

Numberphile Podcast Transcript
Episode: The Happy Twin - with Ben Sparks
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Our guest is Ben Sparks - teacher, math populariser, and Numberphile regular.

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[Videos with Ben on Numberphile](#)

[Video of Tim Sparks performing Your Own Idea - Nikko Fir](#) and [here's Tim's website](#)

[A pic of Ben and Tim](#)

[The Bill Clinton picture](#)

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[gentle music]

Brady Haran [BH]: Today's guest is Ben Sparks. Ben's a teacher, a public speaker, a math popularizer. In fact as you'll find out today, he's a man who wears many hats. And not all of them are great fashion choices. [music continues] Hopefully you might already know Ben from his Numberphile videos which are also favorites with our viewers. They include amazing explanations of

the Mandelbrot Set and an explanation of why the Golden Ratio is so irrational. [music fades out] But this interview starts with a topic I always find personally fascinating.

[gentle violin music]

BH: Ben, really often I ask people about like, their childhood and their really early days, I'm really excited to ask you about this, because if memory serves correctly you are a twin.

Ben Sparks [BS]: [chuckles] I am a twin.

BH: I'm fascinated by twinness.

BS: [laughs] So am I but then... there's personal sort of experience or victimization perhaps.

BH: What's it like being a twin?

BS: It's normal. [pauses] I mean... this is the question everybody asks when they find unusual, right? Particular maybe twins, but the...

BH: Yeah?

BS: It's completely normal for me. I don't know any other way, so it's very difficult for me to compare some sort of normal existence where I don't have someone who's genetically identical to me. But it, you know, there are pros and cons, like many arrangements in this life.

BH: It's an identical twin is it?

BS: Identical twin, not fraternal, what's the opposite? Monozygotic, is that the

technical world? One egg.

BH: Oh ,okay.

BS: One egg which splits, which is the opposite of if... twins can come out if there were two eggs happened to be lurking around and they both get fertilized.

BH: Yeah.

BS: And that's just like siblings.

BH: That's non-identical twins.

BS: Yeah. I'm sure they share a special bond but it's nothing like the annoyance that I can create to my twin brother [laughs]. And vice versa. So yeah we are the genetically exactly the same. One sperm, one egg turned into two people. He's called Tim. And, you know, if people wanna go and find him online he's doing some awesome bits of music so that's always fun to go and...

BH: Alright, we'll link to whatever we need to so people can go and check him out.

BS: How did you know I was a twin, Brady?

BH: I'm sure you've just told me in conversation. I'm sure you've told me multiple times, it's come up, just you know.

BS: Clearly I'm bragging about it.

BH: Well, no, I think it's just come up. Were you close, like, were you... are you like, you know, are you like absolute best buds or... 'cause you know, some siblings are really close...

BS: Yeah.

BH: Some siblings are just you know, acquaintances. Are you guys like, you know, best buds?

BS: I think we are closer than most brothers and sisters but we're also more annoyed by each other than most brothers and sisters. And, you know, brothers and sisters tend to annoy each other by default, but so we're really close in that we're very similar. But we... he lives up north and I live down south so we don't see a lot of each other but we... we quite often hang out online but we don't actually chat about life a lot, we often just play games. I think we have both been surprised how similar we end up, particularly when we are separated. 'Cause we don't have the reaction response.

BH: Hmm.

BS: When we're in the same place, [chuckles] we tend to react off each other and diverge. 'Cause we see, what the other person's doing.

BH: Yeah. Right.

BS: When we're apart we just settle into our normal genetic material and it turns out that's identical. [chuckles]

BH: So what's an example of that? What's like you haven't seen him for a while and you catch up, what's something that'll make you go, oh, ah, oops?

BS: If we've both read a book recently it will quite often end up, you know, picking the same films or books just because we have the same interests from growing up and we'll end up talking about that and realizing we've done the exactly the same sort of process about reading books in some order.

BH: Yeah.

BS: But then, I think the most obvious effect is that within a few minutes we have the potential to get seriously grumpy with each other because we... so I see Tim, basically being a bit of an ass, you know [laughs] like stop it.

BH: Yeah.

BS: And he's being really annoying and then I suddenly have this realization, this bombshell of like, oh... that's exactly what I do.

BH: Yeah.

BS: And so you have this... horrible mirror. You know It's a very sobering thing, it's probably a good thing...

BH: Yeah.

BS: But it is suddenly like, oh... he's being annoying and I'm annoyed by it but that's exactly what I do.

BH: I mean a lot of people get that from their parents, don't they?

BS: Yeah.

BH: Like, oh my goodness I'm turning into my mum or dad, but you've got someone who's your exact same age.

BS: Yeah. I get it from my parents but... Tim and I both experience that and we'll tend to oscillate in that one person will be super grumpy and the other one's all carefree and just being themselves and then it'll switch. Depending

who's drunk the most beer first, probably.

BH: [laughs] Do you look alike?

BS: Yeah. A lot of judge if they want to go and find photos. I... he's a little bit, you know, slimmer and more handsome than I am...

BH: [laughs]

BS: [chuckles] But actually at school it was fun... we weren't in the same class but we obviously had overlapping friends.

BH: Yeah?

BS: But the nicknames were basically... Tim's friends would see me coming down the corridor and shout, oh look it's... it's Tim but he's smiling. So I got the nickname Happy Tim, 'cause he just had this reputation for being a grumpy sore... [laughs] I don't quite remember.

BH: Oh okay.

BS: But I was Tim but smiling so I was Happy Tim for a long time.

BH: You were the happier of the two?

BS: I don't think it's true but certainly that's, you know, how these stereotypes start some how and then exist as a joke for a long time.

BH: I'm not gonna be able to continue podcasting til I see a picture so hang on lemme have a look.

BS: [laughs]

BH: Where do I find him? What's his website or something or...?

BS: There's an American guitar player who Tim is very frustrated about 'cause he's brilliant and it's not my brother.

BH: Yeah?

BS: There's also...

BH: And he's the one I'm getting lots of pictures of.

BS: Well there's also a water engineer, and he did a degree in sort of environmental engineering, so Tim's been overlapped by two other Tim Sparks.

BH: I found the video, Your Own Idea.

BS: He's wearing a ridiculous hat.

BH: Oh yeah! [laughs]

BS: It's a ridiculous hat that he's...

BH: [laughs] That's a bit weird!

BS: [laughs] It's not me!

BH: He looks just like you!

BS: Yeah the whole...

BH: Unless that is you? You're not in the video are you?

BS: Not to my knowledge, but you know I look at it and can't tell, you know... [chuckles]

BH: Oh wow, that's amazing...

BS: There's a give away in that he's playing guitar quite well and [laughs] he's a much better musician in terms of practice.

BH: Oh. Ben you've freaked me out. I've got another friend who's an identical twin and the first time I saw his twin I was like... it really weirded me out and you did again.

BS: [laughs] I think it's one of those things, the first glimpse of a twin and we do look similar...

BH: Hmm.

BS: The first glimpse is weird and then within ten minutes you'll be noticing what? How could I have even confused these two? Particularly like visually and our mannerisms will be the same and our voices will almost certainly be... more identical than you expect, but after ten minutes of just hanging out you realize he's an ass and I'm not and that's... [laughs]

BH: Yeah. You're happy. You're Happy Tim. Happy Ben. Well anyway this has been a great... it's been great on the podcast to find out about Tim Sparks, we'll be back next week... with...

BS: [laughs]

BH: [laughs]

[gentle acoustic guitar music]

BH: Let's talk about you but I may occasionally ask you a Tim question, seeing you've got this parallel.

BS: You're welcome to do so.

BH: This parallel life going on. Were you good at mathematics when you were little?

BS: At school I think I was good, or rather I found it straight forward, it wasn't that it was a passion of mine. I think in general I felt like I did good at school and then maybe got called a nerd and a swot and maybe that's not a surprise if anybody knows me now, but...

BH: Hmm?

BS: Maths wasn't a huge passion, that did change eventually...

BH: Yeah? But would you have been like top of the class? Would it have been, you know, oh Ben always gets the highest mark on the math test?

BS: I would have been up there. I don't remember it being quite so clear cut as that, but certainly I think I got disappointed if I did badly in maths. Like it was in my head that I should be able to do this.

BH: So as you were... as you're in those sort of, you know, early years of school, primary school through high school, what did you want to be? What was your like, you know, if someone said, oh hello little Ben, what do you want to be when you grow up? What would that Ben likely have told me?

BS: That's a very good question, I really should've expected that.

BH: Heh.

BS: Listening to some podcasts from Numberphile... but...

BH: Yeah.

