ninety percent being stuck.

BH: Yeah.

KS: And I think that is very much true of doing research in maths. Like you're not constantly making progress, you're often just kind of stalled and going, oh I don't really know what to do with this or I don't know how this works or I can't see how to prove this thing. And then you think about it and you look at something else and you read a thing and you talk to someone and you go, oh my god I can do that and you do the thing and it's like, great! I've done a thing. Right, now I have to do another thing. Okay... [laughs] and it's that over and over again for three years... which is for some people it's really demoralizing.

BH: Hmm.

KS: If you kind of go into without an awareness of the fact that you will spend time thinking, I know nothing at all, what am I doing here? Then it can be really bad and I know some people who dropped out. Who kind of found that it didn't really suit them to be in this kind of environment. But it was a lot of kind of peer support and chatting to each other and going no no, that is completely normal, don't worry, was the way that a lot of people got through it, I think.

[gentle coronet music plays]

BH: So as you come towards the end of your PhD, you must surely now be thinking... what am I gonna do when I grow up?

KS: Yep. [laughs]

BH: [laughs]

KS: Yeah, I realized I couldn't get away with that any longer but luckily something came along that I was interested in doing and there was this kind of... so a lot of people were telling me oh you're really good at explaining things. You're good at teaching stuff.

BH: Were you... why is that? Were you doing like exposition on the side or like... how did people know you were good at that?

KS: I don't know. Just like a knack that I had for it that when people were like...

BH: So it would just be they'd just... they would just know it from the pub then, like you know? Oh you're always good at explaining things in the pub or something like that? It wasn't...

KS: Yeah, I guess sort of yeah. And that kind of thing, and we did a little bit of demonstrating and teaching during the PhD like they allow you to do paid work teaching for lower years.

BH: Okay.

KS: But never proper teaching, like just the sort of...

BH: Yeah.

KS: You know doing the tutorial sessions or whatever.

BH: Yeah.

KS: I'd kind of generally always been told by people that I was good at that.

BH: Yeah.

KS: And I talked to my mum who... as I mentioned worked in mental health and she said, well, the unit at work is full of maths teachers who've had nervous breakdowns, don't be a maths teacher will you?

BH: [laughs]

KS: [laughs] I was like, well, that's a strong argument.

BH: Yeah.

KS: Like I'm the kind of person who cares deeply about things and invests a load of my emotional kind of energy into things and if I found something incredibly stressful, my mum basically said I don't think you could handle the stress. [laughs] And I was like, well.

BH: Okay.

KS: That's... yeah, you know, potentially a reasonable comment and I've so much respect for maths teachers, 'cause they do absolutely fantastic work and it's incredible what they're expected to do and the ones that do it and then also do a bunch of extra stuff on top, it's just unbelievable. But a small part of me was sort of like, I kind of agree with my mum. Like as lovely as it would be to have a really nice sort of solid career as a maths teacher [groans] yeah, I can sort of see that argument. And, at around about that time there was a conference that they ran in Manchester, it was kind of a one off conference that no one had done before, called How to Talk Maths in Public.

BH: Okay.

KS: And they basically pulled together a bunch of people who communicate maths so like people who do talks, people who write books about maths, people who make TV shows, like anyone in the UK maths communications community, had brought them all together and I had just got involved with a little project that someone was doing called Maths Busking, which was this idea to kind of take mathematical ideas and just show them to people either in the street or in a context where you were kind of just going like, have you seen this thing, isn't it cool?

BH: Yeah.

KS: And just sort of using the innate interestingness of bits of maths to engage people. Kind of like the way that, you know, you tell someone a joke and they would go, ha ha! That's excellent and then they'd go and tell someone else the same joke, so that kind of viral almost but in real life [laughs] aspect of that. And the Maths Busking thing, we'd done a couple of training sessions and we'd done a couple of science festivals where we'd gone and sort of stood around and

talked to people in... around the science festival. But we were invited to go to this conference... to sort show some of the work that we'd been doing with Maths Busking and talk about it, and it was in the building where I worked so I was like, yeah. That's fine, I can go to this.

