Are emerging technologies more hype than reality?

SPEAKERS

Sam Gilbert (Bennett Institute), César Hidalgo (IAST, TSE, University of Toulouse), Jeni Tennison (Bennett Institute)

HOST

Rory Cellan-Jones

Rory Cellan-Jones 00:00

Hello and welcome to Crossing Channels. I'm Rory Cellan-Jones. Are emerging technologies more hype than reality? That's the subject of the latest in our podcast collaboration between Cambridge University's Bennett Institute for Public Policy and the Institute for Advanced Study in Toulouse. As ever, we're going to use the interdisciplinary strength of both institutions to explore a complex challenge. We'll discuss emerging technologies like generative AI and the metaverse, the cycle of hype then disappointment, which many seem to go through, explore their possibilities and harms, and examine strategies to mitigate the associated risks. To explore these issues today, we have César Hidalgo from the IAST. César, remind us of your main research interests.

César Hidalgo 00:55
I'm very much interested on how societies learn, so I study the growth and diffusion of knowledge.

Rory Cellan-Jones 01:02
Excellent. And joining us from the Bennett Institute, we have Jeni Tennison and Sam Gilbert. Jeni, what does your research focus on?

Jeni Tennison 01:09
Well, I run a campaign called *Connected by data* which seeks to give communities a powerful say over how data is collected and used. And I'm most interested in learning from how other sectors, regulation around food or housing, can be applied to data and AI.

Rory Cellan-Jones 01:24
So we'll have lots to discuss in terms of how these technologies impact the general public. And Sam, what are your main research interests?

Sam Gilbert 01:32
So at the moment, I'm particularly interested in helping policymakers and members of the public get a richer and more empirically informed understanding of digital technologies and what they might mean.

Rory Cellan-Jones 01:43
So we've got an extremely well-informed panel to crunch through these issues. We're going to be looking at two technologies in particular, so let's start by introducing them. First, there's been tremendous hype around generative AI tools like ChatGPT, or to use the lingo LLM, Large Language Model. Jeni, start us off, I've been hearing about AI for years, so why has its moment appeared to arrive in the last couple of months?

Jeni Tennison 02:09
Well I think it's worth recognising that OpenAI, who are the organisation behind ChatGPT and other things like DALL·E, which generates images, have really done a blinder with their PR, right? They've been able to describe this as a step on the way to artificial general intelligence, which everybody gets very excited about. But also hint at these terrible existential risks that there might be if anybody other than them were in charge. And they've also been really clever about releasing it in a way that goes viral. So it's free and easy to access, very little barrier to using them, and the results, of course, are really shareable. Just in this last week, we've probably seen the pope in a puffer jacket generated by Midjourney.

Rory Cellan-Jones 02:53
You're telling me that wasn't real?

Jeni Tennison 02:55
Wasn't real. It was a generated image. But it's important to remember that we're not actually talking about some magic here. And this isn't artificial general intelligence. It's just lots and lots of computer power over lots and lots of content that has been generated by humanity over centuries and then very well marketed by companies who really want to sell their products.

Rory Cellan-Jones 03:20
Sam, have you got a theory about why companies like DeepMind defeating champions of Go, we've had self-driving cars and so on, why this particular tool, has really made the world sit up and think and worry about AI?

Sam Gilbert 03:36
Yes, well, I think I have somewhat of an explanation of that and how the market landscape has developed. In the past couple of years, we've come out of this period where everything was really defined by mobile and social media, into a period where entrepreneurs and venture capital investors have been looking around to try to find the next big thing. And up until the generative AI moment, the big candidates to be the next big thing were web3. So that's the next iteration of the web core infrastructure that includes things like cryptocurrencies and blockchain and NFTs. And then the other candidate was the metaverse, which we will talk more about later. But I guess the reason why generative AI has so much momentum is because investors, entrepreneurs are just really desperate to find new places to put their capital to work, and develop the next generation of businesses that will achieve the same sort of scale that Google and Apple and Meta and all of the rest of the big tech companies have managed to achieve.

Rory Cellan-Jones 04:43
And César, this is global, isn't it? It's not everybody everywhere, seems to be excited and worried about AI all at once because of this tool?