BS: It's not obvious to me, looking back, and I remember besides from being a kid and wanting to be a fireman or something mainly 'cause they drove red trucks... I'm sure that was part of my very small imaginings but then I think I enjoyed messing around with computers. I was no particular sort of early programming prodigy or anything like that.

BH: Yeah.

BS: But I think possibly thinking about going that direction.

BH: Yeah.

BS: But then I also enjoyed like the more sort of social aspects and music and stuff and so it wasn't a clear career path in my head. I wasn't like I'm gonna be a musician. That never really crossed my mind. Also wasn't good enough, or at least it felt like that as music.

BH: Yeah.

BS: But then I think I wanted to do something with computers and mathematics.

BH: As a musician what were you... what band... I know you play guitar now, is that what you were playing then or what did you play?

BS: Actually I was probably singing more. Mate, we've come back to twin stuff without you ever asking.

BH: Yeah.

BS: But... it's inevitable when talking about my growing up so... Tim studied A level music. He didn't do GCSE music but my brother did A level music and sort of caught up on that. And I did the maths, further maths, physics, chemistry thing at A level.

BH: Yeah.

BS: Really predictable. I'm kinda jealous now 'cause he learned a lot about just other stuff, particular... well music in particular, doing that, and as a result he played guitar and he played the trumpet. I played the violin a bit but I was... I just didn't put enough practice in. And that is the main problem. Thinking you're not good at stuff is usually equivalent to not doing enough time with it.

BH: Yeah.

BS: But I sang and I used to sing in choirs and stuff and I didn't particular enjoy the choral stuff and it really took off when Tim started realizing he could play stuff on the guitar that we all knew and I could sing it and we could sing together and actually that was one of the biggest things with having a twin is that singing with your twin is like having a multi-track on demand, right? [chuckles] The harmonies and stuff like they blend very easily.

BH: Ah, yeah.

BS: And that's still really. I love singing with my brother. So it was singing for me music but then I learnt the guitar when we both went off to uni and suddenly my accompanist and harmonizer had gone off to Cardiff.

BH: Yeah.

BS: So I had to [stutters] learn some chords on the guitar.

BH: What was your... what was like the go to song for you guys? Did you have a party trick song like everyone has a karaoke song? What would...

BS: Oh yeah...

BH: What would Tim and Happy Tim sing if they were like... if everyone was like c'mon sing us a song guys!

BS: There would have been quite a lot by the time we got to eighteen. But I think I remember... maybe it was a karaoke thing at like the yokel... the local... [sighs] the yokel's probably about right actually. [chuckles]

BH: [chuckles]

BS: The local youth group drop-in... regular we had like Friday night drop-ins and occasionally we'd do karaoke things.

BH: Yeah.

BS: And I think we got up and sang together as a horrifying twin double act. Do you remember... They Might Be Giants? I mean they're still going, right.

BH: Yeah.

BS: The song Istanbul Not Constantinople.

BH: Okay.

BS: They also did Birdhouse in Your Soul, which is a lot more famous but we did a little double act to [sing-song] Istanbul was Constantinople not it's Istanbul not Constantinople [sing-song ends] and I'm not gonna sing anymore.

BH: Okay.

BS: And it's probably looked like some horrible cabaret mess. [laughs]

BH: [laughs]

BS: But I think learning that we could sing together and it was fun and people liked it, that definitely for both of us is a big energizer. This slightly egotistical performance thing is... is running through both of our psyches.

BH: At what point then in high school did it become apparent you were going down this mathematics track?

BS: I did GCSE maths, 'cause you have to, right? And I did well and I think I was in a class of people that were doing well and it wasn't particular unusual that a whole bunch of us did well, but it was then choosing A levels and I remember having conversation with my maths teacher saying maybe I could do maths and a further maths, 'cause I quite like maths and I remember them saying, nah, don't bother. No one needs really further maths unless you wanna go and be an academic mathematician and like... actually now I say it I clearly didn't wanna go that way because that put me off.

BH: Right.

BS: And I tried to do computer science instead and then there was some weird option mess-up and I couldn't do computer science or they weren't offering it that year and I defaulted back to doing further maths, the second A level in

mathematics in the UK.

BH: Okay.

BS: And that is when I started to realize, oh there's... it's not just calculation, it's not just arithmetic, it's not just occasional easiness with an occasional smile, it's actually there's sort of mysteries of the universe and you start to get a glimpse into them.

BH: Yeah.

BS: Things like complex numbers first turned up at that level at school and I loved it.

BH: What did you do at university then? What did you choose? Did you do mathematics? Just straight mathematics at uni?

BS: I did straight mathematics at uni and I, in hindsight, think I did it for the wrong reasons in that I chose the one... the subject I was finding easiest. I was probably always gonna go that direction.

BH: Yeah?

BS: But I don't think I really understood what the subject was about and when it got hard at uni, and it did get hard and it got very abstract, I didn't enjoy it as much so... the honest judgement of my degree was that I didn't have a good time doing the subject.

BH: Where did you go?

BS: I went to Oxford.

BH: Yeah?

BS: I very nearly didn't. It didn't really fit my imagine of my own stereotype to go to Oxford to study. And I had an offer from Bristol to do mathematical engineering which actually even now sounds like an amazingly interesting course full of Artificial Intelligence mathematics stuff.

BH: Yeah.

BS: But you get an offer from Oxford, it is difficult to turn it down.

BH: Yeah.

BS: And I didn't. And I'm very glad I went to Oxford. I had a great time there. But it has it's issues. And it's hard, right? And I found the maths more difficult than I was expecting. And this is really normal, I now know as a teacher [chuckles] to see the transition from school to uni and like, flip this is difficult.

BH: How did you find the whole from being probably I imagine, you know, at big fish in a small pond to being, you know, just a guy doing maths at Oxford with all the best people in the county there?

BS: Yeah, it's sobering. It's not pleasant.

BH: Yeah.

BS: But it's also it wasn't the end of the world, and what it, I think, it made me do was treat my degree rightly or wrongly as not the priority of my [chuckles] time at university. I wouldn't be the first to have done this, I'm sure, but I spent a lot of time doing other things. So I joined an a cappella group, or I helped start an a cappella group at Oxford. An all male a cappella choir, and we were singing pop and rock stuff and...

BH: [laughs] I was gonna say was this the 1950s? You know [laughs] like...

BS: It was... in America college a cappella is absolutely huge. It's like the equivalent of a first football team. It's like you can join the college a cappella group.

BH: Okay.

BS: And there was an American guy doing a graduate program called Derek Smith, and he started this group called Out of the Blue, and it wasn't an all male fun choir. It wasn't like... Oxford's full of choirs. Full of choirs, singing choral stuff.

BH: Yeah.

BS: And this was fun, and we were singing Red Hot Chili Peppers with fourteen guys unaccompanied and people go crazy.

BH: Oh yeah? [whispers]

[low quality live recording of a cappella singers]

[singing fades down in the background]

BS: Because it was kind of new in the UK, there weren't that many a cappella groups.

BH: Yeah.

BS: There're still not as many as America. [a cappella recording continues] But it just took off, and we went round the world several times. Sang for Bill Clinton

and things... [recording fades up]

BH: Oh!

[live a cappella recording]: Don't let me be the last to know. Don't let me be the last to know.

[recording fades down]

BS: It ended up being that that was what I spent a lot of my time focusing on during uni. [recording fades out] It was music, socializing. I think I was really into the church group I was part of as well. So there was a lot of other things competing for my maths time.

BH: Yeah?

BS: And I remember my tutor asking me, like, you know, is maths your priority at the moment? And [chuckles] I was like, nah.

BH: [laughs]

BS: [laughs] And he brought this up at the end of the course. After we'd all finished and I, you know, passed.

BH: Hmm.

BS: He was like, I remember you telling me maths wasn't really your priority the moment [laughs] he told me how horrified he was and then I think he appreciated by the end... there was no point in pretending.

BH: Yeah.

BS: But we both... you know he prevailed on me to do some math sometime and I managed to do alongside some music and that was good.

BH: It just sounds like you had a good work life balance to me.

BS: I think that... the nature of... the notion of a good work life balance does not exist in Oxford.

BH: Right.

BS: So it was very imbalanced in that everything was mental. You get eight weeks to be at uni and then you're off. Like that's a term. So you're at uni for... less than half the year paying your fees. [laughs]

BH: Yeah.

BS: And everything is crammed into those crazy eight weeks. It's a very strange environment.

BH: It's four lots of eight weeks.

BS: Three lots of eight weeks.

BH: Three lots of eight weeks?

BS: Yeah, there are three terms.

BH: I didn't know that.