BH: Yeah.

KS: But it was just... it was really eye opening to see that there is such a thing as the maths communication community.

BH: Yeah.

KS: You know it's not just a weird thing that I'm doing as hobby on the side of my PhD. It's actually a job, it's a career for a lot of people and in a hundred different ways people are doing this, and they're kind of making their own niche and they're doing things in their own way or they're working with others to build something.

BH: Yeah.

KS: And I thought it was really inspiring to see that this is actually a proper thing. [laughs] Almost, it hadn't occurred to me before so...

BH: Katie was it inspiring because, you know, you love mathematics and love communicating it and like that kind of altruistic math disciple type thing or was it inspiring 'cause you thought, oh my goodness I could earn money doing this?

KS: [laughs]

BH: I could pay for a mortgage, I can eat, and still do something I'm good at and I like?

KS: Yeah maybe a bit of both. I guess like...

BH: Yeah?

KS: With that kind of awareness in the back of my mind that this was... I'm gonna have to get a job eventually, like actually this is not just a hobby, this is a valid job.

BH: Yeah, yeah.

KS: And I could use this to fill that gap and also that the inspiration that actually I wouldn't be on my own doing this.

BH: Hmm.

KS: I'd kind of gone into the Maths Busking thing with a kind of attitude of like, well you know I already have regular experiences of making an idiot of myself in the street, I might as well do that while talking about maths.

BH: Yeah.

KS: And it was kind of just a... an experiment I guess but through that I made some connections that kinda gave me an insight into actually those people who would let me come and do talks, or they would pay me to come and do this and I thought, well you know... I've got... I've finished my PhD in summer. I'll give it six months. I'll try being a freelance maths communicator, I'll just do whatever comes a long.

BH: Yeah.

KS: You know, I have a little bit of money to fall back on to do that, so I wasn't too worried about not having a proper job for six months, but if at the end of six

months I haven't got enough work and it's a complete nightmare, I'll suck it in and get a proper job, but I'm gonna try it.

BH: Hmm.

KS: And I had the support of my other half and, you know, was in a good situation to do that and it really frustrates me that a lot of the kind of science and maths communications scene is founded on the idea that people can afford to work for free for a little while.

BH: Hmm.

KS: It really annoys me because there's a lot of people who can't do that and I feel incredibly privileged to have been in the situation where I could do that, but it was... I'm always trying to kind of give opportunities to people and if possible paid opportunities, you know, to try and kind of balance this out.

BH: Hmm.

KS: Because I feel like the universe has given me this massive kind of pile of karma that I need to dish out, but yeah it was... it was a bit of an experiment and I started doing some talks in schools and some workshops and doing Masterclass sessions for the Royal Institution and doing bits of these Maths Busking jobs and it kind of worked. So I kinda just kept doing it.

BH: That's pretty amazing, though! Like were you hustling hard? Like were you like always on the phone and email and pestering people for work? Like I imagine a lot of people who dream of doing what you just did would think, how did you get them to say yes?

KS: Again I was very lucky in terms of the connections that I managed to make, so some of the people that were involved in the Maths Busking project

essentially just took me under a wing and shepherd me and gave me opportunities.

BH: Right.

KS: So in particular Matt Parker, who you may or may not be familiar with.
[laughs]

BH: [laughs]

KS: [laughs]

BH: I've heard of him. [laughs]

KS: Passingly familiar with... so he at the time was kind of taking off in his sort of maths communication career and he'd got involved in this project and he was like, I've now just got to the point where I'm getting too many emails to answer myself.

BH: Yeah.

KS: So, as a part-time job that I'd just sort of billed hourly, I would do Matt's emails. [laughs]

BH: Yeah?

KS: And this was like...

BH: That's how we met. [laughs]

KS: Yeah it was like a conversation in a pub where we were just like, he was just like, ahh it's getting, you know, effort.

BH: Yeah.

KS: And I was like, well you know what? [laughs] I've got some time and interest. So I did that for a little while and it was really useful actually to see the backend of a maths communicator's kind of life.

