Numberphile Podcast Transcript
Episode: The Singing Banana - with James Grime
Episode Released May 20 2019

James Grime website - includes a section to book his talks

A selection of James' videos on Numberphile

James' own channel - Singing Banana

James discusses The Little Professor

The first proper Numberphile video from 2011

Filming at a gritty, urban underpass

Status: Black Eagle

James talks about Enigma

Brady's Bibledex

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Brady Haran [BH]: We should have recorded us talking about the Superman movies.

James Grime [JG]: I know!

BH: That sounds like that's something we could talk about for hours.

[music fades in]

JG: [laughs] Well that's for our other podcast.

[music continues]

BH: For a lot of people I feel like maybe this is one of the episodes you've been waiting for because today we're joined by James Grime. The original Numberphile presenter. [music continues, gets louder] James fronted the very first video in our series and he's been a mainstay of the channel ever since. But despite his bubbly personality and unquestionable passion for mathematics, well… I mean James is a private guy and that's what I think makes this episode a real treat because James is really gonna open up and tell us about what makes him tick, where he comes from, and maybe where he's going next. It was a chat that I really enjoyed and I hope it's something you'll enjoy as well.

[music fades out]

BH: You're like the Numberphile original aren't you? You were in the first Numberphile video.

JG: Yeah! That's correct.

BH: You must have been in the most of anyone?

JG: I think I've been in the most of everyone, yeah.

BH: Do you feel like a kind of warm attachment to the project then?

JG: Of course. Of course! I don't wanna speak out of turn but I feel I'm a founding member.

BH: Founding father.

JG: Yeah. Maybe this is over… emphasizing my influence but I feel like we found the tone.

BH: Yes.

JG: At the beginning.

BH: Yes.

JG: I mean how do you make a maths Youtube channel? We were finding the tone.

BH: We went out into a field with a piece of brown paper.

JG: Yes, I remember.

BH: I remember we filmed like near an underpass tunnel with all graffiti 'cause I originally imagined in addition to the brown paper to make the videos feel all gritty.

JG: Yeah.

BH: I wanted them to be in quite gritty locations as well. So we were all out all over the place filming and I sort of didn't end up doing that much anymore after.

JG: Well, I… you told me this and I went… okay… I'm really not urban. I'm really not gritty at all. I think you're on to a wrong end there. So I think, I was just too dorky to pretend to be cool and urban.

BH: I was right about the brown paper though.

JG: You were right around the brown paper. And I thought you were right about the brown paper. When you mentioned it to me, I said, good one. We went through all this together at the beginning, didn't we? The brown paper, all that. People ask why the brown paper, all the time? Do you want to give the definitive answer? You've probably done this loads of times.

BH: There are multiple answers to why we write in Numberphile videos on brown paper as opposed to white paper or a whiteboard or a blackboard. I did consider like buying slates and chalk but the reason is… well there are a few. One is, it shows up better on film, like it looks better filming the brown paper than white paper. I'm able to keep all the work afterwards, if it was on a white board it would all be erased and I want to be able to keep everything as an object but also as something I can refer back to so I like that they're tangible objects. I like that it's like a physical object, it's unique and it's a bit gimmicky. You know, it's unique to the channel as opposed to the cliche of the white board.

JG: It's a brand isn't it?

BH: Yeah it's like a brand. And it's more kind of sort of physical and people interact with the paper and there's a big long shopping list of reasons but…

JG: And I was all for it. I thought it was a really good idea that you had. And people are disappointed when I don't turn up with brown paper. When I go and give talks, they go where's the brown paper?

BH: Hopefully you have a few rolls in your backpack sometimes?

JG: Well this is a Numberphile brand thing, so maybe I… with different hats… I do it in different ways and different styles.

BH: Yeah, yeah. Has it changed much from the start from your perspective? For people who don't know which is every single person except you and me,

we've just been recording for the last couple of hours here in my office. Is it different, like today than it was all those years ago?

JG: Yes. I think definitely. I think when we started the first idea, the original idea which… I still think is a good idea, is each video was about a number, wasn't it? It was riffing on your periodic videos and the Sixty Symbols. It's a hook to hang it on. I was all for that. So definitely even more so at the beginning though, today's number is… whatever four hundred and ninety-six and then you talk about that. And then I always hoped and thought we would be able to branch away from that once we got established and we have done, so we kind of talk about maths generally now. I almost feel like the level has gone up.

BH: As in complexity?

JG: Yeah. I think the videos we do now are at a higher slightly higher level than the original videos. I still like to throw in videos that hark back to the original ones. I still do, hey today we're doing the number such and such because I was there at the beginning. I still kinda try and tie it back into those roots. I do like to try and keep the levels different. So when we come and film, I tend to do five in a row… are we giving away secrets?

BH: No, no, no, that's what you like to do. Once you feel like you've got five you wanna do, you'll jump on a train and come and visit me.

JG: That's right.

BH: And we'll film together.

JG: Exactly, and it makes sense, doesn't it? So we do five in a row but then I tend to break it up… I like to have meaty one, like a really good proper serious maths one, and then I throw in something slightly whimsical or something that's at a lower level. Partly it helps me, 'cause doing five heavy ones in a row is

actually hard work. But also I think the channel should mix up the level.

BH: So James I'd like to come back to Numberphile later, 'cause it is a big part of your life now, making videos so that's something we're obviously going to talk about, but before we get too lost in the weeds with the minutia of the videos I want to find out a little bit more about you and your background. So… where are you from? [laughs] Where did it all start? Where were you born?

JG: So I'm born in Nottingham, although my family are from Lancashire. So they moved to Nottingham, I was born in Nottingham. I lived in Nottingham until I was seventeen.

BH: Okay, so from naught to seventeen. What were you like? Were you like… math nerd boy right from the start? What were you into as a real youngster?

JG: No not math and nerd boy at all. Perhaps no one really mentioned that I might be… better than average at maths. No one even mentioned it to me so I didn't notice [laughs]. And no one said a thing to me. What I was obsessed with was TV. I mean I could dress that up as media or filmmaking but that's just dressing it up. I was obsessed with TV, I watched so much TV.

BH: Trashy junk stuff or wholesome like Attenborough documentaries or like…?

JG: Everything. I just watched everything. And then… consistently when people asked me what do you want to be when you grow up? My answer was well it was cameraman. 'Cause you know, I was a kid.

BH: [laughs] We've got it wrong James! All this time.

JG: I know. I wanted your job. But I wanted to be probably more a director I think, and probably wanted to be making the TV…

BH: Yeah.

JG: Really I mean, that was my consistent answer for very long time. You know, and that's still an interest of mine. Which is why I'm interested in doing the Youtube stuff, 'cause it's still there as an interest of mine. I feel like I get to do a bit of that as well, as well as with the maths stuff.

BH: So even as a youngster, 'cause like I imagine most kids get pretty obsessed with TV, 'cause kids just love TV, don't they? But were you already an early stage thinking a step ahead and like behind the lens. Like how do they make that?

JG: No, I was analyzing it. So obviously I have an analytical mind. I mean, I must do.

BH: Yeah.

JG: So I was very interested in the process of making the TV. I'm not saying I watched behind the scene documentaries or anything. I do now. I watch loads of those [chuckles] 'cause you just take what you're given on the TV. But I was very interested in how, you know, that person was placed there and that camera was placed there and someone came up with that idea. Who came up with that idea to do that episode on that subject? That was very interesting to me.

BH: Do you remember which TV shows or movies or things like made the biggest impression of the many you watched probably?

JG: I've watched… so much but let's say I mean what turned out to have a big impression on me is the science programming, of course. In another way, so there's on one hand I'm watching TV thinking how is it made, at the same time I am watching the science programming and thinking, oh that's a thing, is it? So

when I said I was consistently telling people that I wanted to be a cameraman, in the back of my mind I secretly was thinking, I know that mathematician is a thing. I'm not gonna tell anyone that I want to be a mathematician because they might ridicule me. That's beyond my station. So, I'm hmm, I'll keep that in mind, and I'll just keep working. You know, I don't wanna have ambitions above my ability.

BH: Was there ability? Were you better at maths than the other kids in the class, or did you feel better or did the teach…?

JG: I didn't feel better. I didn't know. Thinking back about it, so let's say at junior school, so I was eleven and under, probably was finishing a test sooner than other people and I put my pen down and went that's the test done. And waited for the other people. I didn't clock that that meant that I was better at it than the other people.

BH: And teachers weren't saying…

JG: No.

BH: Like, it wasn't in your report card, James has an aptitude for this.

JG: No.

BH: Do you put that down to some kind of humility of yours or do you put that down to the education systems or…?

JG: I'm just totally unaware. I'm not… I guess I'm not someone with a massive ego. I'm slightly concerned about talking about myself for an hour already…

BH: Hmm.