BS: Yeah it's crazy.

BH: That's not a lot of time.

BS: And all your studies and sort of extracurricular studies are happening in that time and then you sort of go home and I had to go back to my parent's house in Dorset and... that's fine but everyone else was still at uni. All my mates who'd gone off to other places. My brother was at Cardiff and they wouldn't come home at all because they had rented, you know, a proper flat, and I was living in some crazy 14th century [chuckles] college room that they rent out to conferences. So I had to come home.

BH: Huh.

BS: Oxford's messed up. But sometimes in a good way.

BH: Just quickly. Bill Clinton?

BS: His daughter was at Oxford the same time as me.

BH: Yeah?

BS: So... [chuckles]

BH: This is Chelsea.

BS: Yeah Chelsea was... I think she was at New College, or at least she had... there was a connection with one of the guys in the group who was an American, Rhodes Scholar, I think.

BH: Yeah?

BS: And I remember one rehearsal for Out of the Blue, Wes who was this guy, he had sort of second-hand connection with Chelsea. He turned up late to rehearsal and that was really like it was almost run militarily, it's like you don't

turn up late or you get a face full of [chuckles] our president of the group. So Wes turned up late and on his phone.

BH: Yeah?

BS: And then he got off the phone, everyone was expecting him to get yelled at and he was about to and then he said like no just listen, they're coming. And we were like, who's coming? They're coming! And it turns out Bill was visiting Chelsea and Chelsea had told Bill about this group, this Out of the Blue group that we were power and he just said oh let's just go and see what they're up to. So Wes had arranged for them to come and visit during rehearsal at like nine o'clock at night. So we all trooped out to this place in New College which is fantastically one of the oldest colleges in Oxford.

BH: Yeah.

BS: Into these dark cloisters around the back and it was all sort of mysterious and Bill and Chelsea were there with a bunch of security guards.

BH: Yeah?

BS: And they said, you know, sing us a song.

BH: [laughs]

BS: So we sang 'em a couple of songs and he had a quick chat and then we sang another song and then shook hands and we all went back to rehearsal feeling slightly spaced out...

BH: Well!

BS: Realizing that no one had taken a photo so we ran back en masse to find

him again and was just coming out of the college.

BH: Yeah?

BS: So there is a blurry grainy photo, which I'll send if you're desperate to see it.

BH: Yeah!

BS: Of all of us with Bill under some street light and almost none of us are visible 'cause it's really dark. [laughs]

BH: [laughs]

BS: It's quite atmospheric.

BH: That's awesome. Do you remember what you sang?

BS: Probably some cheap barbershop.

BH: Yeah. [laughs]

BS: We might've done some Chili Peppers. One of the songs that I used to sing the solo on was Otherside by Chili Peppers, we might've done that, although it's a little bit kind of harsh, brutal. [laughs]

BH: Yeah? That's amazing. Like did you know Chelsea? Did you ever meet her or was it just purely...?

BS: Yeah I spoke to her but she wouldn't know who I was now and...

BH: No?

BS: So I didn't know her well.

BH: She probably thought she was talking to Tim Sparks.

BS: Probably. You know, he's pretty famous.

BH: [laughs]

BS: [laughs]

BH: Ah, that's amazing. So... as you progressed through your years at Oxford, tell me about how your relationship with mathematics was changing.

BS: I was increasingly disillusioned with the pure side of things. Which is ironic now but I'm getting ahead of myself but the... all the abstract proof of like, you know, prove why there's only one zero and does exist at all?

BH: Hmm.

BS: But genuine question to deal in the sort of basis of mathematics weren't exciting me and I increasingly went more and more applied, doing sort of mechanics and physics applications. I did a course on relatively and quantum theory which was fascinating.

BH: Yeah?

BS: Very confusing and difficult but that was what I really got more into and I think I was doing the sort of thing that every student does. You kinda pick the courses you know you're gonna get through rather than ones that you necessarily think are important.

BH: Yeah.

BS: And, so I was getting through it rather than enjoying it. And after my degree I went into teaching. I'd... I did a year teaching maths and physics and music and PE in a tiny little private school in Oxfordshire.

BH: Okay.

BS: With no training.

BH: Had that been the plan, Ben? Like, as you were coming towards the end of university there was never thought to, you know, I'm gonna become a math professor or I'm gonna go and work in the city and make, you know, work in the share markets and stuff, was teacher always the next step or did you kind of just fall into that? Like, in that last year of your university...

BS: Yeah.

BH: ...you must've been thinking, oh my god, what do I do next?

BS: Well the hedge funds are queuing up to recruit maths graduates and...

BH: Yeah [chuckles]

BS: ...all the consultancies and then the other option is teaching. There are infinitely many career choices, I think I only realized that in my third year. Everybody's queuing up to get a maths graduate. And that makes it harder sometimes to figure out what you want to do. And I think I'd always had teaching in the back of my mind. What was more clear is that I didn't want to go into the city and do finance stuff.

BH: Right.

BS: You certainly could do and a lot of people said I don't wanna do it but I'll go and do it for five years, earn my millions or whatever.

BH: Yeah.

BS: And come out and I wasn't really to do that. But someone offered me a job in this tiny private school which I could take without doing any training 'cause it's a private school.

BH: Okay.

BS: Ironically the schools you pay money to go to are the ones that can have people who completely unqualified.

BH: Right. [chuckles]

BS: Around the side. I did that for a year.

BH: And so can you tell me again what were you teaching there? You were teaching maths?

BS: Maths and physics.

BH: Yeah.

BS: And music... I use the term loosely. It was more music appreciation.
[laughs]

BH: [laughs] Right. [laughs]

BS: I think I took some CDs of R.E.M. in. [laughs]

BH: Right. [laughs]

BS: Force these poor teenagers to listen to Nineties rock.

BH: Excellent.

BS: And PE. So I taught Rugby and Football and I was a Grade One qualified Rugby coach.

BH: Wow.

BS: I was awful at it. [chuckles] I was really bad.

BH: You are a proper all-rounder. You're a really polymath there by the sounds of it.

BS: Yeah but then I was teaching in a very small school where you have to wear lots of hats to sort of justify your existence.

BH: Yeah.

BS: And I was also completely untrained tryin' to figure out how to do a difficult job. I loved the teaching. It's hard work and it was... it was just a nice change after studying, I think, to do some sort of social interaction work and...

BH: Yeah.

BS: The bits of teaching that feel a bit like a performance that I think is where I noticed that, you know, I get... the floats my boat, doing something in front of an audience.

BH: Yeah.

BS: That's not just what teaching is but there's an aspect of it and I liked that. I think that year made me realize I should go and train. Like, you know, this is a difficult job I really need some input.

BH: Yeah.

BS: So that's what I did. I went and did a PGC the following year. And that year...

BH: For our listeners, I mean most of our listeners probably aren't British, can you explain what that means?

BS: A PGC is Post-Graduate Certificate in education and it's like a one year teacher training course that you would do after you graduated from a degree

BH: Yeah.

BS: So you do your subject, which I think... and it's a good way, you need to know your subject...

BH: Yeah.

BS: ...in order to impart knowledge about it. And then you do a year focusing on pedagogy and the science of teacher and how it fits with your subject. So it's a very subject specific year but it's also a teaching specific year.

BH: It's sort of... this is converting graduates who maybe didn't wanna be a teacher into a teacher in a sort of a one year... condensed course?

BS: Yeah. Although it's the primary route into... ironically secondary

education. In that most people teaching in a secondary would do it that route.

BH: Yeah.

BS: And if you do a full degree in teaching, which is possible, a B.Ed. or whatever they call it, you might take three or four years. But you don't have time to get the subject knowledge that you need perhaps to teach at secondary level.

BH: Yeah?

BS: So this is the way most teacher's in secondary schools would have trained.

BH: So you do this conversion. You've converted into a teacher in this one year course, where do you go from there?

BS: Then you get a teaching job. I think what that year showed me though, and I credit my tutors who were amazing. It was that mathematics wasn't what I'd got used to at Oxford, which was just a problem sheet after a problem sheet of difficult questions that I couldn't quite see the point. Because when they're training you to teach, you know, what works very well is going back to something you think you know about and you think you can tell other people about, i.e. you're a teacher, tell 'em about factorizing equations and then show them something surprising and if you suddenly see something surprising even though it's basic your motivation to learn something about it just goes through the roof.

BH: Yeah.

BS: So I think that year made me realize why maths is great. That the sort of the playfulness like I wonder what happens if. Instead of following the rules that other people tell you which is kinda how you pass your exams at school in uni, it became well just what happens if this, and what are the consequences of trying

that and I wonder what happens if you play with it like this?