César Hidalgo 04:52
Indeed, it's both global and local. On the one hand, the consumption is global, like people all over the world are using these tools because the web is an excellent distribution channel for them. But on the other hand, their production is extremely local. If you think about it, open AI has been successful in a world in which other companies that are also very well endowed in terms of human capital, such as Google and Facebook, have failed to produce models that are comparatively good. Similarly, like Midjourney, it's so much better than DALL·E when it comes to produce images. So what we have is a world in which production is extremely localised, even within Silicon Valley there are winners or losers, and consumption is extremely global. These are technologies that can have a billion consumers by the end of the year.

Rory Cellan-Jones 05:39
So that's one of the technologies we're going to talk about. Sam, you've already mentioned it, and you've recently released a policy brief on it. The other big trend much hyped over the last couple of years, the metaverse, what on earth is the metaverse?

Sam Gilbert 05:50
Wow, this is the $64,000 question. Nobody, I think, really agrees what the metaverse is. So all one can do is talk about what different sorts of people mean when they talk about the metaverse. So perhaps the best place to start is in science fiction. So the term "the metaverse" originates in a novel published in 1992 by Neal Stephenson called *Snow Crash*. And actually quite a similar vision of the metaverse appears later in a novel by Ernest Cline called *Ready Player One* that got turned into a film by Steven Spielberg. And in those sci-fi books, the metaverse is a kind of 3D embodied version of the web. So I define it in the policy brief that you mentioned as a massive, immersive, persistent, open and economically developed virtual world. So it's something where you can exit from the physical embodied reality that we live in day to day, and go and live in cyberspace in exactly the same way that you do in the real world. And that's all enabled by virtual reality. The more prosaic reality of the metaverse today is that there are companies who have developed Virtual Reality hardware and software that they would like to find a bigger market for. There are companies that are developing massively multiplayer online games and other forms of virtual reality software that they would like to find a market for. And those companies have, I suppose, used the metaverse as a way of articulating why their products are part of an exciting future of the internet, rather than simply things that you can use for entertainment, or to make the experience of remote work a little bit more interesting. So essentially, the metaverse is different things to different people.

Rory Cellan-Jones 07:45
And we're going to come back to it in a moment. But first of all, let's drill down into the policy implications of these two technologies. And first, AI. Jeni Tennison, obviously, we're seeing lots of exciting examples of how generative AI could revolutionise various industries but we're also immediately seeing ethical concerns. What are the main issues policymakers need to get their heads around in the development and use of it?

Jeni Tennison 08:09
I think I'll quote Emily Bender, who was the prime author of *Stochastic Parrots*, this seminal paper on LLMs that came out last year about where those risks are. Because, as I alluded to, OpenAI and similar will have you believe that the risks are kind of existential long term risks about the way that artificial general intelligence might develop and take over the world. But actually, there are risks here and now. The concentration of power in the hands of particular types of people, as César alluded to, reproducing systems of oppression. Damage to our information ecosystem. We're seeing how these technologies can crank out stuff that looks real, like the pope in the puffer jacket, right? In a way that then pollutes what we see and makes us believe things that aren't real, adds to misinformation at scale at real scale. And then there's the

damage to our natural ecosystems. So these models require huge amounts of computer storage power. And that takes energy and electricity. And obviously that has a carbon impact too. It's those bits that are about who is in charge of these technologies, what decisions are they making and in whose benefits that we really need to worry about.

Rory Cellan-Jones 09:34
Can you explain to me why a tool which, you know, will on cue write a reasonably funny limerick is going to pose a threat to particular sections of the population?

Jeni Tennison 09:44
Yeah, sure. So, first of all, I think there's the bit about what reality these tools reflect. If you remember, the way that generative AI works is that it takes in a whole bunch of content that has already been generated over centuries, the stuff that is on the internet right now. And that historic information reflects our historic and current biases. So you get lots and lots of pictures if you ask for them. If you ask for a picture of a CEO, you get a smart white man in a suit, right? If you ask for a scientist, you get a smart white man in a white coat. So there's the fact that it embeds these existing ideas and the biases that we've had for ages into what we generate into the future. There's also the fact that these technologies are going to be used, as we've seen with social media, to target people based on characteristics. So for example, technology is being used to nudify women. To get pictures of them just based on their normal clothed picture to see, what would they look like naked? That kind of stuff is going to be the thing that gets created. And, you know, our historic oppressions are going to be perpetuated into the future. And the final bit about the pollution of our information environment is just that, when you go and search on the web currently for information about something, I don't know about you but increasingly I'm finding that I'm getting content that feels robotically generated, even if it isn't actually, it's stuff that is there for clickbait. But it doesn't demonstrate unique thought, or any kind of creative spark. And with generative AI, we see lots and lots of these copywriting tools that allow us to crank out that kind of content really rapidly, really quickly. And just the volume of that builds up so that we can't find the stuff that is by real people talking about real things that are new and novel and exciting.