JG: I'm not someone with a massive ego. So no, no, it just didn't occur to me.

BH: It feels like a failure of the education system that they didn't identify someone…

JG: No… yeah, yeah, yeah, that they should have mentioned it. [chuckles] 'Cause I genuinely didn't know. Maybe they should have mentioned it. I mean there is, and we're talking about when I was under eleven. There is the lovely story though which we did on Numberphile with the little toy that I had. Do you remember the little professor toy?

BH: The calculator device?

JG: Mhm! It's like a reverse calculator. It gave you problems and you had to answer them. Alright and I was good at that.

BH: Like the worst calculator ever.

JG: [laughs]

BH: [laughs]

JG: The best calculator ever!

BH: Oh yeah?

JG: I think you'll find.

BH: Okay.

JG: You know, and I was really good at that. And so I had that and when other

toys get thrown out, I still kept that. Even when it was younger than my level, I kept that. And then when I got to a point when I said, I'm actually quite far along the road on this road of being a mathematician, I should really keep that toy now because that toy now is something that did help me along the way.

BH: So those devices, those professor calculators for want of a better name, they look like a little man with a mustache and glasses, don't they? Like the way they're designed.

JG: Yeah, yeah.

BH: Do you look at that now and feel warm feelings, like, you know?

JG: Yeah. Yeah.

BH: You're a mentor. [chuckles]

JG: [laughs] More than a teacher at the time, I suppose, and I guess it shows I was… and still I'm a very independent learner as well. So I'm afraid I wasn't taken by the hand by any figure. I was very much an independent learner, so I would do these things at home for myself. Because I'm a curious person who likes to learn stuff. I wasn't necessarily a maths nerd or a science nerd. I was just, you know, let's learn a thing. Oh that's an interesting thing. Like curious facts and I watched all of telly, because I wanted to learn everything possible. I wanted to know as much as a good, so I watched all the telly. Talking about figures who might have led me through my career, led me to my career, it would have been more like the science presenters on the telly rather than anyone in really life.

BH: What about like your family? Were they shoving math books in front of you or fostering that? Or were they just letting you get on with it like…?

JG: Yeah [chuckles] no, no they weren't. I mean they bought me these Little

Professor so I mean obviously thought well maybe we should be encouraging this but not generally no. So I don't come from an academic family. To be an academic is not something that was expected in my family. I think my dad would be the first to go to university, well university means polytechnic. He did economics I think, so two years or something like that.

BH: But not someone who's uncomfortable with numbers than?

JG: No, my dad's not daft. No, not at all. Oh no, he's a good guy my dad. But not an academic, my dad will never list to this so I can probably say this.

BH: [laughs]

JG: He has working class ideas of what your station and not going above your station. Dad will not listen to this, so that's fine.

BH: Alright [laughs] Okay, so he's like… well that's just sounds very typical English humble mustn't grumble… do your bit.

JG: Whereas I thought well can I go further than my dad? Bless him, my dad wanted me to go further than him… as the same as he went further than his dad.

BH: Were there ever times where he would say to you then, don't do mathematics, James? You're not gonna get like a good job out of that and do this. Or was he like, yeah do what you want, I don't understand it but you do it?

JG: Well he's very much of the, I don't understand what you're doing. He does have the opinion that the higher your educated the more money you should be making and that turns out not to be the case.

BH: [laughs] So as your getting a bit older in your teens it must becoming apparent now, oh actually I am pretty good at mathematics and you start

thinking okay I'm not gonna be a cameraman I'm gonna be a mathematician. When does that switch?

JG: Yeah you're right. So I guess then at secondary school, so to add to my previous problems, my secondary school was rough. I went to a difficult secondary school. So I was a clever kid in a rough school. So I mean I was sat there and really fifty minutes of an hour lesson was telling people to shut up and sit down. And I was twiddling my thumbs bored as really going out of my mind. Not the teachers' fault, but I'm afraid it was just a, you know, kind of rough area.

BH: Yeah. Were you able to stay out of trouble at least?

JG: Yeah, 'cause I'm totally not that. And I had a very secure and happy family life.

BH: Hmm.

JG: Which might be not the case for the other people in the school. So I was lucky. I had a better foundation.

BH: Yeah.

JG: To work from.

BH: Yeah.

JG: But that was my experience. Quite frustrating because imagine how much I could have learnt at school if school was able to teach me. So then that again goes to fortunately I am quite an independent learner, so I'm afraid I just had to do it myself.

BH: So what you'd go home with the text book and just like…

JG: Just read it. Yeah just read it. Just read the text book. And then read books for myself and learn stuff for myself. I mean… my aunt used to get me encyclopedias, which was quite nice. You know children encyclopedias not like Britannica. Like a one volume encyclopedia. I used to sit and read it. [laughs] Go through it entry by entry, I used to sit and read that. Now I did start to get encouraged by one of my teachers at secondary school, one of my maths teacher at secondary school.

BH: Who saw something in you or…?

JG: Who did recognize me as being the best one in the class… [sighs] oh I don't want to say that, it sounds awful. So I guess he did recognize and he said, you know I can imagine James becoming an academic at a university. And I went, ooh well that's one other person who thinks I can do that. 'Cause at the moment it was just a secret idea in the back of my head. No one else had said that before. Oh well that's two of us. And when we came to A levels, so what you choose next when you're seventeen, eighteen. I wasn't gonna do maths. 'Cause I thought, well maths is gonna get really really complicated, it's gonna be beyond me. It's gonna be solving crazy problems with really hard math that I can't do. I'm not gonna do that. And this maths teacher said you are doing maths. That was it. [laughs]

BH: Do you remember the teacher's name?

JG: Yeah Mr. Rosinger.

BH: Mr. Rosinger. He said, you're doing it whether you like it or not.

JG: Yes. I might be wrong 'cause, you know, I've got this second hand knowledge. I think he went to South Africa in the end and not a teacher anymore, something like that. So this is the teacher that at least backed me up

on… that I was… that this is something I could do.

BH: And that's all it took? It just took one teacher saying, you can do it. And you're, alright, then I'm applying, that's all it took?

JG: Yeah well, it was one teacher saying you're definitely maths and I went along with it.

BH: What was plan B? What did you think you were gonna do?

JG: So I did want to do media studies.

BH: Right.

JG: But when I was seventeen, media studies was a punchline. People treated it as a joke. Oh what are you gonna do? media studies. As a non-real subject. And you could see why I wanted to do media studies. [chuckles] So I went well I don't want to be a joke. So I was discouraged from that and I went well I'm gonna go the complete opposite. I'm gonna take the most academic thing to media studies. The complete reverse. Maths is the purest most academic of the subjects.

BH: Where did you go? What university did you go to from there then?

JG: University, I went to Lancaster University. Makes me feel awful saying how great I am all the time. I did well. I did well. So I could have picked any subject. I have the luxury of picking any subject I wanted to 'cause I was quite good.

BH: As in… English or Mathematics…

JG: Yes.

BH: Okay.

JG: Yeah.

BH: What score did you get, although I don't understand how A level scores work.

JG: A level scores? Well A to F isn't it. So it was As, yes.

BH: Right, you got all the As. What is it these days people try and get like 3 As or A stars and then something…

JG: So yeah they… since my time they introduced A stars and now it's new again because they've introduced numbers to it. It's not letter grades it's number grades.

BH: But you were getting all the As. So you have some choices. How come you ended up at Lancaster?

JG: So the choice of Lancaster was because… we recently moved. So I was a Nottingham person and then between GCSEs and A levels we moved to Lancaster. So I had already moved recently. I didn't wanna move again. That's part of it.

BH: Okay.

JG: Lancaster's really nice as well, so we had a lovely day when we went to see it and also maybe so okay I've got three As and maybe that's great that can take you to Cambridge and Oxford but then I did not have the confidence to go to Cambridge and Oxford. I would have drowned in Cambridge and Oxford. I wasn't ready for that.

BH: Okay.

JG: I didn't have the confidence for it I needed to be a big fish in a small pool. And that's what Lancaster did for me. And I'm very happy about that. That was what was right for me at the time. I did not have the confidence to go somewhere like Oxford and Cambridge. And Oxford and Cambridge is not everything.

BH: No. So the step up from high school level mathematics to university level mathematics as an undergraduate. Was that a big step? Or was that an easy transition?

JG: It's a step and it's a joy when it was joy. [laughs] So I feel, first of all the GCSE maths that just felt so wooly, I thought this is so trivial and so wooly, it was like how do you tesselate a plane? It's like children stuff. I thought well this is… I'm not interested in this. And then at A levels, A levels is very much learning algorithms and having an equation at the top and then getting an answer at the bottoms, so it's very procedural.