BH: Yeah.

KS: You know, what that kind of contacting schools and organizing talks and books and all that kind of stuff, how that all worked, that was a really good insight.

BH: Yeah, yeah.

KS: But it also meant that I could answer emails that came in that had slightly mathsy questions in, so it was useful for Matt that I could, you know, I had a sort of secret code that if I was pretending to be Matt I would answer a particular sign off on the email. [chuckles]

BH: Yeah. Right.

KS: If it was an easy question that I could answer, I would answer it, and you know, it was... an incredible opportunity and really helpful and I'm very very grateful to Matt for that kind of initial thing.

BH: Yeah.

KS: 'Cause he also put me in touch with people to do talks and that kinda think. He was doing schools' talks and getting too many bookings as well so he was like, well I can send you in place of me if people are happy for me to do that, and we kind of developed a set of talks that he already did and kind of built

versions that I could do.

BH: Yeah.

KS: That I could then take into schools and we had a couple of other people that did them as well at the time so it kind of started a little company, which became Think Maths.

BH: Yeah.

KS: And that kind of went from there and that was a major part of the work that I was doing, was doing schools' talks for Think Maths for a good number of years.

BH: Yeah, yeah. You had your break. What sort of... what've you evolved into since?

KS: It's hard to say, really. [laughs]

BH: [laughs]

KS: I wake up in the morning, think what am I? I'm still a mathematician. So I've never kind of lost that love of maths but I just basically do whatever comes along and in the interim I've done so many different kind of weird projects and random things that've just come along, either 'cause someone's seen me do a thing and though, oh they're alright, let's get them to do this other thing... so I've done as well as the sort of standard science festivals, talks, workshops, things like theater projects, so someone was doing a theater show about the Poincaré Conjecture and I was like, yeah, I know some topology I can talk about the Poincaré Conjecture and I did sort of consulting on that to make sure that the maths in the show was right, but also did a little workshop that was performed alongside the show to explain the Poincaré Conjecture in half an hour to an

entirely lay audience, which is a good... good initial challenge as a...

BH: Yeah.

KS: Communicator, I was like I'll need some inflatables and some plasticine
[laughs]

BH: Yeah? [laughs]

KS: Give me half an hour and some inflatable and plasticine and I will explain the Poincaré Conjecture for you.

BH: Okay.

KS: And, you know, and things like I did a residency in an art gallery for two weeks. Someone was like we want a mathematician in residence doing some kind of art thing in this art gallery on a uni campus and I was like, yeah okay.
[laughs] I'll do that, put something together. And you know it's been a bit of that kind of pushing myself to try new things, you know, I've ended up doing all sorts of stuff, writing, podcasting...

BH: Yeah.

KS: ...you know, Youtube videos. [chuckles]

BH: What I will do, definitely, obviously, is link to Katie's website in the notes for this podcast, 'cause you know you can just go... you can scroll down the list, it's a little bit overwhelming the number of things you're involved in and you do.

KS: Yeah, I need to update that list, there's a couple of project on there that I haven't put on yet.

BH: This'll be a good excuse for you to do an update.

KS: [laughs] Yeah.

BH: I will point people there. Could you tell us perhaps just one thing you're doing at the moment that you're most excited by? Like, what's like, you know, what's the thing that's... getting you really fired up?

KS: Recently I've had a very weird experience that I imagine a lot of freelancers have also gone through which is that, you know, lockdown has happened and its meant that a lot of my live work has disappeared, which is annoying, 'cause that's kind of fun stuff. Thankfully I've got plenty of non-live sort of writing work to fall back on, but I've had a couple of people who've come to me and said well we're gonna try and do an online version. So Cheltenham Science Festival did a fully online version this summer, and they said we wanna try and do some online workshops and they've come to me as someone who's done a bunch of in person workshops there in the past that they know is a solid kind of bet. Could you try and do something online? And I was like, well I've not thought about kind of specifically running online workshops, I was kinda just gonna wait until this all blows over but I realize that's probably not a practical solution longterm. So I ended up developing kind of online stuff that I could do remotely and it, you know, not just me stood in front of a camera doing the talk that I would do in person, but thinking about how the people on the other end can get involved, what can I send them to a website where they get to play with a thing and get to click on stuff?

