Numberphile Podcast Transcript
Episode: Delicious Problems - with Hannah Fry
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Math celebrity Hannah Fry tells us about her life as public intellectual and thought leader - plus her as-yet unreleased novel 'Free as a Bird', written as a schoolgirl.

Hannah's website - including links to her papers

Numberphile videos featuring Hannah Fry

Hannah Fry books on Amazon US

Hannah Fry books on Amazon UK

Curious Cases of Rutherford and Fry

Thanks to BBC 6 Music for the clip from Shaun Keaveny's show

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Hannah Fry [HF]: In America they call it a public intellectual, but I'm not using that because it's ridiculous.

Brady Haran [BH]: [chuckles]

HF: The other one they do in America is they invite you to conferences and they're like, we just really wanted you as thought leader. [laughs]

[gentle piano music fades in]

BH: A thought leader! We're reaching out to you as a thought leader. [laughs]

[music continues]

HF: What does that mean! [laughs]

[music continues]

BH: Hi I'm Brady Haran, today's guest on the Numberphile podcast is the public intellectual and thought leader Hannah Fry. [music continues] Hannah's a mathematician at University College London, or UCL, and we'll be talking about her work shortly but in recent years Hannah's also become something of a celebrity. She's written books, fronted BBC TV shows, she makes radio programs and podcasts and occasionally when time permits even pops up in the odd Numberphile video. [music continues] So as you can guess there's a lot I wanted to ask her about.

[music rises and fades out]

BH: Let's start close to the beginning. What were you like as a little girl? Like would I have known, ah she's gonna end up being, a mathematician?

HF: Hmm. Not early on, no, I don't think so. Not like as a kid. When I was about eleven I think that's when it sort of started to change really and I pinpoint it to one particular event which is [laughs] my Irish mother has a slightly skewed idea of what constitutes a fun summer holiday. So one summer she bought me a maths text book and insisted that I go through a single page in this text book every day before I was allowed to have any fun. [laughs] Which you can imagine my delight as an eleven year old.

BH: Like to give you education, like to be wholesome or thinking that little Hannah would find this fun?

HF: Uh… I'm not sure really. She's just like really really into education. She's always has been. So, you know, her and her family really didn't get very much education. My dad left school when he was really young and I think that she was really just… had this totally inbuilt idea that education is the way that you kind of get yourself anywhere. So she was just very very strict about education the whole way through. So it's just kind of continuing that idea. But I think what happened though with that sort of summer is that then when I went back to school afterwards, actually I must've been ten 'cause I was still in primary school, so I must've been ten. Then when we were doing stuff in maths class I just had seen it all before really. I knew what was coming and I just totally got it. And at that point then it just becomes much more of a playground, right? When you're ahead of the class it's just way more fun and I think that, yeah, that's when I started playing with it a lot more.

BH: So it's not like when you were doing those textbook exercises on holiday, you were enjoying that, but it gave you this skill later on that put you ahead of the curve which then allowed you to look at mathematics in a more fun way later, it's like set you up?

HF: Actually maybe I'm being a bit naive but I think everyone quite likes doing problems when they get them right, don't they? Everyone quite likes it when you get a puzzle correct. So it was only that first bit that's horrible and then when you're sort of in the exercises in the back of the textbook, the first couple are horrible 'cause you don't know what's happening but once you get it you're like, yeah, sailing. It's not like I was kind of getting up in the morning and self motivating myself to sit down and do some of this textbook. That I had someone standing over me… [laughs] so, yeah.

BH: 'Cause a lot of the mathematicians I speak to when they talk about their childhood like confess to being a nerd, they're like, yeah I was bit of nerd.

HF: [laughs]

BH: Were you a nerd?

HF: Yes! [laughs]

BH: You were?

HF: Yeah. Totally wholeheartedly a complete nerd. I mean though what else can you say? [laughs] I was…

BH: What…

HF: You picture a nerd.

BH: Yeah?

HF: And that was me.

BH: Like give me an example of something nerdy you would do besides being good at mathematics?

HF: [laughs] I took extra A level maths modules just because I wanted to.

BH: Right?

HF: That's quite nerdy.

BH: And was that because you were like wanting to be an alpha overachiever or because you just loved mathematics?

HF: Probably both. [laughs]

BH: Right.

HF: Like I just once wrote a book in the summer.

BH: What was it about?

HF: It [laughs] was so [laughs] so sh-t. [censor beep]

BH: [laughs]

HF: Am I allowed to swear on this podcast?

BH: I don't know.

HF: I just did.

BH: You just did, alright.

HF: [laughs] It was an awful…

BH: Yeah?

HF: [laughs] I can't believe I'm telling you this.

BH: What was it about? Like what was…?

HF: [laughs] It's was called… it was about a guy who has a car crash…

BH: Hmm.

HF: …and loses the ability to walk. And then learns to walk again after it

makes friends with a bird in the garden.

BH: How old were you at this point?

HF: Like maybe eleven or twelve?

BH: Okay. Was it the bird that made him able to walk?

HF: Yeah!

BH: Did it have magic powers or…?

HF: No! [laughs]

BH: It wasn't super…

HF: I think it was like encouraging him to walk, so it would like sit on his shoulder and then like kind of [laughs]…

BH: Alright. It could talk?

HF: No, no, but he was like it would be friendly to him. Try to get it to sort of sit on his hand and then the bird would just be slightly too far away so he's have to kind of reach for it.

BH: What was hero's name? Do you remember?

HF: No. I can't remember. [laughs]

BH: You really don't remember?

HF: No, I can't but my mum found this book when she was going through the

attic a little while ago and she wrapped it up and gave it to me for me thirtieth birthday. So I've got it at home.

BH: It still exists?!

HF: Yeah, yeah. And I even got a friend of mine [laughs] he was also like eleven, to illustrate it for me. So it's got like an illustrated cover and everything.

BH: I so want have to see this book.

HF: [laughs]

BH: What was it's name?

HF: It was called Free as a Bird.

BH: Oh!

HF: It's so sh-t. [censor beep]

BH: [laughs]

HF: [laughs] You know when you think you're like this real literary genius when you're like ten?

BH: No, I'm impressed by that. I'm impressed by that. So you were hundred percent like science and math then? You were showing bit of a humanities bent at this point?

HF: No, I think I was just a nerd, mate. [laughs]

BH: Alright.

HF: I think I was just a nerd.

BH: At what point did it become evident that you were actually gonna be like a professional mathematician, like, this was actually gonna end up being my job?

HF: Oh I don't think that happened until it actually happened, really.

BH: Right?

HF: I mean what I really wanted to do was work in Formula One, that was like my single minded ambition.

BH: This is motor racing.

HF: Motor racing, exactly, that was I really wanted to work at. 'Cause my dad used to race motorbikes professionally.

BH: Hmm.