BH: So A levels is like the end of high school for people who don't know what A levels are. It's like what you do to get into university.

JG: Yeah so that's the end of school life. We've not got to like proof, yet. Now I went to university and I'm thinking… well you know, I'm taking maths because it's easy. I'm good at it. It's the lazy option. I'm a lazy person. However, thankfully, at university we started doing things like proof and I went, ah… good… now this I can get on board with. This I'm interested in. Because that's a creative process. You see now I don't wanna feel like I'm doing down the education system or teachers or anything like that, but at least my A levels felt very rote. Rote learning, I learnt the algorithms and I could do them. There was no creativity, so I thought is this maths? I mean this is simple, this is lazy, 'cause I just bang through these algorithms. There's no creative thought. What about my

creative output? And I do feel I've had a creative output because I did want to be making film and television and then yes great. University now here's what a proof is and it involves a creative idea.

BH: But it's other people's creative ideas.

JG: Yeah. The proofs you learn.

BH: Yeah.

JG: But then you have the questions and you are doing questions where you are proving for yourself. That's the coursework, the homework. So you're in the lectures, you're teaching the traditional proofs. The famous proofs. The traditional proofs. You're learning the methods of proof. These are the classic methods of how to prove a thing. And then, you know, in the coursework, the homework, you're getting questions where you're doing it for yourself. And also if it's good coursework, they're giving it a twist to see who's got some original thoughts, who can make some connections between two different things and put them together? You know that's a creative twist there. And then of course you get to the point where you're actually doing an original result for yourself. Which I guess is maybe when you're going into PhDs then, beyond university maths, but then I do an original result that has never done before for myself… that I solved. Proved to be true and it's true forever.

BH: Do you remember a point at university where you thought, yes this was the right decision, like thank goodness I did mathematics?

JG: Yeah, yeah, and I think that's it. It's the point where, you know, we're gonna do proofs and now here's your homework and it's proofs. And I sort of relaxed. I could even think it about and now physically go… ah yeah this is far more interesting, I know I can do this.

BH: Was this a surprise though? Like did you know this was coming or did you sign on for mathematics…

JG: No. I think it was a surprise. I did think it was rote.

BH: Then why'd you sign up for it? Just 'cause Mr. Rosinger told you too?

JG: [laughs] Yeah. Laziness. Total laziness. And that's not a good answer. I admit. That's not a good answer. It's the true answer. However I am very thankful that at university I discovered there was more to it. I would have been bored. If it was rote and I thought that was gonna happen I would have been bored.

BH: So as you moved through, how long was your undergraduate course? Three years?

JG: It was a four year one, I did an extra long one.

BH: And so as that was unfolding, what were you thoughts about your future and your future relationship with mathematics and career? Were you thinking, this is it, I'm here for life now or…?

JG: Yeah I guess that's where I started to think, 'cause that was that secret idea wasn't there, in that back of my head. That was… I know it's kind of contradictory that I'm thinking, I seem to be bored by it 'cause it's all rote but also I know that mathematicians being a thing. I think I maybe I like the kudos of it as well. So that's in the back of my head. Oh okay that's interesting.

BH: But were you thinking of, you know, if I do this right I could go and work in the city of London and be a millionaire or were you thinking I want to be a math teacher or were you thinking I want to prove the Riemann hypothesis?

JG: It was academic. It was only academic, yeah. And then at university I saw that I was actually quite good at the actual proper maths. If I may call it that the proper maths. It's a hurdle. Each time I was passing a hurdle. 'Cause I didn't tell anyone I wanted to do this, can I pass my GCSEs, that was my first hurdle. Oh yes I can. Next can I do the next level. Oh yes I have passed that level. So each step was just can I pass this hurdle.

[gentle violin music]

BH: At university what were you like as like a person? What were you into? Were you in a rock band, did you play cricket, were you in the chess club? What were you like socially, how were you developing like as a person?

JG: Well I'm rather social active, I suppose I had my probably unsurprising nerdy interests, my big interest was the juggling club. I'm a very good juggler, I'll have you know.

BH: Yeah?

JG: But I was the president of the juggling club.

BH: President of the juggling… Mr. President.

JG: Mr. President [laughs] of the juggling club. Which is something I did a couple of times.

BH: Two term president?

JG: Well I did it at Lancaster and then I did at York which was my next university.

BH: We'll get there. Juggling club, pretty social guy then?

JG: And well part of that job is to be the social guy. To welcome people in, and it turned out this is something I could do. I discovered turns out I'm quite personable and, you know, can welcome people in. Newcomers to the club and then I'll teach them the first few tricks and you know so I'll, you know, sort of teaching people…

BH: It's like here we store the balls, here are the clubs [chuckles]

JG: Yeah. That's exactly what it is! I mean, you know, do you wanna learn how to ride a unicycle? Lemme show you how the first few lessons of riding a unicycle. You will fall off, that's normal. And so, you know, we did all that.

BH: Who joins the juggling club? What sort of… don't get me wrong I'm not disparaging you, you know I love juggling too. I'm not as good like you but I do enjoy juggling, but like… what kind of person is attracted to the juggling club? 'Cause I know there's a lot of mathematics of juggling.

JG: You're right, you're right. The people who tended to be attracted to the juggling club fell in two camps which were the nerdy sciency camp, computer scientists, physics, maths nerds and your hippies. Your alternative counter culture hippy types.

BH: And do those two groups get along well?

JG: Yeah. Of course!

BH: Right.

JG: Yeah, and isn't that wonderful? Isn't that nice that those two groups who look different on the outside, 'cause I can say that the nerdy kind of people maybe would be conservative with a small c, if you know what I mean, maybe,

you know, pair of jeans and t-shirt, very conservative.

BH: Yeah.

JG: And you know more grungy alternative people, so from the outside they would look like different people. Different worlds. We're brought together by the love of juggling.

BH: There you go.

JG: Just brings people together.

BH: How many people in the Lancaster juggling club at peak? Is it like four or four hundred?

JG: Fifty or so.

BH: Okay. Are you elected as president or are you like…?

JG: Yeah.

BH: Right.

JG: No, it's not something that I seek.

BH: You were called to public service for juggling?

JG: Well, yeah!

BH: [laughs]

JG: Because like I'm not the kind of person who would put myself forward. I

hope… I've kind of been saying it in this podcast [sighs] I'm someone who thinks I'm great.

BH: No, no, no. You're very self-deprecating person. But someone has to be president.

JG: But it turned out I was the most sensible choice as being someone who knew everyone because I'm quite friendly and personable and would meet people anyway. So I was doing that and also sensible enough to actually run a society because jugglers are not necessarily sensible people. Wacky, crazy, people, not really people who can organize a group to do a thing when it needs to be done.

BH: Did you have campaign slogan like make Juggling Great Again?

JG: [laughs] No campaign slogan. I just seemed to be the sensible choice. Do you know weirdly though, and it is weird, but that was actually a significant thing to me because it meant for the first time, 'cause I'm not someone who seeks being put forward, for the first time I was put in charge of a thing, people listened to what I said. So I said, I think we should do this, and people went, yeah okay! I'm like… oh… oh! I've never had people listen to what I've said before. So that was actually… a big deal to me. Putting myself forward in that way showed that it was something I could do. It turned out I could rise to the occasion so I could take that leadership role. I know it's just the juggling club but it was the first time I ever tried to lead a thing. We would do shows. 'Cause that's what a juggling club might do. And so I'm the president, I'm in charge, so I would have to be the compere, you know I'm in charge of the show. Turned out I could do it.

BH: Was this also do you think a bit of an outlet for that media TV wannabe inside you?

JG: Well when I wanted to be media TV, I never wanted to be the presenter. So I always wanted to be the person behind the scenes. Never wanted to be the presented, so this is the first time where I said, oh… I can actually step in front. It's like the drummer who becomes the lead singer, and I can actually do it.

BH: What did you like about it? Did you like hearing people laugh or getting a clap or just like…?

JG: I was amazed that I could do it, perhaps a joke or something and then produce a reaction from another person. Like those two things are connected and I did that? That was new to me because I was very much wanted to be in the shadows.

BH: So coming to the end of the your Lancaster, your undergraduate, degree, were you high in the class again? You were getting quite strong marks?

JG: Yeah. I was again a big fish in a small pool.

BH: So what happens then? What's the next step? Is this a point where you start seeing strengths and specializations or does not happen at undergraduate level?

JG: No, you're right. You're right. So maybe third year is when you start specializing. Which means I started to specialize… you get to choose the courses. 'Cause the first two years your just do the courses you're told to do, so that you get a broad overview of everything. And then yes you start to specialize, you get to pick your courses. So I was leaning towards the pure maths. It was actually the algebra. It's called algebra but it's not like school algebra.

BH: It's not what is solve for X?