BH: That's really interesting Ben, because so many people I've spoken to, have told me this kind of story that at a school they felt like mathematics was just solving problems and like, you know, brute force...

BS: Yeah?

BH: And then it was when they got to university, this magic door opened and they realized it was not what... it was something else, it was something more amazing. But it sounds like your university experience was almost just more problem solving...

BS: Yeah.

BH: ...and worksheets and tests and things and it wasn't til after university you got this... this new insight that turned... that switched you.

BS: I think that's true for me. It doesn't mean the door wasn't there for me... I just didn't open it at uni.

BH: Yeah.

BS: Some people got that... even alongside me, they were like I just love the stuff and they went into academics maths because they wanted to get more of it. And I didn't through the door, maybe. Your metaphor is like that door is there and it's even there at school...

BH: Hmm.

BS: But maybe having the teacher to point like that though that door lies playful adventurous maths. And through this door is... you're gonna get an A

'cause you do what you're told. And you can go both directions at once but I didn't notice the tinkering aspect of it. The ask your own questions aspect of maths, until I trained as a teacher.

BH: Hmm.

BS: And I'm very glad I did because it gave me massive more motivation to do a difficult job of teaching and something which has lasted now, like sort of motivation just to play with bits of maths that interest me.

BH: Almost invariably we stumble across you know, an inspirational teacher or someone along the way. Did your inspiration teacher come when you were learning to be a teacher?

BS: Certainly one of them. I mean... every story about anyone who's successful in some bit of their life will probably credit someone who inspires them but there were teachers at school who taught me well and weren't afraid to show me cool things.

BH: Yeah.

BS: Dr. Noble, Mr. Turner, my A Level maths teachers. But then... I had a really good tutor at... this is the guy who laughed at me when I said maths wasn't my priority. Dominic Welsh, at Merton College. Like, he was just a legend. He had amazing eyebrows, but that wasn't his defining feature. [chuckles]

BH: [laughs] It sounds like it was. [laughs]

BS: He's an expert in combinatorics and knot theory and probability but also like had been around. Like he knew Professor Tolkien, [chuckles] you know the guy that wrote the book... the Lord of the Rings book.

BH: Yeah.

BS: So at Merton College, which is where Tolkien was...

BH: Yeah.

BS: ...as a professor, Dominic Welsh had been there briefly overlapping with him and you know, things like that were just great... I feel lucky to have gone to places where that sort of thing happened. But he was also a great tutor and a very human tutor and he bucks the trend which was around me at Oxford of this super academic pressure. Dominic was, you know, trying to make me work and do a decent degree but also would chat about normal stuff and engage with me as a human being and I am very grateful to him for that.

BH: Yeah.

BS: And then during my PGC, Anne Watson, who I'm still in touch with now in the maths education and she's recently joined Twitter and put's her opinions out there.

BH: Hmm?

BS: She wrote lots of thoughts about maths education but she was also a really good course tutor on my PGC and made me think about maths and how students learn maths in a new way. Kinda changed my world view that year, maybe it dragged it more idealistically left wing it should've done, but you know you gotta be dragged towards extremes in order to balance out, right?

BH: I feel like just for the sort of the sake of the thread of the podcast we should quickly touch base with... your grumpy twin and find out what he's up to at the moment.

BS: [laughs] Tim had gone to Cardiff.

BH: He'd gone to Cardiff and studied what, something musical or...?

BS: No, he did engineering.

BH: Right?

BS: Actually so he did an environmental engineering degree. He was determined not to go to Oxford or Cambridge. Like this part of the reaction I talked about earlier like if we saw each other doing things we would diverge. I can't do that, that's what Tim does.

BH: Okay. [chuckles]

BS: Or, I can't do that, that's what Ben does. So, and he was really resistant, a little bit like I was to the idea of going somewhere with a prestigious name like Oxford or Cambridge. And he didn't even apply although almost certainly could have got some offers.

BH: Yeah.

BS: He was really anti that idea, and I sympathize with that and he went off to Cardiff and did a degree and realized that the engineering degree at Cardiff was a bit of a hodgepodge of ideas. It didn't really fit engineering, it didn't really fit environmental science...

BH: Right.

BS: ...but as a result he also, maybe there's a theme here, he didn't pay a lot of attention to his degree and did lots of music.

BH: Yeah?

BS: But his was playing guitar and singing on the open mic scene, had a little band going. I remember actually... I remember going across to Cardiff to do a gig with Tim. I think we [chuckles] we called ourselves... there were two other guys, we had a band called Short Straw.

BH: [chuckles]

BS: Which isn't a great name, but it's not terrible.

BH: It's alright.

BS: It was...

BH: It's alright.

BS: It was slightly ruined by the fact that in our gig I sort of decided I was gonna wear a hat and I had the... sort of floppy fedora which I'd come back with America with once.

BH: [laughs]

BS: On stage I think it just looked a little bit like a farmer's hat...

BH: Right.

BS: And then combined with Short Straw and like everyone was like these are a bunch of sort of Dorset yokels tryin' to sing.

BH: [chuckles]

BS: So he did music stuff.

BH: [laughs]

BS: And ended up... [chuckles]

BH: [laughs] Short Straw didn't take off though, they've retired now?

BS: Not for want of talent but...

BH: [chuckles]

BS: Just want of appreciation.

BH: Right.

BS: Uh...

BH: Want of a decent hat. [laughs]

BS: That's what it was, yeah. Tim did engineering though and...

BH: Yeah.

BS: ...as a result of not enjoying his course decided not to do the 4th year which is quite common on engineering degrees.

BH: Hmm.

BS: And stopped at which point they were like, oh, well d'you wanna carry on anyway and do a PhD? I think they were interested in keeping him in there 'cause he was probably doing well, he just didn't really enjoy it. Anyway he

decided to carry on 'cause they were gonna pay him to do a PhD, a graduate study thing.

BH: Yeah?

BS: And... mainly though I think 'cause he could stay on the open mic scene in Cardiff. So he stayed for another three years doing a PhD and I think hated it but there was a conversation sort of ten years later where he was finishing up his PhD, I'd gone back to study at Oxford again and we ended up talking on the phone and he's like oh what you studying today? And I was like oh I'm tryin' to figure out Navier-Stokes equations and how they sort of relate to fluid dynamics and...

BH: Yeah.

BS: And he went quiet and then... the he's like you realize I'm reading that exact page, right now, in my textbook as well? [chuckles] So we...

BH: [chuckles]

BS: We'd come full circle and that was one of those crazy twin moments of like, we're doing exactly the same thing ten years after diverging we're back studying the same stuff.

BH: And just quickly did Tim... has Tim become an engineer? Does he work as an engineer now or...?

BS: He works as a music teacher and a web designer and a general freelance odd-body.

BH: Alright. Jack of all trades. Let's go back to you though you've finished this conversion, this teacher conversion course...

BS: Yeah.

BH: That's one year.

BS: Yeah.

BH: What'd you do next?

BS: I got a job in Dorset at the school I grew up in which...

BH: Huh!

BS: ...is a dangerous thing.

BH: Yeah.

BS: I didn't intend to go there. It was one of those things during the PGC from about halfway through you start applying for jobs 'cause... you need a job and, you know, there's only one way to practice the application things and one of the first jobs I applied for, because it came up at the time, was a job at the school I used to go to.

BH: Hmm.

BS: But and I thought well that's a good way to practice and then I got offered the job and I was like... do I want it? And I think it's a sign of a decent school experience that I even considered going back there and I did decide to go back there and I figured that maybe that's a good place to learn my trade as a teacher in a place that has some familiarity without, you know, there's plenty to learn as a teacher. So I did two years there.

BH: I had a very good school experience myself but I still have like anxiety dreams that I'm back at my school, that I was at as a kid, like it's an uncomfortable dream and you've actually gone back there to work?

BS: And I had to enter the staffroom.

BH: [laughs]

BS: As a teacher.

BH: [laughs]

BS: What is interesting I think I'd left it just long enough that there were no pupils who were there still while I was a pupil, I'd left that one generation through the school so that was good. But there were quite a few teachers that were the same. And that was a mixture of good and weird as hell. [chuckles]

BH: Yeah. God.

BS: I could do all sorts of teacher stories but they're probably still functioning so I should...

BH: Yeah. [laughs]

BS: Yeah, I should censor some of the...

BH: I like that you almost sounded a little bit boastful that you got to go in the staffroom. [laughs]

BS: Oh man that was... my school particularly had a weird set up where if you wanted to see a teacher you'd go and loiter near a little lobby near the staffroom.

BH: Yeah.