BH: Hmm.

KS: You know, can I get them thinking about a thing and then feeding back and sharing their answers and trying to sort of model what I would do in a real workshop but also not too closely because this isn't a real workshop and everything's weird and different and trying to incorporate that as well. So...

having been kind of asked to do that, I developed a thing, but now I'm like I could do more of these. So there's like me and a few other people that I'm working with to kind of put together online workshops and training and that's kind of exciting, 'cause it's sort of a new medium. It's not a thing that people have done much of. I suspect there are people who have done it before but specifically thinking about I've got an audience of people all of whom are just sat in their house, like how do I make this feel like they're at an event and experiencing a thing together, so that's kind of cool.

BH: What would you say motivates you? Because like I don't pretend to know you really well but like, you know, and you're obviously a good speaker and good in videos but you also seem to be someone who does a lot of behind the scenes stuff. You do do a lot of... third coronet type work.

KS: [laughs]

BH: You know, you're always the person who's organizing things and doing all the behind the scenes and someone will always say to me oh yeah we've got this event happening talk to Katie, she's the one who knows everything that's going on and stuff.

KS: Mhm.

BH: So you're obviously you're a really good behind the scenes organizer too... what gives you the buzz? What keeps you working so hard on all this stuff?

KS: I think I just like making things happen. I find logistics immensely satisfying. And certainly having done a bunch of work in this sort of project management stuff.

BH: Yeah?

KS: So one of the things that Matt got me to do quite a lot was, he was like, I would like to do a ridiculous large thing with maths and I was like, I will Google some stuff. And kind of did the sort of project management and the managing the finance and the kind of... corralling volunteers and all of this kind of stuff and chipping in with ideas about the thing itself and how to communicate it and that kind of thing. So it was a good sort of collaboration relationship because I was good at the stuff that... Matt is... less strong on like... answering emails.

BH: [laughs]

KS: [laughs] He was, you know, he was there with the sort of ideas and the brand and the presence.

BH: Yeah.

KS: And we'd kind of work together on things like that and I would do all the tedious admin stuff, [laughs] which meant he didn't have to. I feel like I've almost had a sort of personal revelation now, when you describe that as third coronet stuff, I kind of just realized that's exactly what that is. But I think it's also a very important aspect of it. And I know a lot of people that I've worked with over the years that have been professional project managers and it's incredible how much work they have to do that people don't appreciate at all. So it's good for me to see kind of both sides of that and I feel like it makes me better as a presenter to work with, 'cause I can go to a science festival and they'd say can you do this and I'd say well, I know what you want me to say is this, but here is what I and here's what we can do instead and like I've got a view from both sides almost.

[gentle coronet music plays]

BH: You talk about calling yourself a mathematician, that's what we talked

about right at the start. Do you ever wish you'd done... you'd gone down a more conventional mathematician path or do you think that wouldn't have been for you? You know, would you liked to proved the Riemann Hypothesis?

KS: Well, [laughs] I think I had a moment at the end of our PhD where I had to sort of sit down and think to myself, do I go into this sci-comm career or do I go into like a postdoc and do more research?

BH: Hmm.

KS: And there's a large part of me just went, I have done enough maths research. [laughs] Like the...

BH: Yeah.

KS: ...the amount of time that I have spent bashing my head against the wall of maths is... is enough. I am happy with the amount that I've done and for me personally this is kind of sufficient for me to have got a feeling for how this subject works and I've done something, I've contributed, I've written this thesis and I've published a paper, you know, but maths is welcome to that, it can have it and I'm now gonna go and do something else because I've enjoyed this very much but it's also been incredibly difficult and I think one thing that's actually been really interesting to me is, in the last couple of years, I managed to get a part-time post lecturing in maths at Sheffield Hallam University and that has been really cool because to some extent like while I'm doing my maths communication stuff I'm always talking about kind of higher lever maths stuff. I'm talking about university level maths often with school aged people or with general audiences and that's brilliant but I'm not kind of really doing maths at that level. And it's always felt like a slightly that I'm not quite in there with the mathematicians, whereas having done this teaching at university level I can really get my hands dirty and get stuck in and do this proper stuff and I'm explain it and discovering that actually I've got all these nice explanations for