JG: Yeah, yeah. It's not solving equations. I call it chunky maths. You're taking

a step back from the math and you're seeing the mathematical object as one thing. You're seeing the whole thing. You're seeing the edges of it, you're seeing the whole object. And then you take another chunky bit of maths, you see another mathematical object and you put 'em together like Lego and you're creating another thing. So that it's taking a step back whereas something like analysis is very much about the details. So you're zooming into the fine details, the patterns that are in the fine details. Whereas I prefer to take a step back.

BH: So coming to the end of your undergraduate then, you're started getting a specialization. You're getting good marks, you're obviously still like , you know, very good at it. What are your options at this point? Are your options to… go into the workforce yet? Or…?

JG: Yeah, yeah. Go into the workforce. I went for an internship at GCHQ.

BH: Ooh.

JG: So that's the Government Communication Headquarters.

BH: Spies.

JG: Yeah, that's the spies. Yeah the codebreakers. So it was an internship, I mean I was there with several people. But people you would put forward as one of the best in your university and then we all went and… you got given a test.

BH: What are you in like some secret bunker for it or…?

JG: Yeah, we were at GCHQ which is now actually changed the building that I went to is not the building that's GCHQ now.

BH: Oh, the big posh round one?

JG: The big white donut building. It wasn't that building.

BH: Right.

JG: So it was whatever building it was before that. And well I can tell you the story, I mean I was sat there waiting for this interview. There's a sign on the wall that says, Status Black Eagle, I'm thinking, even the signs on the wall are in code, what does that mean?

BH: Yeah.

JG: Either I'm safe or about to get bombed, it's one of the two. Not sure which.

BH: Status black eagle…

JG: Yeah. Then were we sent, oh you have to go to this building and then we as a group got lost so were wandering around GCHQ, the buildings of GCHQ completely lost, you'd say is this the first challenge? To find the building? Anyway so we… and then we had to take a test. And it was maths and computer science. Now I'm not into computer science, so I'm afraid there's nothing I could do on that part of the test. And you know I had a crack at the math and there was stuff that I hadn't seen before, which was quite difficult under test conditions, you know, things you've never seen before unconnected to what you might have done as an undergraduate really testing your… mathematical abilities and your creative abilities. I'm afraid I didn't get that internship.

BH: Did you know how you did on the test? Did you think, oh I've bombed here or…?

JG: I didn't know but obviously there was a whole section I couldn't do 'cause it was about computer science and so maybe that was important to them.

BH: Did they interview you as well? Was there a personal…

JG: No there wasn't. It wasn't an interview like that.

BH: Did you ever find out what Status Black Eagle, meant?

JG: We weren't bombed. So I assume everything was fine.

BH: [laughs]

JG: But that was my first taste of failure, actually.

BH: Did you feel like a failure, did you?

JG: Yeah that was the first test that I had ever failed. I have a work ethic, I'm not a genius but I have a work ethic. Quietly I was bashing through these hurdles that I had to bash through and I always did and then that was my first test I've ever failed.

BH: How did that affect you? Did it, you know, make you stronger or did it crush you for a while?

JG: That was a new experience to me, yeah. And again I never… I've never thought I am the big I am. But that was a new experience. So I did have a… crisis of confidence yeah. I went, oh… maybe I'm not the best.

BH: So this is towards the end of your degree?

JG: Yeah.

BH: You're not gonna be a spy or a codebreaker by the looks of it. What do you do now? What's next?

JG: This was going to be something that would have been in-between university and then PhDs. That's what it would have been.

BH: So you decided you were gonna do a PhD?

JG: So I was already on the road to PhD anyway. So I did my PhD at York University. Lancaster and York traditionally have a rivalry but [scoffs] who cares about that? What a load of all nonsense. [laughs] So I went to York University, yeah started my PhD. Where the other PhD students are all the best at their university. So suddenly you discover, oh I'm now amongst other people who are also the best at their university. I'm not so special after all.

BH: What was your PhD in?

JG: We can start with group theory, which is maths of symmetry. Symmetry of shapes but in maths symmetry means there's something that you care about that you want to stay the same. So it might be shape, volume, angle, magnitude, something that you care about, you want to stay the same and then you want to mess around with it in other ways but you want that particular property to stay the same. That's symmetry. So for a shape you can rotate a shape, keep the same shape it doesn't bend or anything, but you can rotate it. So that's symmetry in math. So that's group theory. And then representation theory which is what I was doing is a bridge from this abstract maths of weird symbols and wibbly wobbly maths to a more concrete world of matrices. Which is what you would use in computer science, and what engineers would use. So a matrix would be an array of numbers and that's very well understand. Well studied, concrete thing. But there's a connection between those two worlds. Between this weird abstract world and this very concrete world. Now how do you make that bridge? So well there are ways to make that bridge that involve more maths and formulas and wibbly wobbly stuff and I prefer to do it with pictures which is more combinatorial. Combinatorial representation theory, by using pictures, which by

using pictures makes the maths easier to understand. Right so you don't have to get lost in the Greek letters. So using pictures you can make that bridge between those two worlds. But it's a very pure maths thing to do.

BH: Who was your PhD supervisor, 'cause I know that's a big deal in mathematics. You know this sort of who's your supervisor and your supervisor's supervisor and the family trees and…

JG: Yeah the genealogy of it.

BH: Yeah.

JG: My supervisor was Maxim Nazarov, a Russian mathematician. So my genealogy is a whole bunch of Russian mathematicians.

BH: What was it like being surrounded by all these other math geniuses? Like you said, for the first time you weren't necessarily the smartest guy in the room? Was that good for you or bad for you?

JG: It made me realize that I had to use my other strengths as well. And I do have other strengths. Not just being good at maths. So, you know, being quite personable and I'd like to think I can teach things and… you know, explain things and so I started to think, okay I do want to go into maths but also I have skills that perhaps some of these other people don't have. So it's hard to compare yourself, especially if there are people who are doing really really well. But you have to remind yourself that you have other skills.

BH: What was the title of your PhD thesis? Do you remember?

JG: I almost can't remember. I think I can remember. So it was the Hook Fusion Procedure and Generalizations.

BH: Are you proud of it, is it a good one?

JG: Well the best work in it I actually did in my first year of my PhD, so I was started off thinking hey, I'm doing really well, 'cause I've already well some good results and that's going into the final product. Bang, done. I must be really good at PhDing. And then the next two or three years [chuckles] was more of a slog. It was harder. So yeah, I mean you know it's amazing to have your… own results and you proved a thing but also there's work in there that, you know, I nearly completed a bit… there was like a step that I just this close to it and then I didn't complete that step so the work is in there but it kinda feels like incomplete work, so I got this far so this is only a conjecture because this is the sticking point that I couldn't prove. If anyone proves that step, then that's now a theorem. So there's bits of it that look like that.

[gentle piano music]

BH: So you were telling me about the young James in Nottingham, understanding that being a mathematician was a thing. It was possible. Now you're doing a PhD, you're spending all your time with high level mathematicians, doing high level mathematics. How was the reality of mathematics and mathematicians different from what the little boy imagined?

JG: [laughs] It's hard work. PhD is hard work. It's very frustrating. You talk to PhDs students, they have this kind of gray pallor to them. They start off all enthusiastic and then the second year they realize, oh actually I better crack down this because I better have something to finish with it. And then by the time at the third year they've learned that if you die during the course of a PhD you automatically get your doctorate and they start to consider as an actual option.

BH: [chuckles] Is that… I didn't even know that was a…

JG: No. [laughs]

BH: [laughs]

JG: I mean, that's one of the maybe the myths that I've heard about PhDs that I was hanging on to.

BH: [laughs]

JG: [laughs] 'Cause it doesn't sound like something that is true but I thought I hope that's true 'cause that could be my only option at this point.

BH: It does sound unfair to say to a young person basically lock in yourself in a room for three years and have an important original idea that hundreds of thousands of geniuses before you haven't had.

JG: Yeah that does sound hard, doesn't it? So I think there are things that maybe I should have known. I shouldn't have been as hard on myself, as I was then. So, I was very much obsessed, so you'd be waking up in the middle of the night and you're always thinking about the problem and that's the strain. To be always thinking about your mathematical problem and more of a strain than it might be for other subjects. So if you were doing some other… an experimental science or something, at least you have days off where you're doing your experiments, you're planning your experiments, and then you do your experiments. In maths it's all brain work all the time. And I was very hard on myself when you have a day when you achieve nothing and [groans] oh I'm terrible, I'm rubbish. That's really hard. What's maybe I should have been told is that's an unreasonable expectation. To be, all maths all the time. Especially in a subject like maths. I should be two hours in the morning. Two hours in the afternoon, right and, you know, have it treated as a job, and then, you know, have a chill out time.