BS: And there was the sort of holy steps which only teachers could walk on.
[chuckles]

BH: Yeah?

BS: And then you could see them turn left into the staffroom and you never saw that.

BH: Yeah.

BS: Now you know there was an occasional after school concerts and things where we'd, you know, roam the schools and investigate all the places we weren't allowed to see during school. So I had been in there as a sort of illicit visit.

BH: Yeah.

BS: As a pupil, I mean... who doesn't do that?

BH: If there's ever a time you have to go into the staffroom, like you have permission can you please pass this note to Mr. Jones, he's in the staffroom.

BS: Yeah.

BH: And you get to go in, it is, it's like the holy of holies, isn't it?

BS: Absolutely.

BH: You're like, I can't believe I'm getting to see this. This is amazing.

BS: And I think it was like some Christmas concert and we were... backstage if you like and everyone else, you know, and you're waiting your turn to go on but you've got time to kill so we're wandering darkened corridors and managed to break into the teacher's corridor.

BH: Yeah.

BS: I remember someone running down it in slight panic and running into the photocopier 'cause it was dark.

BH: [laughs]

BS: Just heard this crunch. [laughs] I don't know if it worked after that week.

BH: But now you're in the staffroom for real. Like you have like all access pass.

BS: Yeah. Having to call teacher's by their name instead of sir, or whatever.

BH: Yeah.

BS: There was a few teachers where it was really hard to break that even after years of being away, and... and lots of teachers who became good friends, despite having taught me...

BH: Yeah.

BS: ...they became colleagues and friends and so that there's a good redemption process to go through to stop school just from being these teenage memories. I'm glad I didn't stay there much longer. I did two years there.

BH: Yeah?

BS: But that was enough to... otherwise you can get institutionalized really easily.

BH: Yeah.

BS: In schools more than many jobs... but particularly a school you were at as a kid. You get so used to that way of working.

BH: What took you away from the school?

BS: I remember the headmaster, even when I got the job saying, look if you're still here in two years I'm gonna be putting job applications in your pigeon hole. I don't think he was being nasty. [laughs]

BH: Yeah.

BS: I think he realized that early career you should move on. And so I took that advice but I think having done my PGC and two years of teaching I began to realize that I really loved maths. Like more so than I had when I was doing my degree.

BH: Right.

BS: That was the change, like you said. It happened after my degree.

BH: Hmm.

BS: So I decided to go back and study, if I could, while I still kinda recognized that I loved it.

BH: Right.

BS: So I applied for a Masters course back at Oxford, mathematical modeling and scientific computing. Very applied maths course. But crucially like you could apply for funding, right? So you could ask someone to pay you to go and study and I liked the sound of that. [chuckles]

BH: Yeah, yeah.

BS: So I did that for a year and it was really hard. Actually it was... that was really interesting for me as a mathematician. I remembered what it felt like to do uni maths again.

BH: Yeah.

BS: And after a break you get really rusty. School maths is one thing but university level maths... I was working alongside lots of recent graduates who'd just done their degree and were carrying straight on and I was out of my depth.

BH: Yeah.

BS: I remember going into lectures and getting angry. Just a really boiling rage inside and I think at the time I was thinking, oh these people can't teach. I know about teaching, I'm a teacher and this lecturer's just droning on in...

BH: Right.

BS: ...a monotone.

BH: So because you've done that, those few years teaching, you're actually starting to look at your lectures through a different prism now?

BS: Yes. Although I don't think that was really what was going on. That's true... university teachers aren't necessarily employed to be good teachers. They're employed to research and teaching comes as a secondary. Some of them are amazing teachers, and some of them are not.

BH: Yeah.

BS: I don't think many people will disagree with that.

BH: Yeah.

BS: But I recognized eventually after I came out of those lectures and calmed down a bit that the anger is quite often a result of not understanding.

BH: Yeah.

BS: If you're used to understanding something or you want to understand something and someone's not making it clear, it's a really normal reaction to quite irate about it. And then I... there was this bombshell moment of realizing that's... how my students have felt over the last three years of teaching. If they don't get something, it's not a surprise that some of them kick off. And it's not necessarily behavior issues but like... learning is hard work and hard work and frustrating work and so it was a good reminder of what it feels like to learn difficult things. And that has always stayed with me I think and every once in a while learning is something difficult yourself and remembering the emotional reaction to it...

BH: Yeah.

BS: ...is pretty useful as a teacher. And as a speaker and communicator.

BH: It must help you when you're making a Numberphile video with me and

you see that confused look on my face.

BS: Oh does it ever leave your face, Brady?

BH: [laughs]

BS: [laughs]

BH: [laughs] So one year! One year at Oxford, is that right? Doing this Masters?

BS: Yeah so I... and this was the third visit to Oxford, so I've done my three year degree.

BH: Yeah.

BS: I taught for a year, went back and did a PGC at Oxford in fact, although it felt very different.

BH: Okay.

BS: And then two years away teaching and then back...

BH: Right.

BS: For this Masters year and finished that year in mid-September. It was full year instead of a sort of academic year. I had to do a thesis and things. And so it was too late to start teaching again. Which was kind of a relief, actually. 'Cause it meant I had sort of almost... sanctioned gap. And I hadn't had a gap year at any point in my life so I decided to go traveling for the rest of that year.

BH: Yeah?

BS: With a guitar. Went off around the world. Yeah I literally did a round the world circuit carrying a little busking guitar with me.

BH: And what you would busk? Just go and earn money by playing in the streets, would you?

BS: Yeah, I mean I didn't earn a lot of money.

BH: Yeah.

BS: I didn't cover my costs. I offset my costs.

BH: Okay. Did you have the hat with you?

BS: No! Although the hat had become a bit of a thing. It was just one of those... like it was a bit of... unnecessary baggage...

BH: Right.

BS: ...to carry on around the world trip when, you know, baggage is at a premium.

BH: Yeah.

BS: So I'd already decided to buy a small busking guitar, that I was carrying with me all the time and a hat couldn't fit. But metaphorically the hat was out on the street every time I stopped and put my guitar case down I was thinking, it really should've been the hat.

BH: Shoulda had the hat. The hat could've made the difference.

BS: [laughs]

BH: Where did you go in the travels, like, you know, you don't have to give me the full itinerary but what kind of parts of the world did you find yourself in?

BS: Well I did... kind of did an English speaking circuit but, you know, so I started in San Francisco, worked up the West coast to Vancouver into Canada, New Zealand for two months actually, I spent a long time in New Zealand. A month in Australia, and then Singapore and South Africa and then home.

BH: Did you go to Adelaide?

BS: I did not, Brady.

BH: Ohh! Rundle Mall's a great place for busking. You would have covered your cost if you'd gone there.

BS: Well Melbourne was pretty good as well...

BH: Yeah?

BS: Melbourne's a good place to busk in. I had some good... I've still never been to Adelaide... you know, one of the times if we overlap in Australia you have to show me around Adelaide.

BH: Alright. Yeah... you do have to go there. So during these busking, you know your traveling busking period.

BS: Yeah?

BH: Does mathematics play any role in your life whatsoever at this point?

BS: [laughs]

BH: Or it's just parked for now and now you're just like seeing the world and... it's about the music?

BS: Yeah and it plays a part in my chat up lines to people I meet.

BH: Right, [laughs] mathematician right, yeah.

BS: Well, I dunno, I'm not... I'm not completely kidding. It did function... like... it becomes a topic of conversation rather than my job and I was a...

BH: Yeah.

BS: I was focusing more on music.

BH: I guess when you're busking in the street asking for coins you really need to do something to get your cred up a bit. [laughs]

BS: Possibly.

BH: Yeah? [chuckles]

BS: I mean busking mathematicians don't have an... as easy a time as singin' a Crowded House song in Australian.

BH: Yeah, yeah.

BS: What I remember I'd traveled all the way around the world with my bag all time with a little headset, a microphone headset, in case I needed to log back in to do some online teaching. Which was another bit of income, I used to do some online teaching and some teacher training on the side, and so occasionally I

had... I think I did two sessions while I was traveling. I logged in from Australia or something.

BH: Yeah?

BS: To do an online session back in the UK.

BH: Yeah.

BS: Keep my hand in.

BH: Bit of tutoring from the road. Nice.

[gentle acoustic guitar music]

BH: Alright so you've devoted some time to travels and music, you've gotta end this bohemian lifestyle at some point.

BS: [laughs]

BH: What happens?

BS: Really, do I have to?

BH: Well I dunno [chuckles] maybe you don't. What happens next?

BS: [laughs] I did about five months traveling.

BH: Yeah.