HF: So like our family's just very into kind of racing and I just massively massively loved Formula One, I just wanted a way to work in it. And engineering just wasn't really on the table. I don't know… it just never occurred to me that that was a kind of career option. I went to all girls school and just no one ever spoke about it really. So, because I was good at maths I went and did maths at university. Although actually what I wanted to do when I was sixteen, although I was a massive nerd, what I really wanted to do was be a hairdresser.

BH: Right?

HF: And my mum was like, okay [clears throat] what we'll do, you just do your A levels and then we'll talk about this again. So I did maths, physics and

chemistry A levels. And then after I did my A levels I was like, you know I still would quite like to do a hairdressing course. And my mum was like, tell you what, just go off to university and do an undergraduate in maths or theoretical physics and then after that [laughs]…

BH: Then we'll talk about hairdressing. [laughs]

HF: [laughs] We'll talk about it. And then, yeah, by the time I'd finished my PhD I was like, probably not gonna be a hairdresser.

BH: Why do you think you wanted to be a hairdresser?

HF: It's just cool! Like, have you ever been and looked like watched what a hairdresser does? It's cool.

BH: They're just like… cut and do things to people's hair.

HF: Yeah, I know, but they do like magic stuff, they'll like make it all… [laughs]

BH: So it was the process, like you liked the idea of doing the processes that they do? The craft?

HF: Yeah, the craft of it and also but it was [laughs] I think, there's something quite nice about, you know, having a process that's quite short where you get to see the end result very quickly. It's kind of the reason why I liked doing Youtube videos because you have an idea, you execute the idea and then it's sort of out there, it's not like this really long thing that lasts for ages and ages before you know whether it's a good thing or a bad thing.

BH: Short turnaround time?

HF: Yeah!

BH: So when you started studying mathematics properly at university like did it take quickly? Was it like, yeah this is still holding my… well obviously it was 'cause it became your job but like you started to realize this was gonna be your job now? Like, you're all in?

HF: Yeah, so, I just… just always loved it. It's just so delicious and so… I mean I've always just played with it and massively massively enjoyed it. But I did actually make my dream, I did manage to get to Formula One. So after I finished my PhD, which was in aerodynamics, I was kind of incrementally getting closer and closer to working in Formula One.

BH: So this was still… this was a plan? Like you were aiming for Formula One?

HF: Yeah.

BH: You were like making choices that would get you closer?

HF: Yeah, I totally was. I was picking things I was enjoying doing at the same time.

BH: Hmm.

HF: But was kind of edging towards it. And then I eventually got… I just hated it 'cause there wasn't enough maths in it. [laughs]

BH: What did you do?

HF: So [laughs] I was doing… I worked for an aerodynamics consultancy firm.

BH: Right?

HF: So we were designing the wings on cars like Ferrari or like Lotus or like…

BH: Yeah.

HF: HRT as it was at the time.

BH: Yeah.

HF: I had imagined that what this would be would be a group of people sitting around a chalkboard coming up with loads of really clever ideas, writing equations, you know just thinking about the physics of it and thinking about the mathematics of it.

BH: Yeah?

HF: And it just wasn't like that at all, basically [chuckles].

BH: What was it like?

HF: All of these… the really nice stuff has already been wrapped up in computer simulations. So you were just setting up runs on your computer overnight and then coming in the morning and like picking the picture that just had the least amount of blue in it. It's like chucking darts basically. And if you chuck enough darts something's gonna hit. It was just… boring really.

BH: So you thought you'd becoming into work and say I've had a whole new idea for the way we should design the wing and we're gonna completely revolutionize it and we'd all go and… but it wasn't, it was just like, you were just like grunt work.

HF: Yeah exactly, exactly that, grunt work. So that I think was the point where I was like no, I'd rather be a professional mathematician thanks very much.

BH: Do you still like Formula One?

HF: Yeah I do, although I haven't really watched it that much this season just because…

BH: I've liked it this season.

HF: Have you?

BH: Yeah.

HF: I know, I just haven't been around really.

BH: Yeah?

HF: Just too much going on on Sundays.

BH: Okay.

HF: Worked too much basically.

BH: When you watch Formula One now do you look at it differently because of that time you spent working in the behind the scenes with the…?

HF: No, I think I still massively enjoy it.

BH: Yeah?

HF: In the same way, I think you realize just how superficial the information that you get from the broadcast version is. Just how much more… unbelievably delicious technical detail there is going on behind the scenes that you just don't have access to.

BH: Yeah.

HF: I mean ultimately the reason why I like Formula One is 'cause it's just gigantic maths competition, isn't it?

BH: Yeah. Yeah, it is.

HF: [laughs]

BH: But also a big like politics… competition.

HF: Yeah, completely.

BH: It's like a big political thing as well and a big like business financial thing, it's like…

HF: Yeah, totally with a bit of danger thrown in. Bit of jeopardy.

BH: Yeah! Yeah. Can I ask you a gender thing about university?

HF: Hmm.

BH: Were there lots of women, girls on your course, or was it very male dominated?

HF: I would say when I went it was about… hmm… maybe a third were girls.

BH: Oh okay.

HF: Maybe a bit less actually, between a quarter and a third for undergrad.

BH: So it wasn't crazy? It wasn't like you were the lone woman in the course? It was like…?

HF: No, no, not as an undergrad.

BH: Yeah.

HF: There were other girls around.

BH: Yeah.

HF: But then as you go up through the sort of stages, so Masters and then PhD and then postdoc, basically all the women sort of fall away.

BH: Yeah?

HF: So then when I was doing my PhD there were… I would say maybe forty PhD students and there was me and two other girls.

BH: Okay. When it becomes that much a minority does it affect… your enjoyment of it or your ability to do it or are you completely blind to it? Like what's it like when there's so few?

HF: So I personally never really minded that much. But I know that there was one girl who was doing a PhD… she was a couple years ahead of me and she dropped out and I had this conversation with her and she said that actually she just felt incredibly uncomfortable that she would walk into this PhD room, often when you're doing PhD you're not… you don't… you work at home a lot. You

just sort of have days where you're working at home but really you're just sleeping.

BH: [laughs] or watching Countdown. [laughs]

HF: [laughs] It happens quite a lot too.

BH: Yeah.

HF: So you know, if there was no other girls in the office she'd be the only girl in the office and she said that she just felt massively intimidated in that environment. She just felt completely uncomfortable in that environment and it just really put her off. And I think there are some people who do get really put off by it.

BH: Hmm.

HF: 'Cause ultimately, you know, people often ask the question of like why are there so few women in mathematics and like, you know, STEM subjects. And in a way, I mean I've got somethings to say about it, but in a way the people who you should really ask are the people who left.

BH: Yeah.

HF: And ask them why they left. The one thing that I will say about it though is that… and actually I think sometimes you can use this to your advantage, but especially when I was younger and especially when I hadn't done much outreach work, people would often assume that you have no idea what you're talking about. So you'd kind of go into a room, especially if you didn't know anyone, and people'd be having a bit of a maths chat, you're at a conference or something, and people would just assume that you're a complete idiot.

BH: Yeah.