BH: Were you still doing juggling and watching TV shows?

JG: Oh yeah, I was very social, yeah, so my undergraduate I was much better with a much better work ethic which was, you know, I would work and then I would finish at six… and then… that's the end of working. At six and then I'll do my social things. And then at the weekends I would write up my notes for the week and then they would become revision notes for the future. It was a very good work ethic. My PhD I was more of a student in my PhD than I was in my undergraduate. There was less structure to my day. So, I'm… I'm afraid I kind of lost the structure. I would normally impose on myself, I'm not that kind of person typically, the lines between work and not work, became blurred.

BH: You did finish your PhD though, you became Dr. Grime.

JG: Yes.

BH: Now whaddya do?

JG: [laughs] Yeah! Good question. What I did is I did do… a postdoc. So I went into academia. I did academic work.

BH: Where'd you do that?

JG: That was at York, to start with. I did do a little thing in Denmark as well. But it wasn't even a year, it was less than a year. But I did something at Aarhus in Denmark then came back and did something in York, but then I was thinking I want to earn my stripes. I want to do a few years of this kind of academic work but the stuff we're doing now was where I was heading. I was thinking, this is where I'm heading.

BH: As in like outreach and communication?

JG: Yeah. Yeah, I thought I was gonna get a few more stripes. A few more

years and then absolutely just start doing more of this outreachy stuff.

BH: [in background] Yeah.

JG: And that was because… because I was thinking do I want to spend the next forty years of my life becoming an expert in one really small part of maths and the answer was no. I didn't. That did not interest me. I… quite like having a very broad… knowledge. I mean, yeah, I guess you can see that from the things I was talking about as a kid, you know, facts gimme facts! I wasn't particularly the maths guy.

BH: You'd like to be a Jim of all trades and a master of none?

JG: Yes. [laughs] And I'm afraid that's the case. So yeah, very interested in lots of things and maths is a very broad subject too, so even if you're talking about maths, maths is a broad subject. And I was pretty much good at all of it. But going deep just in one part of it [groans] that didn't appeal to me. So something like what I do now though is what I was heading towards anyway. Where I get to learn lots of things at a certain depth. It's not shallow. But I'm not the world expert at anything in particular.

BH: But sometimes you know, when you and I are talking or making videos you'll tell me about this extraordinary proof or a breakthrough or something amazing that a mathematician did and I can tell from your enthusiasm that you're impressed by what they did and the impact they had and what a wonderful contribution they've made to mathematics. Don't you ever wish you were that man or woman who'd done that, rather than just being the person telling the story?

JG: The cheerleader.

BH: Yeah.

JG: Which is how I feel. I feel like more of a cheerleader. I mean, I guess I would but that involves giving up what I've created for myself now. I'm very happy with what I've created for myself now. So… would I do anything different? No, no. I'm where I wanted to be. That is fine. I am where I was heading.

BH: So how did you get from being a postdoc at a couple of different institutions to an outreach dude? What happened next?

JG: Always this idea in the back of my head, you know, being a mathematician but also I mean I was inspired by, if anyone, by these presenters on children's TV, and I was at a school where I was a clever kid in a rough school and I wanted to pay that forwards. So that was always the ambition… to pay that forwards. To do something like… what those presenters did for me.

BH: At that point though I'm assuming, you know, there's probably not… Youtube's not a big thing or anything like that.

JG: No.

BH: How are you thinking you'll do it? You'll apply to the BBC to present their next TV show or something?

JG: Yeah! Exactly, 'cause you know what I was thinking was earn my stripes that I have some qualifications to show off.

BH: Credibility.

JG: Credibility. And maybe then in the future I could do a BBC documentary and that's exactly what I always wanted to do. That was exactly the idea. And then Youtube was invented, in what 2005? I went… here's an opportunity for me

to practice. I mean I didn't know this is the new media. I mean now you and me know.

BH: [chuckles]

JG: This is the new media, right?

BH: Yeah.

JG: But this was an opportunity for me to practice doing that and that's what I did. So I started a Youtube channel and I started to practice how to present mathematical stuff.

BH: What were you doing, just putting like a camera on a tripod and standing in front of it and…?

JG: Yeah, which is still what I do now.

BH: [laughs]

JG: Yeah that's my Singing Banana channel which is where I started.

BH: This is your personal Youtube channel, still to this day where you upload videos and talk about mathematics.

JG: Yes. Exactly.

BH: Why is it called Singing Banana?

JG: [laughs] Why is it… why not? It's perfectly sensible.

BH: That's an unacceptable answer.

JG: [laughs] So Singing Banana was my internet name just generally anyway. So as a teenager or someone in their early twenties, and in the early days of the internet, you would have an internet name. Wouldn't you? You would have a handle, anonymous internet name. And Singing Banana was my internet name. It came from my school's tuck shop. My school's sweetshop.

BH: Right?

JG: Was called the Singing Banana. Which in turn came from an advert for yoghurt that was on TV at the time.

BH: Okay so there was an ad for yoghurt that had a singing banana, they named the tuck shop at your school Singing Banana and then when you were sitting at a computer and had to come up with a handle that's just what you pulled out of the air?

JG: On the internet when you sign up for new things that's just the thing… my anonymous name on the internet.

BH: Isn't that funny that you're school, which you don't speak about with lots and lots of affection…

JG: Mhm.

BH: Still has a big pretty big impact on your…

JG: [laughs] Oh great! Yeah well, you know, it's a funny name isn't it? It's a funny name.

BH: So you start the Singing Banana Youtube channel, you're making videos but that's obviously making you… a whole lot of money or anything, obviously?

JG: It's making me zero money. I've made zero money from my Singing Banana channel.

BH: So what are you doing career wise or work wise while you're making these videos?

JG: So that's still when I'm doing postdocs, I'm still in academia there.

BH: Yeah?

JG: So I'm in academia and I'm thinking I wanna do this communication stuff. I tell you what actually happened then. [laughs] Just when I finished my PhD, so this would be 2006, the Royal Institution advertised a job. Now the Royal Institution of Great Britain, they have this program called the Christmas Lectures for people who are not from the UK, which are lectures for children on Christmas Week about science.

BH: Very famous, very like iconic. An institution in the UK.

JG: A big deal. I mean now that's part of the influence on me as well. 'Cause this is old. This is a scientist talking about science for kids.

BH: And they'd film them and they'd be on the TV and…

JG: Yeah.

BH: Like they either blow thing chemicals up or show you amazing things and…

JG: Yeah, and it's a great thing. Something I do think is great and something that influenced me. So anyway this was the year for maths. They were gonna do

a maths one.

BH: Yeah.

JG: This year. With Marcus du Sautoy and so they needed someone to be the assistant. Help work on the scripts, liaise with Channel 5 it was then, it's gone back to the BBC now, but it was Channel 5 for a period. And liaise with Royal Institution. And I thought, this is a job for me. These are my skills, 'cause I'm interested in media, I'm interested in maths, I'm interested in communicating maths, this kind of presenting for kids is exactly the stuff on need. This would be a great experience for me. So I had an interview with that with Marcus and the Royal Institution people.

BH: Tell me you walked in and it said like Operation Black Eagle on the… [laughs]

JG: [laughs] Yeah. Exactly.

BH: You knew that was a bad sign.

JG: And then, well we're out here, we had a great interview. Me and Marcus, we're getting on like a house on fire. And because I was the last in the day, because I traveled the furthest so they put me last, because I was last I had all the time I needed. So I was just going and then we could do this and then we could do this and then we could do this and I didn't get that job. I've talked to Marcus since about this. [laughs]

BH: [laughs] Yeah?

JG: [laughs] I did not get that job. And I thought that interview went so well and I was so energized for the first time 'cause you know PhD's hard work and then I was so energized by this idea. I went, well clearly this is what I should be

doing because I haven't been this enthusiastic for a couple of years 'cause I've been kind of stressed out. Well, yes, I should be doing it. And then that's when I had this plan of having earned some stripes and then you know really do this. And when I started Youtube so that in future I couldn't be turned down. I thought maybe they'd turn me down because I didn't have enough media experience… I need to make a CV that can't be turned down next time this comes up. And that's what I did. So I started make Youtube, it was partly practice for me, it was partly so I have it on my CV, you can see who I am, you see what I do, I started doing outreach work for the university. I started, you know, trying to put myself as the friendly face of the university, tried to put myself in that position so I could have a CV that can't be turned down.

[gentle violin music]

JG: So then my postdoc was running as postdocs do, I'm afraid, so I had then had to go looking for another job. And then a friend of mine sent me a job advert and he said, that's you isn't it? [laughs] I went, yeah that is me. 'Cause it basically what I had been preparing myself for. It wasn't with the Royal Institution, it was with Cambridge.