BS: Yeah, so I hadn't figured out what I wanted to do. I'd obviously done some teaching, I'd done some studying and I'd done some traveling. And it's

like, what do I do, when I have to sort of settle a bit? I didn't really wanna go back into full-time teaching because I'd starting doing some other projects on the side. So I'd... that year I'd set myself up as a sole-trader. I'd declared myself as a self-employed person, for... in order to take some jobs like tutoring.

BH: Yeah.

BS: And the occasional talk, which I started doing even while I was teaching still. Someone said, oh, can you come and do a talk to this event with like a hundred teenagers. So that was the first time I started doing talks and I was aware that I enjoyed that. It kinda ticked all my performance mixed with education sort of...

BH: Yeah.

BS: ...leanings. And I'd begun to wonder if I could make that a job. Turns out, I couldn't. But... the process of declaring myself as a self-employed sole-trader in order to be... have a sort of legitimate way to take those opportunities if they turned up, was helpful.

BH: Yeah.

BS: So I spent the rest of that year tutoring, one on one, GCSE, A level tutoring, and marking exams which is extremely difficult and very sobering to realize some human, some poor human has to mark every script that the students right and yeah that's a really good insight into how to teach people to pass exams in the end the examiner's a human being. [chuckles]

BH: Yeah.

BS: Who's bored out of their brain and [chuckles] if you make life hard for them by writing illegibly or something, it ain't gonna help. Those sort of

realizations only come when you mark the things.

BH: Yeah.

BS: But...

BH: Did you take marking exams then as like... is it a really big responsibility to you or do you become blasé about it, like I'm fascinating to see behind that curtain.

BS: Yeah that was a curtain I hadn't seen behind even as a teacher. So you prepare all these kids and then so I had this year of doing bits and pieces and right this is a good way to keep my hand in and I remember I asked Edexcel, one of the exam boards, so like I can mark some core maths, some sort of basic A level maths and then they're like it's fine, no we've got enough markers for that why don't you do some advanced statistics. And I was like, okay. Yeah whatever.

BH: [laughs]

BS: [laughs] I then realized that I... I hadn't ever actually studied some of the things that I was having to mark. So things like hypothesis tests which absolutely fundamentally brilliant and important part of mathematics actually. I'd never studied despite having done an A level in maths and further maths and a degree in maths. I'd kinda dodged all those bits 'cause I didn't enjoy it.

BH: Yeah.

BS: And there's a stereotype about people not enjoying stats. I think, that's wrong, it's desperately important, it can be frustrating but I had to learn it from scratch before I could mark the thing.

BH: Yeah.

BS: So it was a mixture. I was kind of a bit blasé and I don't think I was the most qualified to mark it but I could learn it and I knew I could learn it in time to be good enough to mark the thing.

BH: Hmm.

BS: And it was a serious responsibility. Marking exams is not fun and it is boring and you're on repeat and your brain's going to mush and all the time reminding yourself that someone's future depends on whether you put a one or a zero in that little box there.

BH: Yeah.

BS: So it's a weird feeling.

BH: Hmm.

BS: But it becomes... like a production line. So you gotta stay sane somehow.

BH: Yeah.

BS: I'll be very careful about agreeing to do it but I think all teachers should do it once at least, just to see what it feels like.

BH: So what happens now?

BS: That year of traveling with tutoring and examining made me realize that, you know, I liked this slightly smorgasbord employment thing but it wasn't very stable.

BH: Yeah.

BS: And so sooner after I came back, and this is... I'm going off into story mode but as long as you're happy with it.

BH: [laughs] Oh yeah.

BS: I came back and I had long hair and a big pony tail and big beard and was used to sort of swanning around South Africa rather than England. This was probably now March of that year and someone was organizing a maths event with lots of speakers coming and sort of three hundred kids. Year ten or eleven or twelve kids. Joe who was organizing it, asked me oh come along and support and just, you know, see what's going on and I turned up ready to do a bit of sort of magic trick stuff in the intervals.

BH: Yeah.

BS: Just 'cause that was fun. And one of the speakers got stuck in snow. There was a weird snowfall that year and he was coming from up north and he couldn't make it so we had this hour long slot where the speaker and it was ten minutes to go and he wasn't there and Joe was like, we need to put someone up on stage and I was like well I can go and fill some time.

BH: Hmm.

BS: And I had a USB stick, at the time when nothing was in the cloud back then, so I had a USB stick which happened to have a few bits and pieces, in fact... it was the stuff that I've done for you on Numberphile, on the Mandelbrot set. It was an old version of that dynamic geometry file where you move points around complex numbers.

BH: Yeah, yeah.

BS: Without any warning, I'd just turn up plugged in this thing into a computer, got the projector working and did, I think twenty minutes off the cuff.

BH: Yeah.

BS: It was one of those things that you can't end up looking bad at that point. If you're told, okay, in front of this audience, everybody knows you're stepping in, you haven't had time to prepare, so everyone's sort of sympathetic already...

BH: Yeah.

BS: And if you do a good job, they're like impressed, if you do a really good job they are exponentially more impressed, more than you deserve.

BH: Yeah.

BS: And I think that's what happened. Everyone loved it. It was nice pictures. It was moving maths.

BH: Oh yeah, it's a great talk.

BS: I was relaxed.

BH: Great Numberphile video people, make sure you check it out.

BS: It's one of those Numberphile videos that I'm very pleased is on the record. Because I love that bit of maths and I've been doing that for a long time.

BH: Yeah.

BS: And it's a nice story to tell people. But what happened is basically there's lots of kids who I'm entertaining, that's kind of what I'm doing it for...

BH: Yeah.

BS: ...but there are also lots of maths teachers in the room who had, I dunno, jobs coming up. So, at the end of that day, five job offers saying oh, why don't you apply to come and work at our school? Because obviously I get announced on stage, oh Ben's just back from traveling, was a maths teacher and he's gonna tell you about this.

BH: But they're more just trying to justify that huge beard and bushy hairdo?

BS: Well, yeah. I was rockin' it, I was. [laughs]

BH: [laughs]

BS: I remember there was basically a queue of people saying would you... we've got a vacancy, come and talk. So I ended up talking to a few schools after that. I felt really lucky. Outrageously lucky to sort of land in the right place at the right time.

BH: So this was just being invited to come and give like, you know, one off special presentations. Not to come and be there new maths teacher?

BS: No, this was people saying will you come and teach. Because maths teacher jobs are... everyone's desperate for maths teachers.

BH: Right.

BS: So spotting an unemployed maths teacher who's not offensive or... a criminal basically [laughs] is licensed to go and queue up and say, please apply for a job.

BH: Yeah, okay.

BS: And it's still we've got a huge problem in the country of shortage of maths teachers.

BH: Yeah

BS: So I think what happened is they spotted someone who clearly was qualified as a maths teacher, had some stage charisma and everyone was like, let's get him.

BH: Yeah, yeah.

BS: So I ended up, to cut a long story short, working at a posh private boarding school. Which... it's not really my field of... comfort. But they... I went, I applied for a job there as a maths teacher 'cause they asked me to. I went and had a look around and thought I don't really fit in here. Certainly my hair doesn't fit in here.

BH: [chuckles]

BS: [chuckles] At least that's what deputy head told me. [laughs]

BH: Yeah? [laughs]

BS: He was like, you realize you're gonna have to cut your hair if you work here? At the end of the day I'd had five interviews with various staff and thought oh it's all very pretty and exclusive but I don't really fit.

BH: Hmm.

BS: And the last interview was with the head and he said, it's obvious Ben

that you don't want this job.

BH: Hmm.

BS: Which is a bit of facer and you're like... oh is it that obvious?

BH: Yeah.

BS: And he said it's alright we don't really want to give you that job. Which is also a bit of a sobering start to an interview.

BH: Yeah.

BS: But he said, what we'd like to do is recognize that you're doing lots of other stuff on the side, why don't we give you a halftime job as in a pastoral role, which you're clearly good at in the boarding school environment. We'll give you some teaching with it but leave you plenty of time to explore your freelance options speaking and tutoring as well. I hadn't really considered that as an option. I wasn't really sure how you go and ask a school for that sort of option. But credit to the guy he kind of spotted something which really made me interested.

BH: Yeah.

BS: As like I can go back to teaching... but I still...

BH: They clearly wanted to offer you the job but knew you didn't want it so he like... he played you like a cheap guitar.

BS: He played like me and it worked and I'm, you know, it wasn't just... a benefit for them, there was a pretty good outcome for me.

BH: Yeah.

BS: So I worked for five years in that school, halftime but then working halftime in a boarding school is a bit of a joke.

BH: Yeah.

BS: I lived there. And for three of those years I lived in a boarding house and was as close to a father figure for some of those kids as they had during term time and that's worrying for all concerned.