HF: And that I just always really loved that when you could… [laughs] just say something and watch people's faces fall. [laughs]

BH: Yeah. I always wished I could speak other languages…

HF: [laughs]

BH: …so that moment when you're in the lift with two people speaking another language who think you don't know what's going and then you suddenly answer in their language. They're like, oh how embarrassing!

HF: [laughs]

BH: That's like the mathematical equivalent of that.

HF: It totally is.

BH: Yeah.

HF: I was teaching very young, at sort of twenty-two and I was teaching my first group of undergraduates and there was one year when… the first year where I wrote an exam for these undergraduate students and I went off to go to the exam to monitor the students during it and [laughs] they wouldn't let me in the hall because the invigilators were like, we're not allowing any students in. So I kind of argued my way in and they were like, do you have authority to read this exam?! And I was like, well I wrote it so… [laughs]

BH: [laughs]

HF: I'm gonna go with probably yes.

BH: [laughs] So, going back to leaving the wing factory, Formula One.

HF: Hmm?

BH: How did you get from that back into mathematics? What was the path?

HF: It was really straightforward [laughs] because my PhD supervisor, Fellow of the Royal Society actually guy called Professor Frank Smith who is just… there are few people on earth who I admire more than him. I mean I was only there really for a couple of months, right, before I was like I'm done with this. So he had not only sort of set me up with the Formula One stuff 'cause he knew that I want to just do it, but when he knew that I wasn't enjoying it he also set me up with a postdoc. So he's a fluid dynamicist, but he'd been dipping his toe in the water of looking at human behavior and sort of that overlap between social sciences and mathematics, which was a very new area and he had this postdoc that came up and was like, wanted to know if I wanted to do it, and I did and… yeah that's it really.

BH: So tell me about most of the work you've done. It does sound quite accessible for mathematics?

HF: Yeah! Completely.

BH: Your work. How would you explain it?

HF: I mean it's super super super applied, right? It's like the most applied maths that you can get. So the idea is that you can look at humans as though they're a mathematical system and there are some things that sort of make sense, right? If you think about a crowd of people, there are analogies there with the way that fluids move, right? Or if you think about, you know, sort of systems of revolutions and you know politics, the way it ebbs and flows, there are sort

chaotic moments in there, you know you can also think about the systems that work through history that kind of connect up with each other, the networks of people, the way that ideas spread, you know? Influence spreads through a population in a similar way to sort of epidemics do. There's lots of little things about people that if you take enough of a step back you can see them as mathematical objects really. So that's really the starting point. And it sounds like the different things that I've worked on, it sounds like they're really disconnected, so you know, I've worked with the police looking at burglaries, at riots, at terrorism, you know, I've worked with retailers looking at where people spend money in the sort of retail environment, looking at badger culls, right? [laughs] What other stuff? Lots of epidemic stuff, it sounds like those things are really different from one another but actually underneath them all they have this common theme which is that they're about patterns created by humans that move around in space and time and yeah, the sort of theoretical basis of that is actually just a really simple idea.

BH: What mathematical tools or processes do you use to effect this? Like what kind of mathematics do you use?

HF: So there's tons of statistics, obviously, because if you're starting with a dataset and you're analyzing it, the first thing that you want to do is to really get a grip with what kind of patterns are in there. But then from there I mean you have all kinds of tools, you know, in your toolkit that you wanna use so lots of network stuff. That happens quite a lot. But you can build models that are essentially differential equations and then use them to sort of isolate certain situations. Lots of information theory as well, lots of entropy maximization where you're trying to fill in the gaps in your knowledge. All kinds of different things. All kinds of different things.

BH: How do you find non-mathematical people respond to this idea of mathematically modeling human behavior? 'Cause even I feel this like inbuilt resistance to it where it's like, you can't do that we're all individuals and you

know we can't predicted by mathematics. We're unpredictable and we're…

HF: I have free will!

BH: Yeah, exactly, like and suddenly you're there saying, oh I can predict where the next burglary's gonna happen or where the next bomb's gonna go off or where people are gonna walk in a shopping center.

HF: Hmm.

BH: Do you find a resistance to that? Are people very accepting to the fact that you're just treating them like data points or…?

HF: I think the difference is, it depends on what scale you're talking about. So, tomorrow morning if you're working in an office and you were doing your morning commute, it's certainly true that you can change your mind and you can decide to get a coffee or you can sleep in or you know there's all kinds of different things that you might do that are different, so predicting exactly what you're going to do, I'm not always gonna get it right, you know? There's limits to how accurate I can be in that regard but when you scale up to the size of a city, actually that randomness kind of ends up evening itself out and you can predict with quite a high degree of accuracy how many people are gonna pass through a particular station on a given morning. So it's really a think that shift is where people can still hold onto their free will but are still broadly predictable.

BH: Have you read the Foundation series then?

HF: What? The Asimov stuff? [laughs]

BH: Yeah, psychohistory.

HF: [laughs]

BH: Hari Seldon is the king of your mathematical field.

HF: I know it's so true. It's so true.

BH: Hmm. Okay.

HF: I like to think that the outcome of our stuff… is slightly well… I dunno… [laughs] less terrifying.

BH: Is there a holy grail in your field? Like what's your Riemann Hypothesis or the like the ultimate thing that could be done in your field that would make that person the King or Queen of this thing? Like what's the ultimate?

HF: Well so, you know, a lot of the statistical methods are stepping aside for a lot of machine learning techniques now. Which are just incredibly power at following these really really subtle patterns. So, you know, for example, I mean this is not exactly my area, but just for example, there are these really beautiful mathematical models that can predict earthquakes and aftershocks, right? In earthquakes. And they've been around for a long time and we, you know, really know the equations very well. Those equations instantly you find a similar pattern in burglaries which is why I know about them. But now, in the last year or so it's been shown that machine learning techniques are actually better at making these predictions than the beautifully elegant mathematical models are. And it's a similar thing with predicting burglaries or predicting whether someone's gonna go onto commit a crime in future, you can come up with these really well crafted theoretically sound mathematical models. But sometimes all you want is that prediction and so there are occasions when the machine learning techniques are the better route to go down. But some people sort of say that, you know, as artificial intelligence gets better if you have artificial general intelligence then you won't need the mathematical models at all. You know if you have something that can look at a situation, work out exactly what's going on, predict

the future perfectly, and not lose any context or nuance in the process then… who needs maths? [chuckles]

BH: How do you respond to that?

HF: Umm.

BH: As a mathematician? [chuckles]

HF: I think A, it's a long way away…

BH: Yeah?

HF: So I think I still got a job.

BH: Yeah.

HF: And B, I think that actually you lose something when you throw away the mathematical model, which is that you lose an understanding of the mechanisms behind those patterns. So it's all very well saying the statistic shows that this area is the one where burglaries are gonna happen this evening, but if you don't know why and if you don't know what it is in your model that's driving that… that result, then it's very difficult to go in and unpick it and make a positive change for the causes behind it.

BH: Like I don't really understand how a car engine works at a proper level but I just know that if it breaks down, I go and get it fixed, like so do you always need to know how something works as long as it works?