Rory Cellan-Jones 11:49
César, have you seen evidence yet of real harms from this technology?

César Hidalgo 11:54
Well, I think it might be a little bit soon to say, you know, but I do agree on the trends. You know, I do agree that on the one hand, there is an overload of information. On the other hand, I do think that there are other risks that are important. And they might be materialising right now, but they might be a little bit more long term. For instance, you know, young children getting used to the fact that you have models that you can ask for information and taking that at face value, failing to develop that critical thinking skills that you need to process and filter the information that you consume.

Rory Cellan-Jones 12:27
Hasn't that been the case for ever since people began to use the web in general?

César Hidalgo 12:33
I would think so but now you have this sort of authoritative tool that is dialoguing with you. And that might be psychologically different for a young person compared to an article that might come from a reputable source, or might come from a more shady source. And you might have some cues, some heuristics that allow you to maybe start figuring out how things are created and whether they're real or not. So I don't think that the problem is new. I think that technology has always amplifies aspects of our humanity. So I do not blame solely the technology, I do think that the technology amplifies vices that are part of human nature. But I do think that also as technology is developed, that we can indulge, and we need to develop more restraint, you know, similar to the example of you know, the availability of sugar and obesity, we have now a technology that can push us into a world of you know, misinformation content that sounds authoritative and is not such. That's I think, where the danger is that in that the slippery slope and interaction with human nature.

Rory Cellan-Jones 13:33
Sam isn't one of the problems that the very people who may be in position to do something about this, to impose restraints, are going to find it, however smart they are, very difficult to understand where this technology is going? It's going to be galloping off into the distance while they chew their fingernails?

Sam Gilbert 13:55
Yes, I think it's inherently very difficult for policymaking and regulation to keep up with technological change. And I guess one could make the observation about legislation like the Online Safety Bill, which is going through Parliament at the moment.

Rory Cellan-Jones 14:13
That's a UK regulation?

Sam Gilbert 14:15
Yes. The Online Safety Bill, the UK regulation which is designed to make sure that tech companies have increased accountability for protecting their users from harms. The issue with that type of regulation can be that it focuses on the risks and the harms that pertain to technologies which belong to the last 10, or the last 15 years. What I would say, though, is that there's one strength of that piece of legislation, which is that at the core of it is this concept of a duty of care, which effectively says that in future, tech companies will have to be responsible for protecting their users, and keeping them safe from misinformation or abuse or other forms of harm. And it seems to me that that type of principle actually fits quite well with a landscape in which technology changes a lot.

Rory Cellan-Jones 15:11
Jeni, what about the people actually advancing this science, the technologists themselves? Does it strike you that they are looking before they leap? Or is there such strong competition to get ahead that they're insufficiently cautious?

Jeni Tennison 15:22
Yeah, I mean, there definitely is massive competition that is driving. I would say, the release of these models and technologies before they are really ready and before certainly, kind of, society is ready. But I think we should recognise that there isn't an inevitability of adoption, right? We do have some power over whether we adopt these technologies, in our workplaces, in our schools, in our communities, in our professions. How we do that is down to us, it isn't like that's going to just have to happen to us. As well as the kind of high-level regulation that Sam was talking about, as well as those kind of larger frameworks, we have to have frameworks that also drive those conversations at that more granular and context-specific level. How should these technologies be used in recruitment, for example? Or how should they be used when we're dealing with the law? Or how should they be used in a particular school or in your particular workplace? That should be a matter for discussion, for setting up guidelines and principles for that particular context with those particular stakeholders, individuals who will be affected by the technology. So we do need to have a kind of larger societal-level kind of conversation about the big impacts that these are going to have. But we also need to not subscribe to the kind of inevitableism of these technologies. We do have control of ourselves about when we use them. And we can have that negotiation in our workplaces and so forth.

Rory Cellan-Jones 17:05
I was at an event yesterday at a marketing agency and people from across the marketing world. They'd all heard of ChatGBT, they were all tremendously excited. They were all telling each other that, from jam makers to plumbers, to architects, nobody could afford to miss out. There is a huge amount of pressure isn't there when these technologies arrive?

Jeni Tennison 17:21
Yeah, definitely. And I think generative AI is a new general purpose technology. But we do have choices as we go along that path. And we do have choices, even at a very granular level about when we adopt and how we adopt. We need to experiment and there needs to be room for experimentation so that we can put in place the right kind of guidelines and barriers in order to get a positive outcome in that large timescale.