BH: Yeah.

BS: We're almost up to date 'cause I did five years of that and developed my freelance work on the side and was increasingly doing maths talks and other bits of freelance business. I really enjoyed the flexibility of having a bit of my life which is under my control as a freelancer and so after five years it was probably time to move on and... I'd been working with the Advanced Maths Support Program who... they used to be called the FMSP, but they're now the AMSP.

BH: Hmm.

BS: They had employed me for a bit of my time while I was teaching down in Dorset and said instead of paying your piecemeal for these talks can we pay you... second you a tiny bit from your job.

BH: What's this group, Ben? This is an organization that provides... what... talks and extra math teaching, is it?

BS: Originally they were set up to provide teaching. They were called the Further Maths Support Program 'cause people who wanted to study further maths as an A level sometimes couldn't access it at their school.

BH: Hmm.

BS: So originally about fifteen years ago they were set up to provide some teaching for kids who couldn't access it at their school.

BH: Right.

BS: Sometimes remote teaching, online, and sometimes by tutor who would pop into their school.

BH: Yeah.

BS: That very quickly developed. The government realized this is... they needed to support math education 'cause there's a huge shortage of qualified mathematicians and maths teachers so they put money into this project and it became about encouraging maths and supporting maths education in general.

BH: Right.

BS: So, partly teaching the subject so people can access but also training teachers. That's a big part of it, and also doing enrichment to inspire people to make the choices later on.

BH: Yeah.

BS: And that's the bit, those two bits are what I fell into, doing some teacher training and some enrichment stuff.

BH: So you'd go... maybe you'd go and sometimes you'd go and inspire teachers. Sometimes you'd go in front of a group of a few hundred students and just like, you know...

BS: Exactly.

BH: ...wow them for half an hour and make them think, oh maths is school.

BS: Yeah, certainly if you can do that. I mean you can try and do that and sometimes it doesn't work, right?

BH: Yeah. [laughs]

BS: It's important in any subject to remember why it's worth doing even if the exams were canceled. Which is a very interesting observation right now when exams have just been canceled in this country and suddenly everyone's noticing, oh, you know, what is worth doing even if the exams are off?

BH: Hmm.

BS: And they're realizing that studying maths in order to progress to the next stage or because it's interesting, is a valid option. Or it's much more obviously a valid option again.

BH: Yeah. So while you're at the college for five years, you're doing a bit of work for this organization on the side, like they're basically engaging you as a freelancer to go and do talks.

BS: Yeah they actually... they kind of bought my time out of the school. So I ended up being fully employed by the school but this company paid for a chunk of that time.

BH: Okay.

BS: And what happened is that they were interested in connecting more with

universities. That overlap from school to university is a difficult one, for kids and teachers to know how to support. It's difficult for universities as well, 'cause they don't really know what school feels like.

BH: Hmm.

BS: And... so the AMSP said we should have a connection with university and they approached Bath. They had already had lots of connection with the university but the University of Bath was also thinking we need someone who knows about the school's and so that little marriage was like who could fit this role? And I was like, I'll do that! Put my hand up and... so I moved from Dorset to Bath and stopped the teaching half of my job, really, but kept the AMSP half of my job.

BH: Yeah.

BS: So I ended up employed by the University of Bath, but the money comes from the AMSP, and that's half a job, and I go and do teacher training enrichment for them and that meant that the other half of my time is now completely unaccounted for and some I'm freelance for the rest of my time.

BH: Right.

BS: And that's kinda been the case for the last... six years.

BH: So half your time's... what's it called? ASMP? A...

BS: [laughs] the A... Advanced Maths Support Program.

BH: So half your time is AMSP...

BS: Yeah.

BH: ...and half your time is whatever you choose and... that can be all sorts of different things?

BS: Yeah, loosely. There some complications in there as well but, yes.

BH: Well. So tell me about that other half for a second. I know occasionally you do Numberphile videos, obviously. [laughs]

BS: Yeah.

BH: That's the part I know about. What else do you do with this huge wedge of time is yours to be creative with? And earn money with?

BS: What's confusing is that a lot of it ends up being very similar work to what I'm employed to do with the AMSP, so if a school approaches me, oh can you come and do us a talk, I need to check whether that's part of my job with the AMSP.

BH: Right.

BS: And if it's not for any reason or I've done my hours or whatever, then I can do that as a freelancer and invoice them. [laughs]

BH: Yeah.

BS: That was a big shock actually, moving from a teaching world to having to charge people for your time...

BH: Yeah.

BS: ...is a strange shift but... no one teaches I think, no one teaches to earn a

lot of money. It's not super well paid. It's decent wage, it's not a very mercenary job. You do it for the love it and it's hard work.

BH: Yeah.

BS: Whereas suddenly have been shifting to do the same sort of thing but to give people a bill, that was a bit of a shock. So it takes a longtime to get used to that way of working.

BH: You're adventure so far sounds very... it sounds like very piecemeal and very... like it's not very typical.

BS: Yeah. [laughs]

BH: Have you been... are you satisfied with it? Like has it made you'd happy, has it been what you expected? Has it been, like how do you feel about it? When you tell the story of it now like this?

BS: It is nice to reflect on it. I think everyone reflecting on their stories has sort of weird moments of like did I follow the right path. But I don't feel dissatisfied I certainly appreciate the flexibility that my job has now. You have to sacrifice something in terms of stability for that. It's interesting, you set this up nicely, talking about Tim earlier on has made me realize that the parallels are interesting now. 'Cause my brother is doing a very piecemeal job. He's doing sort of four or five different bits that he can flit between and some of them are freelance and some of them are employed.

BH: Hmm.

BS: And that's very similar to my... what'd they call it? A portfolio career, but what it gives us both is flexibility and we're clearly drawn to that.

BH: Hmm.

BS: Possibly we don't like being told what to do. [chuckles] Or at least having the option to revert to a situation where we're not told what to do.

BH: Yeah. Yeah.

BS: So I'm glad about that and I recognize that a twin brother who has the genetic experiment of doing the same thing as me or different things with the same starting point has ended up in a similar role.

BH: Yeah.

BS: So, maybe we were always gonna go that way.

BH: I guess your main... your main job now then, when you really boil it down...

BS: Yeah?

BH: ...is getting up in front of a group of people and talking to them...

BS: Yeah.

BH: ...about mathematics.

BS: Talking maths in public.

BH: Talking maths in public, yeah.

BS: Which... I'm using that phrase as an acronym sort of deliberately in my head with capital letters and you know about this because we... there was a

group of us who were organized as a sort of company. We're now a charity actually, called Talking Maths in Public, and we're running a sort of conference every couple of years for people who do this slightly weird niche job which is stand up in front of people and talk about maths.

BH: Yeah.

BS: It's not different really from a teaching job in that... it has that educational aspect but it has a much more of a performance side to it. Maybe that's why I'm happy doing it 'cause I love that slightly egotistical performing thing. And maybe I say it like it's a bad thing but I... even when I'm doing music I really enjoy and all performers do I think, they enjoy the feeling of doing something well and seeing other people having a good time because of it. That's very obvious in music, if you get it right at a gig and you sing a song or something and you just see people enjoying themselves, that's a huge payback, which is why musicians do it not for a lot of money perhaps but...

BH: Yeah.

BS: Performing a mathematics talk can give me the same sort of rush and yeah... occasionally I will play music in a mathematics talk but only if I can shoehorn it in.

BH: I know there's a million ways to answer this question and you could do a whole course on the answer to this question so please don't.

BS: Hmm.

BH: But [laughs] but... what do you think the secret is to successfully talking maths in public, like if you were gonna just cherrypick one or two little nuggets for people who might be listening who are math teachers or... or are just curious about what makes people good at it? Can you think of like a little piece of advice

or something that you think works? That not everyone necessarily thinks of?

BS: I mean the stereotype of maths being hard and sort of academic is something you can't ignore. So, if you play into that too much and blind people with science it's gonna absolutely not help you. So I guess my one obvious go to advice, which I have to tell myself regularly, is motivation. If you can find a way to motivate people to learn further, a lot of the work is done. And that might be showing them something surprising, showing them something interesting or pretty or cool or curious. And then you've got sort of the fuel which is necessary to go and study the sort of the detail.

BH: Why is that fuel? Just because if something fascinates you, you just naturally want to know more about how it was built sort of thing?

BS: Yeah I don't think any human does anything without some sort of motivation and it can be the carrot and the stick business like it can't be someone threatening you like, if you don't do this you won't have enough money or if you don't do this I'm gonna threaten you or do this because the carrot is dangled in front of you and you're like I want that. So I guess nobody would like to think that people only do stuff 'cause you threaten them to that seems like a... inefficient thing of doing something.