HF: I think yeah, I think you do actually. I think if you don't understand how it works then you can't be sure that it's completely robust. You can't be sure that what you've created isn't just making it's decision based on something that isn't

part of the situation at all. So to give you an example, right? There was this driverless car that was built in like the Nineties, I think it was called ALVINN. And it was amazing, it was an amazing driverless car, it drove thousands of miles, had a camera on top of it, a neural network running behind the scenes that was working out where to drive, it was brilliant, right? Until they asked ALVINN to drive over a bridge. At which point it went completely made and almost killed the driver… or it would be the person inside the car.

BH: Right.

HF: And they worked out what had actually been happening was all of those thousands of miles that it had been driving, it had learned to just drive with the grass on the lefthand side… righthand side I guess 'cause it was probably in America. But there had always been a verge, it was always nice and simple, and then as soon as there was a bridge and there was no grass it was kind of essentially hunting for grass, right?

BH: Right.

HF: And you can end up with a similar situation if you're hunting for criminals or you're working out where burglaries are happening in the city. You want to be sure that it's really picking up on the signals that you want it to be picking up.

[gentle chimes]

BH: I wanna ask you something about doing mathematics or being a mathematician. So take away all the other things you do on the side.

HF: [chuckles]

BH: You know, extracurricular activities and the administration of being an

academic and even take away teaching. Just like when you're doing your research.

HF: Mhm?

BH: What does that look like? Like do you come into work with a notepad and a pencil and think, okay, today I'm gonna have an idea or do you go for a walk around a park? For you what does the process of doing new mathematics look like?

HF: So to be honest, it's a lot a lot of stuff on the computer where you're crunching through data looking for stuff, doing statistics on a machine essentially. Or when you're building models inside a machine but if you are sort of back to like the pen and paper mathematics where you're designing something. Designing a model from scratch or you're doing some analysis on your model to try and work out where it's limits are or where the weaknesses are or, you know, how it works in particular situations. Then you are literally just in a room with the doors closed and a pen and paper and scribbling and then, you know, when you get stuck you go for a walk to think it through.

BH: Do you have like a happy place or an inspiration place or a way that you give your brain a little kick start to start thinking about…

HF: Oh yeah, always on a walk.

BH: A walk?

HF: Always on a walk. Yeah, isn't it the same for you? I always have my best ideas when I'm walking.

BH: I have my best ideas in the shower.

HF: Do you?

BH: Or water or a swimming.

HF: When you're working on a particularly creative project you just find yourself fully immersed in water most of the time?

BH: [laughs] Yeah it's very hard to edit underwater.

HF: [laughs]

BH: But like I'll go for a swim and have all these amazing ideas and by the time I've like dried off and gotten home and it's time to work again like all the inspiration and motivation's gone. But I find water very inspiring. But yours is a walk? But you walk around like an urban environment or does it have to be like a natural environment?

HF: No it can be an urban environment too, but if I'm working on something and like really kind of embedding myself in it then I try to take my doggie for a nice long walk everyday. But the reason for it though is exactly what you said about swimming. That you can write stuff down when you're swimming. Where is if you go for a walk, you can like have a phone with you and kind of take notes and stuff.

BH: Professionally, academically, what's been your proudest moment? Like what's been the paper so far…

HF: Hmm.

BH: …that's the one that you're like that was really good. That was the one that you would like, you know, show another mathematician…

HF: [laughs]

BH: …look, you know…

HF: Hey.

BH: I was pretty good that.

HF: [laughs] Okay so, [laughs] the truth is that the one that I like the most in that regard is also the one that no one will ever read. [laughs]

BH: Right?

HF: I mean it's almost certainly got zero citations, but it took me the longest to write and its a paper that I wrote with my PhD supervisor, Frank Smith, and it's where we have taken a very old model of retail behavior and we have bent it out of all of recognition into the most delicious mathematical problem imaginable and just played with it to our hearts content. That's my favorite.

BH: So this isn't one that like Westfield are gonna use 'cause…

HF: No. [laughs]

BH: …it's applicable to their shopping centers?

HF: God no.

BH: This is one where you guys just have gone like freestyle and played with math?

HF: I think we turned shopping centers into a one dimensional continuous line.[laughs]

BH: Right? [laughs] Do you remember what it's called or…?

HF: I think it's called Rate Effects on the Growth of Centers.

BH: Okay.

HF: As I said no one has ever read it. [laughs]

BH: We'll link to it.

HF: But I like it.

BH: We're gonna link to it in the notes from this show.

HF: [laughs]

BH: So people can go and have a look.

[gentle chimes]

BH: Obviously in the last few years a lot of people will know that you're like on TV a lot now and on the internet and on Youtube and radio and podcasts and books and all sorts of things and we'll talk about a few of them probably shortly, how did that all start? How did you become like… outreach person as well?

HF: Wasn't just an accident, really? It was never an intention. It was never sort of my ambition but I did this [chuckles] very stupid talk in a pub which was about sexual contact networks, right? It's called the Friendship Paradox, do you know about this? It's the idea that when you have a network that structured like a sexual contact network or like a friendship network, so actually the way that Twitter's structured is very similar, there's a strange paradox which is this, your

friends are more popular than you, essentially, so on Twitter both the people you follow and the people that follow you will on average have more followers than you do.

BH: [laughs] So you're always bottom of the heap?

HF: Yeah, I think it's for ninety-five percent of users this is true. Right, which is a really strange idea. It's a really kind of weird idea. Actually…

BH: That doesn't seem possible!

HF: It doesn't seem possible does it? The thing is that actually the reason why it happens is because a slightly odd quirk of when you use the mean, it illustrates the downside of using the mean, because you have people on Twitter like Katy Perry right, who've got ten million scrillion billion followers. So if you follow her that number so massively dwarfs everyone in your network who's like you, that the people who you follow are then way more popular than you are. But it also happens in the reverse, all it takes is a couple of people who are really popular who follow you and then it skews your numbers too. But it actually has a really interested implication when it comes to targeting intervention programs for halting the spread of sexually transmission diseases, this is a really nice idea. Anyway, I did this very stupid talk about it, it has this thing about Mick Hucknall being the center of the hub 'cause apparently he slept with three thousand people.

BH: Okay. This is Mick Hucknall the singer.

HF: Yeah, he's also I would say not the most attractive man that's ever walked the earth.

BH: No. [sighs] Well there are three thousand people that disagree, but alright.

HF: [laughs]

BH: [laughs]

HF: So I did this stupid talk about that.

BH: Yeah.

HF: In a pub.

BH: Yeah.

HF: Kind of like a comedy night thing.

BH: Yeah, yeah.

HF: And someone was there who then invited me to go and give another talk that was filmed.

BH: Right.

HF: Which did really well on the internet.

BH: Okay.

HF: And then someone saw that and then asked me to do another talk, which was a TEDx talk which I did the Maths of Love for.

BH: Okay.

HF: Never expecting anything to happen from it but it ended up being

promoted as a proper TED talk.

BH: Okay.