BH: Yeah.

JG: And they needed someone to work publicly to talk. And I thought well this is ahead of schedule 'cause my schedule is to do a bit more academia and then do that, but… I'll go… actually I wanted to go for the practice of the interview. I thought I wasn't gonna get it. Because I didn't get the other one, the Royal Institution one.

BH: Right.

JG: This was again just practice for the interview so that I can do this right.

BH: And what was the job though? Just to be like an outreach person? To go…

JG: Yeah.

BH: …and give lectures and something?

JG: Yeah that's right.

BH: Go to schools and…?

JG: That's right, yeah. Public and maths communication, public stuff. But in particular they had an Enigma machine that was on loan to the maths department and so the job was who wants to show this Enigma machine off around the world?

BH: This is the machine the Germans were using to send codes and was later broken, so that was gonna be like a prop that you could go and travel around with and… do maths talks?

JG: Exactly.

BH: Okay.

JG: Exactly, yes.

BH: So you went to the interview thinking, well I'm not gonna get my hands on the Enigma, but… you did?

JG: [laughs] Yeah! Yeah.

BH: Did you walk out of that interview thinking you'd aced it?

JG: No!

BH: That's the secret, James. It's always the interviews you think you bombed that you end up getting. [laughs]

JG: [laughs] Yeah, yeah, yeah. Well, I thought because I didn't get that other one I thought, well, you know, I did this one perfectly fine. I thought I wouldn't get that one. I can't see any difference between how I performed in what this interview and that interview. And then like… 10 minutes later… 'cause I think again I was near the end of the day. 10 minutes later they phoned me up and offered me the job. I was still stood at the bus stop.

BH: [laughs] Brilliant, did you walk back and sign the papers? [laughs] That's… I've never heard of someone hearing that quick.

JG: I heard afterwards that they thought, 'cause I was the second to last interview, and then the person who was the last interview they went in…

BH: They called during that interview, halfway through it? [laughs]

JG: Wouldn't that be awful. He came out, this is terrible, he came out looking slightly gray, oh dear. But I was still there 'cause it was raining.

BH: Okay.

JG: It was chucking it down. They thought I was hanging around for an answer.

BH: Oh…

JG: Like I was some sort of weirdo hanging around for an answer. I wasn't hanging around for an answer, it was raining.

BH: They thought you were a weirdo but they still gave you the job. [laughs]

JG: Yeah! [laughs] He seems to be very keen to find out… tell him now! Well, I wasn't I was just waiting for it to stop raining. So I was waiting at the bus stop in the rain, that's when they phoned. So I didn't take it 'cause I was getting on the bus, you know, I got this job and that was a big deal to me.

BH: Yeah. Did you enjoy that? Did you were you like…

JG: It was my dream job. I mean I'm still doing it [laughs] I'm still doing it pretty much.

BH: Not for Cambridge anymore but like yeah?

JG: No, not for Cambridge but basically I'm still doing the same sort of thing. I travel the world, I give talks, of course I can do other things on the side like on Numberphile.

BH: Well let's explain that. 'Cause I guess a lot of people listening to this will just know you as the guy who's in lots of Numberphile videos. Explain to people this other job you have. Your day job, your actual job. [laughs] How you actually eat. [laughs]

JG: [laughs] Yeah pays the rent. So I travel the world, travel the UK mostly, and travel the world, giving talks often about Enigma and I still have the Enigma machine on loan to me. So instead of being loaned to the university, it's on loan to me now.

BH: Yeah.

JG: And I give talks about how the code was broken and Alan Turing and it's

about motivating. It's about inspiring people.

BH: Who do you give these talks to?

JG: So often I'm talking teenagers or kids. I go all levels and I enjoy going through all levels. This is part of the reason why I enjoy the job so much. I talk to small kids… ten year olds, nine year olds, that kind of age. And then I'll talk to teenagers and then the higher end of that, the eighteen year olds. Universities, I'll talk at universities. I'll talk to mathematicians. I will talk to the general public. So pretty much any level.

BH: So what happens do people like go to a website, do they? And book you and like and you come out and…?

JG: Yeah. That's it. I was very lucky 'cause I inherited something from Cambridge, so that was all kind of set-up for me. 'Cause I'm inheriting something. And then when I inherited it I said, oh I could really make this mine. I think more-so than my predecessors who kind of came into the job and out of the job. No, this is a job I can make mine.

BH: Hmm.

JG: Because this is right in my wheelhouse. I already had that, I didn't like have to chase it and so word of mouth is how most of my bookings happen. I'm not very good at self-promotion. And now we're on a podcast, self promoting it.

BH: No I'll promote it for you. There'll be a link to James' website in the notes to this podcast and if you know someone who wants to have a great talk about mathematics and the Enigma machine, go ahead and click on that. Presumably you have to carry this [laughs] great big heavy machine…

JG: Yeah.

BH: …all around the world?

JG: Yeah, I do.

BH: What happens when you go through like customs at countries and you've got this Nazi code machine?

JG: I tell them it's a typewriter. So it looks like a typewriter and telling them it's a code machine just sounds dodgy.

BH: Yeah?

JG: So I tell them it's an old-fashioned typewriter.

BH: Has anyone ever said, no it's not! That's an Enigma machine!

JG: So what happened, sometime last year and I even forget where it was. At some airport and I was doing this. Now normally that just goes through. They go old typewriter? Old fashioned typewriter, that's a weird thing to be carrying, but okay. Now they're too busy to really investigate that any further. Now there's nothing illegal about what I'm taking through, so there's nothing wrong with this. Then they send it through the scanner, right? It looks like an old typewriter, but yeah there was an occasion like last year where like the guy went, oh! Oh an old fashioned typewriter? Well, okay, we'll send it through and then he shouted to the person at the other end, at the other end of the scanner, we got an old typewriter coming through! It looks like an Enigma machine but it isn't! [sighs] [groans] Oh don't shout that out.

BH: What did you say? Did you say, it is! [laughs]

JG: No, actually. [groans] It's just that a whole airport can hear this.

BH: It's not like someone's gonna steal it?

JG: Well… I wouldn't want to give people the opportunity. Yeah it looks like luggage. Just looks like luggage but maybe I'm giving away secrets.

BH: Okay. We've said enough. We should point out though it does work, it's not like just a relic, you look at.

JG: We brought it on to Numberphile. I should mention it belongs to Simon Singh. So it's his personal Enigma machine that he lends to me.

BH: You've had it for a long time now, does he ever… does Simon ever ring you up and say can I see my machine? [laughs]

JG: Occasionally but actually hardly ever. I have been looking after it for a long time. I have been very careful not to say my Enigma machine, to remind myself. 'Cause I've been looking after it for so long I have to remind myself it's not my Enigma machine.

BH: [laughs] It's Simon's but he's been very generous with it.

JG: Yeah. Because he wants it to be shown off and used for education reasons. We are in agreement on that, so we, you know, I do it on his behalf.

BH: Do you ever get sick of giving the same talks and telling the same stories though?

JG: So, what's different for me… what I'm doing, it's yes my talk is… let's the say the same or you know same-ish or on the same topic, you know, relatively the same. But what I've got everyday is I'm talking to a different audience, different age groups in a different town, sometimes in a different country.

Different ability levels. I'm working really hard. The only thing that's actually constant for me is the actual talk. And now I'm sure every job involves some sort of repetition. Every job involves going to a place and doing the same sort of things everyday. I don't feel too bad about that, the only thing that is constant for me is I'm talking about a particular topic. I do talk about other things, I should say I do talk about other things. And Numberphile's very nice for me 'cause I get to talk about other things via Numberphile, right? So I don't get too bored, but… all those other factors means that I'm actually working very hard. I'm looking at my audience, I'm trying to keep them on board, I'm trying to judge their level. Trying to judge if they're gonna go with me if I go this far. Under the surface I'm paddling.

BH: We're getting close to Numberphile again, clearly at this point, a lot of people probably wanna know how you became involved in the project as a founding father. [laughs]

JG: Mhm. Buckles on my hat.

BH: Yeah.

JG: Buckles on my shoes.

BH: I will be curious to hear how you tell the story because I work on a few Youtube channels and I've been sitting in the audience before with some of my other collaborators like on Periodic Videos I was once sitting in an audience where Professor Poliakoff told the story of how he and I started making the Periodic Videos project… and I couldn't believe the story he told. [laughs]

JG: [laughs]

BH: Afterwards I said, that is very different from my recollection and he has adapted his story since, so I would like to hear how you tell it.

JG: This is interesting ‘cause I was gonna ask you the exact same question.

BH: [laughs]

JG: I was very interested in how you tell this story as well. Whether it was different to my version of this. Who’s gonna go first?

BH: Well… it feels like you should, you’re the guest.