this stuff at that level as well and you know, having some really nice moments in class where people ask me a question, I'm like, ah well, here's a really nice analogy for that. And they're like, oh I get it now, and that's been really wonderful to sort of... I hate to use the phrase do some proper maths for a change, 'cause a lot of this stuff that I talk about to other audiences is proper maths. But I always have to kind of temper it with like, you know oh there's some extra conditions that you have to put in here for this to work but it definitely works. Whereas at the uni level I can be like, oh it's these things, like here's the proper definition. Here's how this all fits together. Here's this beautiful structure that you can build out of maths and here's how it works and kind of watching people discover that is really nice.

BH: I almost feel silly asking you this because you seem like someone who just sort of tumbles from one thing to the next and didn't look too far ahead, but do you have a grand plan or an ambition or a thing you really want to make happen or do down the track that you're working towards or hoping will happen one day?

KS: I'm to some extent still resisting the idea of deciding what I wanna be when I grow up.

BH: Yeah?

KS: I think one of the things that I've started getting involved with while I've been at Sheffield Hallam is bits of research into not maths but specifically maths communication. So research into teaching methods and into how people interact with maths communication activities.

BH: Hmm.

KS: We've been doing a bit of research into like, you know, if you watch Numberphile videos when you're a kid, does it increase your chances of going

and doing maths at uni and things like that.

BH: Hmm.

KS: Which is obviously a very difficult thing to pin down but kind of looking at that, potentially going more into that kind of stuff might be fun but I don't know and I guess I'm also just open to whatever comes along really. I've done okay with people just approaching me and saying, d'you wanna do this thing? I've done bits of TV stuff which is been fun but... a nightmare and difficult and TV is awful, but it's also brilliant. Potentially something like that but I don't know where that would go, like I'm genuinely open. I've got an idea for a book. Haven't written it yet.

BH: Yeah?

KS: You know, some part of me feels like I need to maybe put the brakes on a little bit and reduce the number of different projects I'm working on at any given time but it's, I don't need to yet. I've still got the energy to keep going with this, I think, for a bit longer, so...

BH: Can you tell us a little bit about the Talking Maths in Public... what do we call it, is it a business or a program or a project? It's a project isn't it?

KS: It's a project yeah. I think we're technically a trust. [laughs]

BH: Right.

KS: On paper. But this was kind of having gone to the How to Talk Maths in Public conference all those years ago and having had that experience of like, oh wow this is a thing. I kind of wanna give that to other people, like I want there to be people who, you know, still at uni or at the kind of age who are looking for something to do, do realize that this is a industry and a career and a thing, so

there's a conference called Matrix which is a maths communication type conference that's run every two years. One year recently it was in Leeds, and I was there with a few other people who were all saying, this is like an international one that moves around so I think it's... it's gonna be in Paris this year and it's been in various different countries. Why isn't there a UK one of these? 'Cause there's certainly a large community of maths communicators and we all just looked at each other and went, should we just make one? [laughs] So we decided to do a conference for maths communicators in the UK and it could be training and workshops and discussion sessions and networking and chances to meet other people doing maths communication but just mainly to give people that experience of feeling part of a group. So I've done loads of stuff on that now, that's become another kind of branch of my work is running this conference and running various online events sort of tangential to it as well.

BH: It was good. I went to the most recent one... when was it? I can't even remember when it was. Was it...

KS: [sighs]

BH: Was it last year?

KS: 2019, yeah.

BH: 2019... I was lucky enough to come along and it was fantastic. It was very motivational to get all the people in one place and mixing and like not just hearing ideas and hearing people talk but also just like the networking side of it was fantastic.