HF: And then really it… that sort of got millions of views and everything really came from there.

BH: Okay. And then more and more people started asking you to do more and more stuff.

HF: Yeah, exactly.

BH: You said yes to it. So clearly there's something you like about it. So what's been you feelings about now going into this outreach side of things in such a big way?

HF: Well I think that initially… I was a real scaredy cat when I was younger, right? I never like pushed myself or anything, just like your classic nerd. You know, never went anywhere, never travelled anywhere, never took any risks at all, and so when this stuff started happening and it was people coming to me asking me to do something, right? I just sort of thought, well, I'm just gonna say yes, because I'd rather live in a world where I said yes and it went badly than I said no and never and didn't know how it would go. So I just had a year where my motto was to say yes, basically. And then actually all of the stuff went quite well and now I'm in this situation where you know, I get to like… have someone pay for me to go to Dubai and fly in a helicopter over the desert at like sunrise and watch people who've built jetpacks strap them to their back and like chuck themselves out of a helicopter and fly around the desert. I mean like who the hell wouldn't want that?

BH: So is it just the experience of doing it that's motivating you, do you like have this underlying I must do outreach for the people. I must bring math to the

masses or is that not really like motivating you?

HF: I think it's a combination of the two really, I mean on the one hand it's like, you know, you only get one life and like, why on earth would I ever turn this stuff down? It's amazing to have these opportunities, but I think on the other hand I mean I really do like whole-heartedly believe that maths has got this reputation that it doesn't deserve and I think it's a massive shame that there is this just glorious living breathing playground that is just so incredibly wonderful and people just think it deserves to sit in a dusty textbook and be ignored and you know, I don't think that you can force people to like the subject. I don't think you can make people into mathematicians who were never going to be mathematicians but I do also think that actually the whole of society has something to gain by just looking at it with a little bit more understanding about what they're actually talking about.

BH: 'Cause this side of things really become a big part of your life now. I imagine it must take a lot of your time because of the some of things you've been involved with, the books and the excellent TV programs. How has that affected your ability to still be a working mathematician?

HF: So actually the biggest thing that affected me being a working mathematician was having a baby. [laughs]

BH: Right. [chuckles] Okay. Yes.

HF: So, I'm half and half, right, so I'm half proper academic and I'm half a outreach person, I guess.

BH: [chuckles] Outreach person, is that what you would call it?

HF: Outreach person. Well I dunno, what'd'you call it?

BH: I dunno.

HF: In America they call it a public intellectual [with an American accent].

BH: A public intellectual?

HF: But I'm not using that 'cause it's ridiculous.

BH: You're too late, you said it.

HF: No! [laughs]

BH: And you said it in an American accent. [laughs]

HF: [laughs]

BH: Okay so half half. So how do you feel about that? How do you feel about being a half academic? 'Cause it seems like something that, you know, when I hear you talk about your academic life, I see the pleasure that it gave you.

HF: Mhm.

BH: And the happiness and the pride, and having to start squashing that more and more 'cause of the other stuff, you know, you think you got the balance right? How do you feel about it?

HF: Yeah, I mean I think so, I'm about to go off on maternity leave again and I think that, it's inevitable actually that, this is sort of the main thing, right? I think like lots of females find this the… when they have children there's a period of time where it's very very hard, right? You can't just pick up and put down research. It's really really hard, you kinda it takes momentum and it takes, you know, being embedded in the community and being at the conferences and

hearing all of the current ideas and you know, being totally immersed in it. So a lot of female academics have this where they have their first child and they're away for a year and then they come back for a year and then they're away for a year and it's three years really out, so I think really that's the thing that's stilted stuff, right? That aside, the being half and half, in some ways it quite helps with the research because you meet people you would never meet otherwise. You have the opportunity for collaboration you would never have otherwise. And also you have the opportunity for engaging people in your projects, right? In a way you wouldn't have otherwise, so just to give you an example, earlier this year, this project that we did with the BBC, that was also with the University of Cambridge and the London School of Hygiene and Tropical Medicine. It was a program called the Pandemic, right? Now in epidemiology there's one big problem which is that you can come up with these glorious mathematical models but if you want them to really work, if you want them to be able to predict how an epidemic might spread, you have to have a real idea of where people are traveling, how far they're moving and how many people they're coming into contact with. And the only information that we had up until this point is a paper survey that was conducted ten years ago where it was like how many people do you reckon you met this week? Right, which is… there's limitations to how well, you know, that can actually be employed. So, because I had this sort of platform, this opportunity came up where we got the BBC to pay for an app to be built, people could download to their smartphones, that would collect their data for them and we've created this unbelievably glorious dataset that now is, you know, gonna be released to the academic community and make a massive difference, you know, for years to come really and that's something that you couldn't do unless you had this double edge to your bow, what's the phrase?

BH: Oh.

HF: Double sword to your…

BH: Second string to your bow, is it?

HF: There we go, we'll go with it.

BH: One of those.

HF: [laughs]

BH: How has being like a more public figure changed your life away from the academic side of things? Has it been… like, 'cause you know I imagine you would get recognized more than you used to 'cause your in television shows and things like that like… has it been like a real positive experience for you being a public intellectual? Or…

HF: [laughs]

BH: Has it been… has it been… [laughs]

HF: [laughs] D'you know…

BH: A Public Intellectual is probably the title of the podcast now.

HF: [laughs] Shut up, no you can't do that. [laughs]

BH: You're totally screwed. [laughs]

HF: You can't do it. The other one they do in America is they invite you to conferences and they're like, we just really wanted you as a thought leader. [laughs]

BH: A thought leader? We're reaching out to you as a though leader. [chuckles]

HF: [laughs] What does that mean!

BH: I dunno.

HF: What does that mean.

BH: I don't know.

HF: Nothing, I think. Don't call me that. [laughs]

BH: Alright. [laughs]

HF: [laughs]

BH: So has it been like quite positive? Do you like the sort of glitzy celebrity side of it?

HF: I think the glitzy celebrity side is where you going down red carpets, right? You're getting papped, you're appearing in Hello magazine, I mean those are celebrities, right?

BH: Okay.

HF: Whereas if you're just on BBC 4… [laughs]

BH: Yeah.

HF: Or like… [laughs]

BH: Okay.

HF: Radio 4 in the morning.

BH: or Numberphile. [laughs]

HF: Oh, yeah. [laughs]

BH: [laughs]

HF: Exactly.

BH: Yeah. [laughs]

HF: And getting the Tube still. I mean…

BH: Okay.

HF: It's not like you know…

BH: You don't still get the Tube do you?

HF: Sometimes.

BH: [laughs]

HF: [laughs] Actually I quite hate the Tube. Uber's ruined my life. [laughs]

BH: Alright.

HF: But… no, I really get the Tube, I do get the Tube.

BH: Yeah?

HF: But it's been almost universally positive. It's been almost universally

positive.

BH: Yeah.

HF: Like you get letters of support from people who just make a massive difference. You know, things that you… aren't even really aware that your having an impact on people and then they contact you, it just makes an enormous difference.