JG: Okay. I’ll go first.

BH: Alright.

JG: So my version. I was doing my Singing Banana videos. In my memory I was doing like one a week, looking back I was doing like five a year. And that’s not how I remembered it. I think I did go up to one a week at some point.

BH: Right.

JG: So I was doing these Singing Banana’s videos trying to present maths… and that was before Periodic Videos in my memory so Periodic Videos came along…

BH: This is the series of chemistry videos.

JG: Your chemistry channel.

BH: Yeah, yeah.

JG: And I said what a wonderful chemistry channel. What a lovely thing. Wouldn’t it be nice if there was something like that for maths. I was actually

trying to push that in Cambridge. I was trying to say to people in Cambridge, you see what that guy's doing with Periodic Videos? We should be doing that with maths.

BH: Why were you going to Cambridge and saying that? Weren't you just thinking, well I'm doing that? I'm doing it for mathematics.

JG: Because I thought we could do that with all those lecturers and the Cambridge University resources that we have.

BH: Yeah. You wanted the famous professors to be fronting it?

JG: I was still, oh I wasn't presenting. I was still the back… I was still organizing it. I was the back stage of this. Oh I still wasn't putting myself forwards. No, the idea was to do Periodic Videos with all these clever Cambridge people.

BH: Yeah.

JG: So, yeah, Cambridge shrugged.

BH: I'm glad you didn't get that off the ground. You would have scuppered Numberphile before it even started. [laughs]

JG: But then I tried… I said to Cambridge look it's easy! And then I was doing more Singing Banana videos.

BH: [whispers] It's not easy.

JG: [laughs] Look, look, look I can do it on my own! Here's me just doing it on my own.

BH: Yeah, yeah. Imagine what I could do if I had the power of you behind me?

JG: Imagine if you gave me a filmmaker and worked with me, yeah. So I was doing more Singing Banana trying to prove to them that this was a thing that could be done. And then I think there was a video you did on Periodic Videos about ice… something like that. And then I riffed off that. In the old days of Youtube, Youtube had reply videos which I miss as a feature. Do you remember reply videos?

BH: Yeah! I've forgotten about that.

JG: I miss that. That was a good feature that they took away.

BH: Hmm. Hmm.

JG: It was more of a social network then, it wasn't just broadcasting. It was a conversation. You would reply with a video and reply with a video. I miss that feature. And I replied to your ice video, saying well… and you know, snowflakes are always hexagons. They're always six pointed hexagons because ice molecules make whatever a hundred twenty degrees and then they must fit together to make hexagons. So you've might have noticed that, I don't know, and also the other thing is you had another channel called Bibledex.

BH: Yes.

JG: And I may have been the only fan of Bibledex.

BH: Oh!

JG: [laughs] Well I dunno…

BH: There were a few others. [laughs] That was a video about every book of the Bible. It was quite an academic channel as well. Professors talking about them and…

JG: But that wasn't the feeling I was getting to you. 'Cause I was sending you, maybe I was sending you tweets or something.

BH: Hmm.

JG: I was saying, love your Bibledex, because I'm not religious. I'm not necessarily, I don't know this stuff. See I've always wanted to learn, I was always interested. Your chemistry videos, your physic videos, I kinda know it 'cause I'm in the science world. That's not outrageously new to me. The Bible stuff, all new, don't know it, loved it, thanks for the videos, Brady. So I think maybe you notice, alright, and then I did say if you ever do a maths channel ask me and I might be able to help. I think that's what I said and I wasn't… maybe if I say this now you might not realize I wasn't putting myself forward as a presenter. I was putting myself forward as a helper… resource.

BH: Yeah. Producer.

JG: Yeah. And then you did contact me, didn't you? You got that Google money?

BH: Yeah. Yeah.

JG: 'Cause Google started to try and put out some channels of their own. There was a bit of… a sponsorship or something, whatever you call it?

BH: Yeah.

JG: A grant.

BH: Yeah.

JG: And then you did contact me.

BH: I mean, yeah, that's not… you're not far wrong there. That's a... I mean from my end I was making a few different Youtube channels. Periodic Videos, Bibledex, ones you mentioned, Sixty Symbols and a few others. Youtube approached me and had grants available to start new channels and they said to me if you're were gonna start a new education channel, what would you do? And I said to them, oh I've got two ideas, I'd wanna make an astronomy one, which became my Deep Sky Videos channel and I said I'd wanna have a mathematics one, my idea to do it was to do was Numberphile, make it about numbers, so it was less intimidating and not straight away math math math. And they agreed they were good ideas. But to my surprise they funded both. So I had a grant and now I was like, oh good I've got to make these videos. And that basically coincided with the time that you just happened to get in touch as a viewer and said, hey I like what you're doing, I'm interested, this is what I'm doing, if you ever want to work together. And like I probably get a lot of messages like that still to this day. And nine times out of ten I can't do anything about it. They just kind of drift past and I say thanks for the offer but I'm really busy. But you just came along at that perfect time when I needed someone who knew mathematics and knew communication and video and like I basically snatched you once… snatched you up while I could.

JG: I think I had the feeling you snatched me up, yeah.

BH: Yeah?

JG: I think we had that first conversation about it and I thought I had a few like maybe ideas which probably turned out to be the first few videos. I think the one that might have turned you was the amicable numbers. I'd told you about

amicable numbers, that first meeting.

BH: Yeah.

JG: Which is the… was it two, eight, four, and two, twenty.

BH: I remember. I remember like, 'cause those stories about just arbitrary numbers that have interesting properties like still give me chills. Still sometimes now if we're filming and you show me just some random fact about a number, I still get chills down my spine.

JG: [laughs]

BH: From that way more than all the others.

JG: Well it's a random fact about a number but there's a lovely twist to it so the two, twenty, two, eight, four is the factors of one number add us up to the other number. So the factors of two hundred and twenty add up to two hundred and eighty-four. Factors of two hundred and eighty-four add up to two hundred and twenty, they come as a pair and in ancient times they would represent love. So it's not just a fact about a number it's more than that.

BH: Something cultural as well?

JG: There's a human story to that. There's a twist to that.

[gentle piano music]

BH: So obviously, some Numberphile videos in fact lots of your Numberphile videos have become very very popular. They've been watched millions and millions of times. That's like great, 'cause that's [chuckles] always what we wanted to do. But I guess that doesn't come without problems and negative sides

as well. There's the notorious Youtube comments. There's the fear of getting things wrong on the internet. Which his a fear that lives with everyone who makes things on the internet. How have you found coming to grips with that? As you become better and better known, and more and more people are watching and also the internet becomes a more crazy place? Do you read comments?

JG: I read comments on Singing Banana. I used to read them on Numberphile in the early days and then when Numberphile became too popular.

BH: You're still very loved James, you must read them sometimes.

JG: I'm… I'm afraid I haven't read them. And also if I dismiss the nasty comments by the same token I have to dismiss the… generous comments.

BH: What about the stuff that's like mathematical though? People who wanna discuss with you…

JG: Hmm. I would love to but I can't wade through all those other comments to get there. In the Singing Banana, I do read all the comments on the Singing Banana and so it's very likely that I will engage with you [laughs] via the Singing Banana comments section. I wanna say, hey, I grew a thick skin, that's not true. Comments, nasty comments, get under my skin… it's not nice how could it be? I'm not super human, they're not nice at all. There are some comments you could dismiss in the early days of Youtube. Gay… First… Fake… right? You say, oh it's twelve year old. That's so easy to dismiss. Though and then there are comments that aren't, that just you know… comments that attack my presentational skills or my mathematical ability, are actually personal attacks. [laughs]

BH: Yeah.

JG: And that's not nice, is it?

BH: No.

JG: The only reason I'm here is because I'm supposed to have mathematical skills and presentational skills. So you've just attacked the exact thing I'm interested in providing. And that's not nice, so I'm afraid I can't claim to have a thick skin about that.

BH: What are some of the nice things about doing it, though? You keep doing it though so there must be some positives?

JG: Yeah. Because I'm on a mission. I didn't really fall into it, I didn't put myself forward for things. I think I've said that. But it's not like I fell into it by accident. When opportunities arouse I took the opportunities very quickly because I knew that this is what I wanted to do. You know, if there was something like Numberphile come along or my job at Cambridge came along or… you know when Youtube just… by existing had gave me an opportunity, yes I took those opportunity. So I am on a mission, I want… as someone who came as a clever kid from a rough school I want to find those little James Grimes. Who don't come from academic families. Who are in a rough area. Who have not been exposed to this academic world. 'Cause that's exactly what's my childhood was but through TV and children's presenters, those programs, I discovered that that was a thing you could do and it was an idea in my head. A seed was planted and that's what I'm trying to do. And I can do it and it's amazing that Youtube allows me to do that and it allows me to do that around the world. So I get emails from around the world. People saying, thank you for the videos which is lovely and meaningful. I reply to those emails as well, you know? My reply is thank you… this means a lot to me. And that might just sound like what you write in an email and those are very meaningful emails to me, so, I appreciate them.