Rory Cellan-Jones 17:55
César you wanted to come in.

César Hidalgo 17:56
So I agree with Jeni that we have choices that we can make individually. But I also do think that it's important to consider that there are multiple scales in society in which those choices are going to interact. So when electricity comes along, you can decide to continue to run a factory without electricity. But the question is, are you going to be able to remain competitive? When these technologies come along, you can choose not to adopt them. But the question is, in the context of your firm, let's say if you're an advertising company, are you going to get out competed by those that do? And at the end, the inevitability doesn't come from individual choices, but comes from that secondary-level in which different groups of people that have made different choices compete in an environment in which some of them grow and accumulate more resources than the others. And I think that's, you know, what makes this complicated. It goes beyond individual choice because of that second layer of selection and competition that the market has.

Rory Cellan-Jones 18:53
And there's also the global context. I saw one Silicon Valley, kind of evangelist for all that saying, yeah, okay, if we stop for five years, do you think the Chinese are going to stop for five years?

César Hidalgo 19:03
Exactly.

Rory Cellan-Jones 19:04
Sam is that kind of thinking uppermost in the minds of policymakers? They're looking at global competition, they both want to control it, but they don't want to be left behind.

Sam Gilbert 19:14
Yes. And I think there are some real tensions between different types of policymakers when it comes to this technology. Something we haven't really touched on very much is the enormous potential that generative AI has for increasing economic productivity in certain sectors. So it may well be that there's a group of policymakers who very much want to promote the use and adoption of the technology because it should have favourable economic outcomes that then become beneficial to society. At the same time, there's going to be another group of policymakers who are very worried about the types of concentrations of power that Jeni alluded to earlier and will really be wanting to preempt the emergence of open AI as the next big tech company. So I think they will incline towards competition policy as a defence against the potential development of new technological monopolies. A third group of policymakers who are more focused on issues of online harm may then see competition policy as something that militates against their ability to preempt harms. So if, for example, large language models, generative AI became much more open sourced and more and more individuals and organisations were able to run them on their own hardware, it will become a lot more difficult for policymakers to implement measures that would insist that those companies put in place guardrails of the type that, to their credit, open our eye has been doing in relation

to the GPT models. So potentially different constituencies of policymakers are going to think about this very differently.

Rory Cellan-Jones 21:04
Well, let's move on to the metaverse, which was a topic of huge excitement, possibly excessive excitement last year. One company changed its name, it was so convinced it was the future. A company called Meta. So how much should all of us - citizens, business owners, policymakers - care about the metaverse? Is it the next big thing? Or should we just get on with worrying about AI, Jeni? You're sitting there not looking, as far as I can see, too concerned about the metaverse.

Jeni Tennison 21:36
I am very sceptical about the metaverse in the way that it is described as a kind of virtual reality version of our current reality. I think we already, in some ways, occupy the metaverse in that we, you know, we communicate with each other digitally. We're talking to each other over the Zoom.

Rory Cellan-Jones 21:54
We're a 2D metaverse.

Jeni Tennison 21:55
Yeah, having discussions on Twitter. You know, I'm not convinced that the benefits of the kind of fully embodied version, the VR fully embodied version, are going to be so much greater than what we already have through our current methods of communicating with each other. For me then, the metaverse is about connection with other human beings, right, it is about the communities that we create in our relationships with each other. I am not convinced that the fully embodiedness of VR, especially this kind of stuff that we've seen currently, is going to give us that much more of a benefit than the ways of connecting that we currently have.

Rory Cellan-Jones 22:38
Sam, we've, well I've seen reporting on this, wave after wave around virtual reality back in the 90s. It came along. It made everybody sick. It went away. It came back massively in the last decade, huge amounts of investment, augmented reality as well as virtual reality. It's fading again, isn't it? And yet, Facebook, that company that now calls itself Meta, has basically bet its whole future on it.