BH: Yeah. That's nice.

HF: There's downsides too. I mean obviously.

BH: I'll ask you a question, but it'll be hard because it will make you sound unhumble so I'll ask you to be humble and self-deprecating. Answer both sides of it. When it comes to outreach what do you think you're good at, and what part of it do you think you're still not good out? Like you when you look back at stuff… yeah?

HF: Ooh, good question.

BH: Like what's your strength and your weakness?

HF: Okay, so… I think that it's quite new to have someone who's not a middle aged man. [laughs]

BH: Right.

HF: [laughs] I think that's quite a big part of it.

BH: Yeah.

HF: I think also if I'm honest…

BH: But you can't say I'm good at being… a young woman.

HF: I'm good at not being [laugh] I'm good at not being a man.

BH: That's just what you are.

HF: Okay.

BH: [laughs]

HF: Alright I think also the fact that I'm not a genius helps, a lot, actually. I think the fact that…

BH: You're like a professional mathematician though it's not like you're like…

HF: Yeah but I'm not like a good one. [laughs]

BH: [laughs]

HF: You know I'm not like Marcus du Sautoy who's like professor at Oxford.

BH: Okay.

HF: And professor twice 'cause he's a proper professor and he's also a professor… an outreach professor.

BH: Okay.

HF: I'm not like David Spiegelhalter who's like… have you read someone of the papers that man was writing when he was twenty-three?

BH: What so you think you're seen as having like a common touch?

HF: Yeah I think so. I think so. I mean basically I'm just a normal person who just really likes maths, basically.

BH: Alright.

HF: So I think that helps.

BH: Yeah.

HF: And then I also think that I don't take myself too seriously, I'm quite happy with people take out the piss out of me.

BH: Hmm.

HF: Which I think helps to be a bit more approachable.

BH: Especially as a public intellectual.

HF: [laughs]

BH: [laughs] Yeah?

HF: As speaking as a thought leader and an intellectual, yeah. [laughs]

BH: [laughs] Okay, yeah. Right.

HF: I think that stuff helps.

BH: Yeah.

HF: But in terms of what I'm still not good at, oh my god. Like everything. Every time I do a project… I have a little notebook where I give myself a star rating.

BH: Really?

HF: Yeah. On everything.

BH: Oh wow.

HF: Actually it's not really a star rating, it's a score out of ten.

BH: Right, on anything you'll do like a…?

HF: Every talk. Every radio program.

BH: Youtube videos?

HF: Uh… yeah.

BH: Does that mean that you've got star ratings for your Numberphile appearances?

HF: Oh yeah.

BH: [gasps]

HF: Yeah, although, it's slightly different when you're edited. Your performance isn't totally… do you know what I mean?

BH: Yeah.

HF: It's not like totally… but yeah totally with the idea… yeah completely.

BH: How have you been going on Numberphile so far?

HF: [laughs] So some of them I'm really happy with.

BH: What's your highest star rated one so far?

HF: Umm… I think it was the Rock Paper Scissors actually.

BH: Okay, yeah?

HF: Which was my first one.

BH: Yeah, that was good. That was the first time I ever met you.

HF: Yeah, I think it was.

BH: Yeah. We've just gone downhill since, have we?

HF: I know. [laughs] No! [laughs]

BH: [laughs]

HF: You know, I 'm not giving myself tens or whatever.

BH: No, no, no.

HF: But the thing is I think it's incredibly important to look back at what you've done and… acknowledge where you can improve.

BH: Yeah.

HF: So I still do… I mean I've given hundreds of public lectures now, right, hundreds of public talks, and I still do this where it's like, I have a note… you know, little notes… in every folder where I save the talk and I just say what worked and what didn't work.

BH: Alright.

HF: So that next time… yeah.

BH: What's been your… your biggest crash so far, and what's your like highest rating? What's the high and the low so far?

HF: Ooh that's a good question.

BH: Have you ever got a ten or is ten not allowed?

HF: I've got like close to a ten a couple of times.

BH: Hmm.

HF: So one actually, I did an interview on Shaun Keaveny's show.

BH: He's great.

HF: He's brilliant, I like him a lot.

BH: Yeah, yeah.

HF: And that got a really high mark, but it got a really high mark because I managed to like keep my nerves under control.

BH: Yeah?

HF: And I was really nervous about it, it's like Shaun Keaveny, do you know?

BH: Yeah.

HF: And I hadn't done this program before and I hadn't done loads of radio… chatty radio shows before. But I… yeah, managed to not sound like an idiot.

[Radio clip fades in]
Shaun Keaveny [SK]: Our next guest is an expert in fluid dynamics, understands the trigonometry of love and can tell us a thing or two about ear-worms. Here to talk about… I've gone a little bit William Hague.

HF [in clip]: [laughs]

SK [in clip]: Here to talk about… Theon! Here to talk about the next series of the Curious Case of Rutherford and Fry, it's Hannah Fry, good morning!

HF [in clip]: Hello, good morning.

SK [in clip]: Thanks for coming in.

HF [in clip]: What an intro.

SK [in clip]: It was quite good.

HF [in clip]: I enjoyed that.

SK [in clip]: I know it's hugely… we start well and then it goes downhill. [laughs]

HF [in clip]: Well I think if anything it peaked up as the voice… you know…

SK [in clip]: As it went a bit William Hague, yeah…

[radio clip fades out]

HF: 'Cause the thing is on those kind of shows, right, you have to be really careful that you are jumping in exactly the right amount. You can't just sit there and wait for them to talk to you. [pause] Because it has to be a conversation, so you kind of have to jump in a little bit.

BH: Were you doing it via phone or were you in the studio with him?

HF: I was in the studio, yeah.

BH: Okay.

HF: Which makes it easier.

BH: Yeah.

HF: But you also you can't jump in when they're talking when it's not appropriate.

BH: Yeah.

HF: So it's really hard to like get that balance right.

BH: Okay.

HF: But then also I just explained my thing that was going on… quite well…

whatever.

BH: Yeah.

HF: But I mean I've definitely bombed a lot of talks. [laughs]

BH: Like do you ever get a zero or a one, what's like, what's the lowest mark you can get?

HF: Oh… no because I try… I always really prepare.

BH: Okay.

HF: So I never get a zeroes and ones. That would be like…

BH: A zero would just be falling over on the stage and then not giving a talk at all?

HF: [laughs] Or I… just going in and shouting at everyone.

BH: Yeah.

HF: Going like, hey y'all! [growls] [laughs]

BH: [laughs]

HF: And stalling up. [laughs]

BH: Okay. [laughs]

HF: But I think that you know, I've definitely got low marks where I just haven't thought enough about what the audience were wanting.

BH: So a low mark is at times where you feel like you've just missed the audience? You've missed your…

HF: Yeah, or maybe I've been a bit sloppy and I haven't prepared as well as I could have done. So one thing that I'm still not very good at, right? That Matt Parker is amazing at actually, instantly. Is that, if the audience is in a really good mood and they're going with me I can accelerate that when I'm stage this is. I know how to accelerate that and, you know, get it to feedback on itself. But sometimes the audience just isn't in the right mood and what Matt can do is he can turn the audience to being into him.