KS: Yeah I think it's useful to see like if you're the one maths person in the place where you are or the one person that's doing outreach in the maths department where you are or, you know, the... kind of feeling slightly lonely if you're a freelancer say, to just go and be in a room full of other people who do

the same thing and who communicate maths in all these different ways, that's a really nice aspect of it, but it's also useful training.

BH: You talk about, like looking at math communication with a more sort of critical or research eye, so you obviously you spend a lot of time thinking and talking about the best and worst ways to communicate mathematics. Have you got one insight or secret sauce or...

KS: [laughs]

BH: ...clue or puzzle or anything that you would say to someone who might be listening to this who wants to be a math communicator. One thing... everyone gets wrong or a few people get right?

KS: Ooh.

BH: What would be like a little nugget you'd drop?

KS: I'd guess to pick one, which I think might be quite useful universally, is to always remember the person that you're talking to doesn't have the same experience of maths as you do.

BH: Hmm.

KS: So like I as a person who's, you know, at that level where I'm teaching maths in a university, always got okay with it, enjoyed it very much, went through it, if I now talk to someone who's at school, who's either, you know, missed a chunk of teaching or struggled with it for whatever reason, you know, their experience of maths is very different to mine, and the one really nice bit of advice would be, don't kind of make assumptions about that. So like don't say, oh we're gonna do this one next, it's an easy one, because if someone doesn't find it easy that really kind of... you know, slams a door down for them because

they're like, oh well I'm not finding this easy so obviously that must be my fault.

BH: Hmm.

KS: And I... I never... I try never to describe something as being easy or kind of make any prejudgements about how people are going to interact with something. I'll say something's interesting or fun or, you know, whatever, but I won't kind of tell people how they feel about something, I guess. And I feel like that may be useful advice.

BH: That is good advice. How do you feel about, taking it the other way? Sort of people who will say, look I know maths is hard, I know math sucks but let me show you this, like will you... do you avoid that or will you sometimes fall into that?

KS: I mean if anyone directly asks me... then I will definitely agree that maths is hard.

BH: Hmm.

KS: And it's a quote from... the ever present Matt Parker that I often repeat for people is... you know, mathematicians aren't people who find maths easy, they're people who enjoy the fact that it's difficult, right? So it's kind of... wanting that puzzle and wanting the thing that's gonna challenge you.

BH: Yeah.

KS: And I think that a lot of the problems that people have with maths are because they don't realize that it's normal to feel like it's difficult. Like they look at something and they go I don't really know what to do here, and because they're not trained to go, let's ignore the fact that I don't know what to do here and just try something anyway, that they kind of are more likely to give up too

soon, I guess. And it's partly to do with the fact that the way we teach maths is very much there is a correct answer, you've gotta do this, you've gotta get the right answer and if you're not getting this right answer, it's because you're bad and you don't know what you're doing, and I know no one would ever deliberately say that to someone but that is kind of the impression that comes across from the way maths is sometimes taught and you've kinda gotta get across to people that actually finding it difficult is normal and the way that you'll succeed with it is if you find it difficult, feel the fear and do it anyway, I guess, is a thing people say. And I think mathematicians tend to be people who are just prepared to get stuck in and have a go regardless of whether they actually feel like they've got a handle on it yet, just try some stuff and see what happens.

BH: Well Katie if... one of the defining traits of a mathematician is someone who's willing to work very hard and do things that are difficult, you are definitely a mathematician.

KS: [laughs]

BH: The third coronet of mathematics.

KS: [laughs] Maybe, yeah.

[gentle coronet music plays and fades into piano music]

[music continues]

BH: Well that's all for today, thanks to Katie for her time and always I'll include links to her stuff in the show notes. Do go and have a look and make sure you're following Katie on things like Twitter so you can find out when she's doing all those online workshops and other things she mentioned. [music continues] Now I know it's a bit of a podcast cliché but please also consider reviewing and rating this podcast [music continues] it just helps us become that

little bit more visible and means we're better placed to make even more episodes. You can also support us on Patreon, at patreon.com/numberphile. I'm Brady Haran, and you've been listening to the Numberphile podcast. We'll be back again soon.