BH: Hmm.

BS: And if you can show them the carrot dangling and say, ah that pretty picture like take the Mandelbrot Set, like, look at that. What is that and why does it happen, is a lot of fuel for studying some difficult concepts.

BH: They're already certain people that will be motivated by that though, won't they? Like if you...

BS: Oh, that's true, yeah.

BH: Like if you show someone the Mandelbrot Set I think there's a certain subset of people that will go, that's beautiful and fascinating I wanna know more, but I can think of a lot of people in my life who would look at that and just like... just they'd go, uhh, what? That's just what a mess.

BS: People's taste are different, right? And I think as a teacher particularly that's in a classroom of people, you've got thirty kids and they'll all have different kids and leanings but if you don't show them a range of things then the chance that some of them get turned on by that little image or something will be lost. Like I'm not claiming that everybody will get a massive rush out of everything I show everyone. And it's like music everyone has different tastes, you go to a gig and some people love it and some people like meh, that's not done in order for them to study further, that's just imparting pleasure. But you don't impart the same pleasure to everyone all the time.

BH: Yeah.

BS: I do think it's true though that nobody does anything without motivation and whether you are concealing the motivation or haven't noticed it consciously it's true whatever we do. Like, you know, you wanna go and cook food, it's 'cause your hungry partly. And so education's a bit like that if you want to get through an idea to someone you've got to show them even unconsciously a reason to do it.

BH: I've seen you give a few talks and obviously I've filmed you making Numberphile videos and I can see, you know, the tricks you use and the inspiration you use and you obviously you use humor a lot very cleverly as well. So...

BS: [laughs]

BH: You're obviously very good at that. The thing I wanna ask you though... is about talking to a group of mathematics teachers. 'Cause I do talks as well and I quite enjoy doing talks.

BS: Yeah?

BH: There's nothing I find harder than talking to a room full of mathematics teachers. Like that is a completely different beast.

BS: The stereotypes really kick in at that point. I mean in any audience you're gonna have people who pick you up on details but maths teachers are the worst. The stereotype of us of being pedants and like... oh you've spelt that wrong, again, the apostrophe's in the wrong place, even if it's not maths pedantry, so I think they're a frightening audience.

BH: But they're also, their... their motivation is very different to other audiences I find. They don't...

BS: Yeah.

BH: They're like you can keep your maths tricks til the cows come home. That's not gonna help me in my job. And the reason I'm here is 'cause I need help in my job.

BS: And this is true of a lot of teachers. Teaching is hard. And so, we're back to our carrot and stick metaphor. Just survival as a teacher becomes your overriding motivation.

BH: Yeah.

BS: And however you love your subject what's gonna get you through the next period with the year 9s on a Friday afternoon is more important, because...

[chuckles]

BH: Yeah.

BS: Basically it feels like your world's gonna end. So yeah. I mean I remember feeling like that as a teacher.

BH: Yeah.

BS: You stop paying attention to maybe the bits of your subject should get your excited and you should be able to show people and you start occasionally getting blinkered into I just need to get through this and I need to find a decent assessment tool that helps me get through this and reduces the amount of blooming paperwork. Maths... teachers in general are a hard audience 'cause they're doing a difficult job...

BH: Yeah, right.

BS: ...and it's hard to get through the motivation sort of blinkers. In the right context if you can get through that suddenly you can provide other motivation. And I know a lot of maths teachers who are insanely grateful that Numberphile exists, so fair play to you because you're providing an easy accessible way of seeing little nuggets of motivation that aren't exam focused. And that's a really good thing.

BH: What do you want to be doing next then? You seem to have this... be tumbling from one thing to the next, like is there... have you got like this endgame or... grand thing or you really... is what you're doing now [pause] good for now?

BS: I dunno. Any suggestions?

BH: Wow. I dunno. You could always do more Numberphile videos, I'm totally in favor of that.

BS: I'd like to do that.

BH: [laughs]

BS: I am happier now. I feel a bit guilty that I'm not teaching in a classroom but I feel like I... someone has to do these bits that are slightly outside the classroom and I'm really glad to be in this situation now. I don't know how long it will last, and freelance work is always a bit like how long is this little niche gonna actually employ me?

BH: Yeah.

BS: But I feel like there are a lot of options and things will change I have no doubt in the future. Even during. I mean we're recording this in sort of lockdown state and so everyone's but stuck at home a lot longer but I've... as a result dug out an old MIDI piano and recording studio bit setup and I'm trying to like maybe resurrect a bit more music which was a big part of my life for a long time and I haven't done a lot of recently.

BH: Hmm.

BS: So I don't think I'm ever gonna make my way as a paying musician or a paid musician but there are lots of bits of things that I enjoy doing that I've had a chance recently to maybe tinker with again.

BH: Yeah.

BS: If you've ever... if anyone who is listening has ever seen a Numberphile video for me you realize that I spend a lot of my time tinkering on bits of

software as well like there's one called Geogebra where you can maths move and I spend a lot of my time tinkering with that and so there's options there to sort of do less presentation maybe in the future and more work on making resources that make maths move and look exciting. I mean there's lots of other people doing that really well.

BH: Yeah.

BS: As well.

BH: Yeah.

BS: There's a few options out there. We'll see.

BH: Are you still doing any one on one tutoring?

BS: Not personally.

BH: Right.

BS: The AMSP who I still work for in the sort of floating role of doing enrichment, particular during lockdown, they've had to change how it supports students so I can see that might actually start happening again maybe online doing some tutoring to small groups and things but right now, no, I'm not doing any tutoring, I don't have time to make it happen.

BH: And finally, you mentioned we're in lockdown, are you having a lot of contact with Tim at the moment?

BS: [laughs] Yeah. We speak regularly, he's got a five year old son called William who... I need to catch up with from time to time.

BH: Yeah.

BS: But to be honest one of the main things Tim and I do is that every Sunday night we have... we both log on to Steam and play games together. We start over a sort of audio call, headset, and then play some stupid online games together, and that's our twin bonding time at the moment.

BH: What do you play?

BS: All sorts of things. [chuckles] Usually really old games.

BH: Yeah?

BS: There's one kind of Soldat, I think it's a Scandinavian thing, where you're sort of stupid side running around others cooperative or you know shooting people. These are not sort of high level thinking games, these are fun bits of time with your brother.

BH: Oh I know the Numberphile audience, if I don't find out what games your playing there'll be like a riot.

BS: I used to spend a lot of time playing X-Com, which is a sort of turn based strategy thing but when playing with other people it's a really different thing. And I enjoy playing games on my own but they're usually sort of... much slower paced and people playing with me would be like seriously what?

BH: Alright.

BS: So it's much more arcadey stuff when I'm joining with other people.

BH: Well in the notes for the show, people, I will be linking to most importantly Ben's website and you can get in touch with him. You can see all

sorts of things he's up to, and very importantly you can book him in for a talk or something when all this lockdown shenanigans ends.

BS: Indeed.

BH: Get him to come out because Ben's talks are excellent. I've seen a couple and they're definitely worth your time.

BS: Thanks Brady.

BH: And I will also link to some of Tim's music so you can check out what he's up to as well.

BS: I mean one of these days I need to record some music myself but that I think...

BH: Well I did have an idea actually. 'Cause I do use little bits of interlude music just to break the interview up and at the start and the end and I do have like Numberphile music. You could do your rendition of the Numberphile music and I'll use that as all the little stings and ends and things like that. It could be you playing. And I'll tell people that at the end as a surprise.

[gentle acoustic guitar music]

BS: Okay. I'll have a try. I'm not gonna promise anything. My musical skills almost always ended up being... I wanted to sing which is always very difficult to do as a background things. And so my guitar skills are basically background accompaniment and anything which is just guitar always makes me feel like I really should've actually, you know, learned to play this properly. [music fades up]

BH: So as our Ben plays us out on the guitar, my thanks to him and to his twin

Tim who was unwittingly dragged into this episode. There are links that we discussed today and Ben's website of course in the video description. [music continues] I'll also link to Ben's Numberphile videos. [music continues] Numberphile is supported by the Mathematical Sciences Research Institute in Berkeley, California. It's also made possible by support from people like you listeners and viewers via small contributions on Patreon. If you'd like to help us out it really makes a difference, even like a dollar a month goes a long way. Go to Patreon.com/numberphile. Thanks to those of you who already support us. You're names are all listed on our wall of fame. I'll link to that as well in the description. I'm Brady Haran. We'll be back again very soon with another podcast.

[Music fades up and ends]