Sam Gilbert 23:07
Yes, I think and part of the reason that it's fading again, is just an appreciation of some of the fundamental technical barriers that there are to achieving the Snow Crash style completely immersive 3D type metaverse. But I guess there probably are some elements of it that we still ought to care about, whether as citizens or policymakers. So one of the things that is actually really brought into focus is the way that the usage of the web by young people, particularly, is very different from the way that those of us who are

slightly more advanced in life probably think about it. So, one thing I learned in researching this topic, is that an absolutely staggering number of young people, so I think, in the United States 85% of 8 to 14 year olds are on the platform Roblox, which is sometimes described as a metaverse platform, it's definitely a gaming platform. And within platforms like Roblox, and also massively multiplayer online games like Fortnite, there is already a very significant trade in virtual goods. So by some estimates, that amounts to $93 billion a year. And it also seems to have done something to change the threat and the potential harms that people are exposed to when they use these platforms. So I think when policymakers are contemplating online harms at the moment, they'll be thinking about issues like cyber bullying, for example, or the exposure of young people to content that promotes self harm. But when you look at what is actually going on inside platforms like Roblox, it turns out that there are real issues to do with children working as developers, effectively gig economy workers inside distributed game studios where they're coordinated by adults or by older children. So there are issues of their labour rights that come up, the way in which virtual goods are promoted and sold through these platforms, to children, again, just feels quite dissonant in a world where we place a lot of focus on consumer rights. So it might just be worth taking that vision of the future seriously because that part of it is already happening and it demands some policy responses that are a bit different from the ones than we're probably accustomed to thinking about.

Rory Cellan-Jones 25:33
César, it strikes me this is partly a sort of cultural thing. That the same kind of people who are very excited about the metaverse and the web3, as it's called, were very excited about cryptocurrency and blockchain and they tend to be kind of libertarian, they tend to reject sort of mainstream views on how the world works. Is that why there was so much excitement around this idea?

César Hidalgo 26:00
Look, I have a particular view of the metaverse in part because when I was at MIT, I even experimented on developing experiences, when virtual reality was coming again, you know, in the middle of last decade. We bought a headset, I had a Japanese postdoc that started to work on it. And what I learned is that, in some ways, the way that the metaverse has been sold is very different from the way in which it produced value. I find that virtual reality experiences can be very profound in a short period of time and that's how you want to consume them. So with some friends, we created a VR music label, in which we said, what is the type of content that is short, that can be entertaining? And we thought about music videos, we produced three music videos that are available for free on Steam right now. And like people love them, and it filled them with joy, but is that short experience. So I do think that the metaverse, unlike the mobile phone, unlike the web, unlike LLMs that are designed for this massive consumption and frequent use, is a technology that also has its virtues. But its virtues is not that it's going to transform everything, it's not to go to work on the metaverse that's really lame. But to have an art experience that is three or five minutes, that allows you to have a sensation that you cannot have outside of it. I find that to be profound. And that's why it's important to understand that technology in that context.

Rory Cellan-Jones 27:22
Well, that's interesting what you say. I found when I was covering this area that I would bring home headset, and I would put it on relatives and friends. And I found there were three stages. The first time it was "wow". And the second time they tried it, they were kind of "okay". And the third time it was "meh". So there seems to be, I think you're sort of saying this, a niche technology. You know, smartphones came along, and people at one stage thought they will be for a certain part of society, they turned out to be something that was gonna change the world for just about everyone. Jeni, do you share my scepticism, that this is a phenomenon that doesn't reach beyond a certain quite niche area?

Jeni Tennison 28:08
Yes, I think so I'm convinced by César's description of it is something that you kind of dip into and dip out of. One of the things that is really interesting there is seeing kind of the subversion of those technologies for the purpose of art and for creativity for music, right. And I think that this is one of the places where we really need to make sure that we're not, when we're regulating these technologies, stopping that kind of creative use of them and subversive use of them. And, you know, there's similar kinds of issues with generative AI and LLMs. Currently the thing that I think is, as you use them, you get to the kind of "meh" part is that you realise that they average things, right. So the stuff that they come back with when you're brainstorming with them creatively, or you're getting them to write something is like it's the average of what people would say and do and write and draw. It's not the extremes. It's not the stuff that pushes us, it's not the stuff that excites us. And I think that that's going to be the bit that both from a technological point of view, and from a regulatory point of view is going to be the challenge. How do we allow for that experimentation, those extremes, that are outside of that "meh" average?

Rory Cellan-Jones 29:36
Let's try and end by sort of drawing common lessons for policymakers when new technologies arrive. I mean, the key thing to me seems to be deciding when they need to worry, when they need to be interested. Sam, it sometimes seems to me there's as much hype about the ethics of AI as there is about AI itself. Somebody told me that the other day, they thought there were more ethical AI institutes than AI institutes. Why has the world decided that's something to worry about, and possibly, well probably rightly, not the metaverse?