BH: Do you feel like your reaching the right people? You know you said you wanna reach people who are disadvantaged and like…

JG: Hmm.

BH: Do you ever worry that you're preaching to the choir and the people watching are already the smart kids who are into math?

JG: No I don't feel that's what Numberphile is. Or Singing Banana. I don't feel that's what it is. It's 'cause I thinks and it all hangs on Youtube's favor but you stumble across Youtube videos, don't you? You go, oh what's this in my recommendations, hmm, click, now you're at home. You've no peer pressure, you're not being watched by your mates. They're not judging you, you can sit and click that and watch it with no pressure at all in your bedroom. I imagine I'm talking to someone that's maybe, you know, a teenager who's watching that video by themself outside of school. This is not something a teacher has made them watch. They found it for themself, they discovered it for themselves. So therefore they're already engaged in it, 'cause they kinda discovered it for themselves and from that you click on the other videos, that's made… that comes up in the recommendations, if you like it. If you like it. If you don't like it, fine, no pressure. I'm not trying to force anything on you, but it's so minimum pressure that, you know, you just discovered it. You try it. Try another one. Try the next one. I think we do reach those people who would not otherwise been exposed to that kind of academic idea.

BH: Do you meet people? You know, starting out at University who say that it had… it made a difference?

JG: Yes.

BH: Because I get… I meet that a lot. [laughs]

JG: Okay, then yes. [laughs] So, yeah, I do get emails, first of all. And they come in drips and they're charming all of them. Now, 'cause we've been doing it for 7 years, haven't we? Now I get people at a university talk or something like

that who will come to me at the end of a university talk and say actually I chose to do maths at university because of your videos on Numberphile. And I feel like, oh geez, I can't take the responsibility for your life choices [chuckles], don't put that one me. But I mean wonderful that was the intention, so that, thank you very much.

BH: Do you ever get recognized just walking down the street, or at a restaurant?

JG: Yes.

BH: You sort of say that you're quite personable and outgoing and you are very charming and nice, but you also seem that guy who likes your own space and...?

JG: Yeah.

BH: When you're not performing you seem more withdrawn? I find it hard to imagine how you'd react to strangers coming up to you and saying oh, it's James Grime!

JG: So yeah this happens regularly, yeah it happens. And… [laughs] when it first started to happen I did not react very well to it. I did not go, why are you talking to me… I'm not famous, stop treating me like, you know, I'm famous. I'm just a guy on Youtube, anyone can do it. [laughs] Stop treating me that way. 'Cause I'm not, I'm just some dorky mathematician. I don't like being treated that way, thank you. And that's… not very… what's this word I'm trying to get to…?

BH: Gracious?

JG: Thank you. That's not very gracious way of taking what they're doing. And that's… absolutely true. So now of course I take that with better grace.

Which means, if that happens, they come up to me now I have to switch… into that… persona. That presentational persona. I try to be welcoming and ask them who they are and what videos they like to watch and we have that moment. They're looking for a moment with me. That's the frustrating thing, isn't it? I'm just going about my shopping or daily life and they see me and they want to have a moment with me and that's the difficult bit. Giving that person a moment which is… I don't always do very well… but at least I try and take that graciously. Yeah.

BH: Has it ever happened to you when you've been with your Dad?

JG: No.

BH: That's the moment I wanna see.

JG: It's just never happened with my Dad or my parents and I've told them that I get recognized. I've never told them about it because I think they need to see it for themselves, 'cause they'll just say… yeah, sure.

BH: Okay.

JG: I believe you, James.

BH: [laughs]

JG: You know, I'm sure you did.

BH: [laughs]

JG: I don't think they will appreciate the impact and how much the viewers love what we have created if they don't see it for themselves. They have no understanding really of what we do. [chuckles] So I'm afraid I'm… we'll have to

wait for that moment.

BH: When you give talks and things like that… and you obviously I imagine you have question time at the end of a lot of your talks, what question do you think people ask of you the most?

JG: Well I prefer to keep things on topic. I don't want questions about myself, I prefer not to have questions about myself.

BH: I'm sure you prefer but my question is what question [chuckles] are you asked the most?

JG: Well now I tend to maybe arrange things so that I do questions on topic. I rarely get questions about Numberphile or myself, right? But it's increasingly true that the audience are people who know me from Numberphile.

BH: Right.

JG: Which is actually a hinderance in some ways, because it's a lot easier to talk to an audience who has no idea who you are and then to introduce yourself to that audience and win them over, then to have some people in that audience know who you are and they go, this is James Grime from Numberphile.

BH: Or ask you a really niche alienating question about Parker Squares or something?

JG: Oh yeah, yeah. [chuckles]

BH: And nobody knows what it is, yeah.

JG: So, I'm afraid I don't have a good answer for this because I don't tend to get Numberphile or personal questions in my talks.

BH: Let me ask you one then.

JG: Yeah?

BH: What's your favorite Numberphile video you've made?

JG: Nice question.

BH: You must get asked that a lot?

JG: I have been asked that question. Where I've done events which are a bit more general.

BH: Yeah.

JG: When it's a bit more general where I'm actually there as a presenter as someone who does Numberphile. So yeah, and favorite Numberphile video, yes I have been asked that. My favorites are the ones where I get to do something a bit meaty. Actually some proper maths. A proper theorem and explain it and give you at least a good decent explanation of the proof within in that ten minute structure of a Numberphile video. So, I think, some successful videos like that… quaternions we did. I think that actually turned out quite nice. I explained what it was nicely in that ten minute kind of restriction. So quaternions, or the Four Color Theorem, you know that proper maths. And also where I tackled the proper proof.

BH: Cool.

JG: Is that okay? How do you feel about that?

BH: It's your… it's a personal decision.

JG: [laughs]

BH: Is there a topic or a video that you wanna do on Numberphile that you haven't done yet for some reason because you're too intimidated by it or you can't quite get it right? Have you got your white whale?

JG: Yeah, yeah. There's some that I, like, I'll have my list of ideas and they remain on my list of ideas and then there's some that… I like that where maybe they're too much for me to take. I need to have some time to really learn that thing and then it turns out someone does it before me and then they always do a much better job than I would've done and I watch them and I think oh that's wonderful. That's a wonderful video, I mean we did… Marcus du Sautoy did Gödel. The Gödel Incompleteness Theorem. That was on my list of ideas but also I want before I do that video I wanna know it properly. I want to understand it properly before I then regurgitate that for the Numberphile audience. Thankfully Marcus who knows this stuff already can do that for me, he took that pain for me. And then sometimes I have a good idea and it gets… I get scooped.

BH: You have to let me know James, I'll always give you first bite.

JG: I always think they do a much better job than I would have done. So I much prefer that they did it. Is there any that's still on that list that I need to get to…

BH: You don't have to give 'em away, no I don't want you to give them to other people to scoop you.

JG: [laughs] Well then maybe I'll have to keep it a secret.

BH: One last thing. What's the next thing for you? Like I hope you keep doing Numberphile videos. I'll keep begging you to do them and I'm so grateful that

you do. But like do you have like a next big step. Is there an endgame? Do you want to present that BBC documentary?

JG: Hmm.

BH: Do you wanna do something different in a new mode of communication? Do you wanna go back into mathematics more and actually maybe prove something? Create a theorem?

JG: And I've considered all those things. I have considered going back into academia. Yes, I have considered that. But I think I'm in… I'm doing what I do best. I'm using all my skills really it's my dream job. I'm where I want to be. And it's where I was going anyway. It's where I was always going. All these influences have all joined up and combined to what I do now. So how could I beat what I do now? What could I do next? I mean I… if I was offered… anything exciting I will take anything exciting and if I had the ability to do what I do now but perhaps maybe not travel around so much that would be less exhausting for me. I mean I must be honest. I would be looking out for something where I could do more my communication of maths, talk to the public and maybe stay still. That would be nice.

[gentle music fades in]

BH: To learn more about James. To watch his videos, all that sort of stuff, maybe even book him to speak at your school or organization or club, check out the links in the notes for this podcast. A good starting place is Jamesgrime.com. [music continues] Our thanks to James for joining us today and his ongoing dedication to Numberphile videos. For supporting this podcast I'd also like to thank the Mathematical Sciences Research Institute in Berkeley, California. And also in Berkeley, the audio engineering company Meyer Sound which when they heard we were starting a podcast threw their support behind us. We're really appreciative to them as well. We'll be back again soon with another episode but

from me, Brady Haran, it's bye for now.

[music fades out]