BH: Win them. Win them back.

HF: He can win them, right? And I just haven't quite worked out how to do that yet. I haven't worked out that when you've got a bad audience, not to just be like okay I'm just going to say what I was gonna say and that's it and then I haven't got anything else… but rather be like, what is it about you that you need, you know, do you need me to be more goofy, do you need me to be more energetic, what is it that you need? And give them that and then turn them to your side, I haven't worked that out.

[gentle chimes]

BH: Let's talk about your books for a second. You've done a few now, you had a few like light hearted fun ones. One about love and stuff and one about Christmas and now you've written a more hardcore one.

HF: Yeah.

BH: Tell me about the… how they were different. How writing them was different?

HF: So the love one [laughs] well, in a way, I sort of don't want anyone to ever read that book [laughs] because… I'll tell you why [laughs]

BH: [laughs] Okay. Link in the show notes, people. [laughs]

HF: [laughs] I know you're not supposed to say this about your own work.

BH: Yeah?

HF: But what happened with that book, right, was that I'd just done this talk, this TEDx talk, got an email from TED saying, we're putting it on the main channel, we're making it a proper TED talk. It's completely unexpected, right? And then a couple of weeks later, they said, actually what we're gonna do, we're not gonna put it online yet, because we want you to write a book to go with it.

BH: Hmm.

HF: And then we'll launch them both together.

BH: Hmm.

HF: And I was like… my god this is amazing! I mean I never would have written a book if someone hadn't come to me and said you need to write a book, right?

BH: Yeah.

HF: Never in a million years. And then I kinda thought about it and was like okay I'm gonna do it. And they were like, great! We need the whole book delivered in six weeks time.

BH: [gasps] [laughs]

HF: [laughs] And I'm like full-time academic. Got a full-time job, you know, it's like right, that's not really gonna be possible. So I tried to negotiate with them and they were like [tsks] yeah… thing is… we're TED… so…

BH: Yeah. Yeah.

HF: Do you wanna do it or not?

BH: Yeah.

HF: So I did it. I mean it was the most horrific experience of my life.

BH: Bit of it… you felt like it was a bit rushed?

HF: Yeah I do think it was a bit rushed, yeah.

BH: How many stars does it get in your notepad?

HF: Oh god… I mean… a lot less than it gets on Amazon. Put it that way. [laughs]

BH: Right. [laughs] Is that a humble brag? I can't quite decide. [laughs]

HF: [laughs]

BH: [laughs]

HF: Blimey [laughs]. It might be.

BH: It gets very high ratings on Amazon! [laughs]

HF: What I'm saying… no… [laughs]

BH: But I think it's rubbish!

HF: No it doesn't, no it doesn't, it doesn't, it doesn't but what I'm saying is that people are still being generous.

BH: Okay.

HF: That's what I mean.

BH: Okay.

HF: I mean like, don't get me wrong, I mean I think the idea is there, like taking maths and something love and smashing them together. I still would like stand by that idea and I think there was like the kind of beginning of something much better there. But it was just such a hard process. I'm not a natural writer and… getting the ideas… it wasn't my research area either, right? You know, getting that up to the point where it's like, yeah I'm really proud of this and I'm ready to release it to the world, it just wasn't… I just needed more time and just didn't have it.

BH: Hmm. Hmm.

HF: The Christmas one on the other hand, I think I did have more time with that and I did that with… as a collaboration with my colleague Thomas Oléron Evans, who is basically a wonderful human being. And we just had loads of funs writing it and just being really silly and… playful and whatever and coming up with stupid ideas and seeing them through. So that one's kind of more like what I wanted Love to be, if you know what I mean.

BH: Yeah.

HF: But I really like that book, it's really… it's just a stupid little fun book.

BH: Yeah.

HF: But then the latest one, the Hello World one…

BH: Yeah.

HF: I sort of see that to be honest as my first book.

BH: Right.

HF: Because six weeks to write a book is just like a pamphlet, not a book. And then the other one was just me mucking around with someone.

BH: They're sort of more like stocking filler type fun books?

HF: Yeah, totally, I mean they're very thing, right? They're like twenty-five thousand words or whatever.

BH: Yeah.

HF: Whereas Hello World is like… I mean it's still quite, well I hope anyway, that it still got that chatty style and there's still like some silly bits in there, it's not completely serious, not like it's really serious heavy read. But it's not just much more the things that I'm actually interested in, in terms of research that I do. And also I just think it's got some really good stories in it.

BH: Where did you write it? Where do you sit and write?

HF: On a walk, mate.

BH: You write it on a walk?

HF: Yeah. [laughs]

BH: But you can't type on a walk.

HF: You can dictaphone though can't you?

BH: Oh, you dictaphone it!

HF: Yeah, so I'd go for a walk with my doggie. For a really long walk and I'd dictaphone loads.

BH: Oh.

HF: And then I come back and I type it up and make it into sentences and then pad it out and do the same next day.

BH: Have you still got the dictaphone recordings?

HF: Probably, yeah?

BH: Will you give us like… fifteen seconds so we can hear what that sounds like?

HF: [laughs] Yeah but my sentences are really slow.

BH: That's okay!

HF: So I'll be like…

BH: I'd love to hear what it sounds like, you know, for a peak behind the curtain.

HF: [laughs] There'd be heavy breathing as I'm walking up hill. [laughs]

BH: Yeah!

HF: [laughs]

BH: I'm gonna lobby you for that. I'm gonna lobby you for a little…

HF: Okay, I'll see if I can find one.

BH: If you can find some, just give us a little snippet and we'll just play it now so people can get a feel for that.

[gentle chimes]

[low quality dictaphone recording of Hannah Fry plays]: On the one hand it means that we don't… we kind of feel surprised when things get stuff wrong… and on the hand it means that we are dismissive… when things go wrong. That's what we're just really bad at that stuff. Because we're not really good at calculating, but I sort of think actually the more interesting and more accurate way to frame it [bird chirps] is to have that as a secondary idea. [audio distortion] And instead have how much power should we give the… the machine. [breathing and audio distortion] [bird chirping] Part one is the algorithm gets final say, part two is that the human gets final say. [bird chirping] Maybe the algorithm should have final say. [audio distortion] but the problem [whispers] squish too much of this sh-t [censor beeps] [birds chirping] [audio distortion] So how bout we just go? Include all the AI stuff in with the algorithm bit, then go, should you blindly follow it? [yells] Molly! [audio distortion] Oh

sorry, I didn't see you there. [voices in the background] [bird chirps] I know! [laughter in the background] [Hannah talks to someone in the background] Yeah she's a cockapoo. [dog growls] [background chatter] [child talks to dog]

Child on Recording: Bye bye doggie!