Sam Gilbert 30:09
I think there's probably too good explanations for that, or maybe three good explanations for that. The first one, I think, is that we all have quite strong mental models of what a dystopian future in which humans have been supplanted by intelligent machines looks like. And I think those background assumptions whether they come from Snow Crash or whether they come from the Terminator, or Philip K. Dick or whoever it may be. They play a really important role in how people think about technology. So, yeah, ethical AI is partly an outgrowth of it just being easy to imagine those futures thanks to sci-fi. Probably the second good explanation relates to a concept called *criti-hype*. So this is something that was coined by the

Science and Technology Studies scholar Lee Vinsel. And what he's trying to get at with that label is the situation where critics of technologies end up being backhanded promoters of the technologies in that they implicitly buy in to the most extravagant boasts that the creators of the technologies make about what they're capable of. So from the previous generation of technologies we were worried about, we might look to somebody like Shoshana Zuboff as being an unwitting proponent of criti-hype in that she believed or believes the worst things that Facebook or Cambridge Analytica said its technology could do. And as a result of that has arguably ended up setting the policy agenda around data in a way that ends up not being all that helpful because it's quite, sort of, decoupled from the much more banal reality of how targeted advertising happens. So we may be in danger with generative AI and the metaverse of also having these criti-hype dynamics. My third more sort of comical explanation for why there are so many AI ethicists is that previously, it was really hard for philosophy, academics to get jobs. And so there was just a supply of people looking to apply their ethical thinking to a real world domain.

Rory Cellan-Jones 32:31
Hurrah, it's boom time for philosophers. César, have you got to take on that?

César Hidalgo 32:35
I do think that on the one hand, there's definitely a supply and demand issue, you know, many more people can enter the field of AI ethics, whether it comes from philosophy, whether it comes from moral psychology. There's also a thing, a world in which we have developed a very moralised dialogue across a large number of topics and AI is just another example of that. So I do think there are several forces that have pushed us, you know, into that world. And I'm guilty, I wrote a book called how *How Humans Judge Machines* that compare people reactions to machines and humans, in part because I wanted to explore that as well, using, you know, the experimental methods that I felt comfortable with, and we run, you know, more than 80 experiments, you know, and, and we learn some interesting things. That people use, for example, different moral philosophies when judging machines, more utilitarian, and philosophy is based more on motivation and intention when it comes to humans. But since then, so much has happened, that it's hard to keep up with the literature, because it's a big space, and it's getting increasingly more crowded.

Rory Cellan-Jones 33:35
Finally, Jeni Tennison, isn't there a danger that we're at a moment of huge advances, potentially, with generative AI that could be very exciting, that could be incredibly positive that could, for instance, transform health care, give people with disabilities skills that are denied to them otherwise. And that we immediately see this as a huge problem that policymakers need to step down on?

Jeni Tennison 34:04
As Sam described, there's both the hype from the providers of these technologies and the kind of amplification of that through the vast amount of kind of public discourse that is currently happening around them that makes policymakers want to act and get in on the game. But actually, that discourse at

the moment, I think, is not really based on what is happening now or what will happen in the near future. I think what it really calls for is that kind of agile and responsive regulation in its broadest sense, right. Not just laws, but actually putting in place the governance structures and the places where we can have discussions about how we want this technology to be shaped. We need that to be happening now so that we can react quickly to the kinds of issues that emerge over time. And that's one of the reasons that I'm so enthusiastic about having public dialogues, having structured mechanisms for participatory and deliberative conversations about the use of technology in specific places and specific contexts. Because it will land differently in different places and over different kinds of timescales, and we need to have in place the kind of structures that will allow us to respond to that rapidly. And that only happens at a kind of much more granular level and a very context-specific level not at the higher level. So yeah, that's why I'm so keen on having governance being built into the way that we deploy these models early on, and that involving the public in deliberative dialogue.

Rory Cellan-Jones 45:51
Well, that's all we have time for on this episode. Thanks to Jeni Tennison and Sam Gilbert from the Bennett Institute and César Hidalgo from the Institute for Advanced Study in Toulouse. Let us know what you think of this latest episode of season two of Crossing Channels. You can contact us via Twitter - the Bennett Institute is @BennettInst - the Institute for Advanced Study is @IASToulouse and I am @ruskin147. If you enjoyed this episode, then do listen to our other Crossing Channels editions, notably our recent one and whether we should give children the right to vote. And please join us next month for the next edition where we'll look at the Constitution and devolution in France and the UK.