[laughs] [audio distortion] [recording ends]

[gentle chimes]

BH: The parts of the book that I've read, what I like about it, is it does sound like you're talking to me, like it's like, oh yeah this is… obviously…

HF: Because I was. [laughs]

BH: Yeah! That… it all makes more sense now. That's why I was gonna say you're so good at writing in your voice, your chatty voice, it's because you are, it is your chatty voice. How has it been going, like, how was it received? I know it's been nominated for some awards and stuff…

HF: Yeah it has.

BH: …so it's obviously, you know…

HF: I has. No, it's been really good actually. It's been really amazing. 'Cause I think… [laughs] one thing that I do find about it is that, I think because I have done quite silly stuff in the past, like the love stuff and, you know, telly stuff, whatever, I think one thing that I've noticed is that people think I don't know what I'm talking about.

BH: Right?

HF: It's sort of back to what we were saying earlier.

BH: Yeah.

HF: About walking into a room and people thinking you're an idiot. I don't think people think I'm an idiot but I think they don't…

BH: Yeah.

HF: I think people are a bit like why is this TV presenter writing a book about AI?

BH: Yeah.

HF: You know, she's jumping on the bandwagon or whatever.

BH: Yeah, yeah.

HF: But it's not really, I mean it's stuff that I've been working on for a really long time. It's been nominated for two awards, right, shortlisted for two awards. And one of them was the Royal Society, which is… like a really big deal because when it comes to science writing, you just don't really get a bigger institution than the Royal Society.

BH: Hmm.

HF: And you know the books that they pick are like, these weighty, you know…

BH: Tomes.

HF: Exactly.

BH: [chuckles]

HF: I mean they really are it's like, you know, a history of engineering, right?

BH: Yeah. [laughs]

HF: Like that was one of the other books. Or like, what I find quite intimidating books.

BH: Yeah.

HF: And why it was a real surprise it was because exactly as you said the book that I've written is really chatty. It's not written in the style of a scientist, really.

BH: Yeah.

HF: So it's really that was really amazing to get that recognition. And then the other one, the other big prize that it's been nominated for is this non-fiction, like, the biggest non-fiction award which is anything in the English language so I think there's only a couple of English authors on there, which is frankly absurd. I mean science books almost never even get on this list so it's…

BH: Brilliant.

HF: It's completely absurd.

BH: Brilliant.

HF: But you know, it's actually I did try really hard. [laughs]

BH: Well, there you go, you did something right. So you get to dip your oar into a lot of the different types of outreach now. You've got like, you know, radio and podcasts which are really successful, you've done these television shows, a book, occasionally you even get to be in Numberphile videos…

HF: [laughs]

BH: …which is amazing.

HF: You know, actually though…

BH: [laughs]

HF: …in terms of people like coming and talking to me in the street, it's almost always Numberphile people.

BH: Ah, there you go.

HF: They're the best people.

BH: Well, keep doing them then. So of all of those, and now there is no offense to be taken here, what gives you the most pleasure? Like, what are the ones like if I said, alright you can't do any of it anymore except one, what's the one that like, you know, feels most in your wheelhouse? That you enjoy doing?

HF: So I… and you know, well I actually have this conversation quite often with my husband who's like, you need to give up something. [chuckles]

BH: Yeah?

HF: [laughs]

BH: He's like, stop those Numberphile videos, mate!

HF: [laughs] But the problem is that actually, each of them have their own merits.

BH: Hmm.

HF: And I think that they all sort of add to this bigger picture, so you know, the radio stuff, I just absolutely love the team that I have. So, you know, it's a podcast called the Curious Cases of Rutherford and Fry, with Adam Rutherford the geneticist. And it's just me, him and this producer, and we just have the best time making these programs. It's just I wouldn't give it up for anything and just absolutely love it. The telly stuff is like, those are times where you get these incredible experiences. I mean it's hard work don't get me wrong, right?

BH: Yeah.

HF: And you do not make your fortune in television. [chuckles]

BH: No.

HF: Believe me.

BH: That's about the access to…

HF: Yeah but it's about the experiences and the access and then…

BH: Hmm.

HF: You know, being part of something that eventually gets seen by so many people and that just looks really beautiful and glossy on the surface and…

BH: Hmm.

HF: Yeah, having that role, I think, is really… I wouldn't want to give that up.

BH: Yeah.

HF: And then the Youtube stuff is where you can actually be yourself, right? It's where you can actually talk about the ideas that you think are interesting to the audience who want to hear them. And get immediate feedback on them and actually kind of communicate with people who are like you. I wouldn't ever want to give that stuff up.

BH: Yeah.

HF: And then the books that's where you get to… really author something. Where you get to think about an idea wholly and completely and just, you know, spend tens of thousands of words getting your own thoughts on a page. So I wouldn't wanna give that up either.

BH: Then your husband says, well you gotta give one of 'em up! [laughs]

HF: [laughs] Yeah.

BH: [laughs]

HF: You can sleep when you're dead.

BH: [laughs]

HF: [laughs]

BH: So, like to finish up then, like, in… five years time what's the next thing?

Or do you not know, you're waiting for someone to offer it to you?

HF: Oh I don't know. I don't know. I think everything's worked out quite well so far by being micro-ambitious.

BH: Yeah?

HF: So just looking at what's immediately in front of you, and doing the very best that you can at that and trying your hardest.

BH: Is mathematics still a big part of it? Like do you think in ten, fifteen years you're still gonna be someone who's like churning out papers and researching, or like…?

HF: I hope so, I hope so. So I mean as I said, you know, I'm just about to go on maternity leave again, so like in the last couple of years I haven't done as much maths as I'd want to. And I won't again for another year or so.

BH: Hmm.

HF: Because, you know, the new baby. But when I come back from that maternity leave, yeah I really want to get back into it, because there's just nothing in the world gives me more pleasure that getting totally stuck into a totally delicious maths problems.

BH: Well… Hannah Fry, public intellectual. [gentle music fades in]

HF: No! [laughs]

BH: Thought leader.

HF: [laughs] Brady!

BH: Thank you for your time today. [laughs]

HF: [laughs]

BH: Thank you very much.

[triumphant piano music]

BH: So that's it for today. Rest assured I will try to learn what mark out of ten Hannah gives herself for today's interview. And I'll do my best to get a look at that manuscript of Free as Bird. It could be one of the great unpublished novels. [music continues] On a more serious note, in the podcast description today I'm gonna have links to all sorts of stuff we discussed. The books, podcasts, and of course Hannah's Numberphile video appearances. Thank you to the Mathematical Sciences Research Institute, MSRI, for it's support of the show, and also to the Berkeley based audio company Meyer Sound, which made this episode possible. Links to both of them can also be found in the usual places. We'll be back again soon with another episode, there's a few good ones recorded that I'm editing just at the moment so I can't wait to share those with you. Also please do consider subscribing to the podcast if you've not done that already and if it's possible we'd also love like a rating or a review, all that kind of good stuff. It helps make the podcast just like that little bit more successful and increases the probability we'll get to make more of them later. [music continues] Anyway, by for now.

[piano fades out]