CONNECTED PLACES

TRANSCRIPT

EPISODE 64: IN CONVERSATION WITH BARONESS BROWN OF CAMBRIDGE

INTRODUCTION

[theme intro]

Baroness Brown:

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INTRO:

Welcome to Connected Places; a podcast about the future of our towns and cities, and how we live and travel in them.

I'm Ivor Wells, the producer of Connected Places, which is brought to you by the Connected Places Catapult.

We're the UK's innovation accelerator for cities, transport and places.

We help to connect businesses and public sector leaders to cutting-edge research and new technologies that can spark innovation and grow new markets.

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Music bed

Ivor:

If there are two topics that have shaped the national conversation in recent months, when it comes to our cities and transport systems, it's fair to say it's firstly climate change, as well as the future of Britain's national infrastructure.

That basket of questions about how we invest for the long-term - whether it's decarbonising the economy and backing the right industries, or the more immediate challenge of responding to environmental and climatic change that is already happening now.
These are big, systemic challenges that demand real creativity and bold decision making.

So we were delighted to have Sir John Armitt on the podcast back in the autumn talking about the UK's National Infrastructure Commission, and 5 yearly assessment of Britain's infrastructure needs the Commission presented to government back in October.

Sir John had some fascinating thoughts to share on some of the big challenges that leaders from across government and industry are grappling with, the role that innovation is playing and how we create more opportunities for entrepreneurs and businesses in the future.

So if you haven't heard the episode, then do have a listen.

Now, in this episode we we're delighted to have on the show someone who has also been very influential at the national level, bringing together the worlds of government and industry, as well as, academia.

Professor Dame Julia King, Baroness Brown of Cambridge, is a member of the House of Lords, but also an engineer by training.

She began her academic career by studying metals, and the composite structures used in wind turbines. Her specialty was designing metal alloys that are resistant to cracks under extreme pressure. Which is a fascinating story in itself.

But over the years she went on to teaching positions at the Universities of Nottingham and Cambridge, as well as senior positions at Rolls Royce, the Institute of Physics, Imperial College, and she also served as Vice-Chancellor of Aston University,

So it's fair to say that she is an expert at straddling the worlds of research and industry, project and people management, and policy and legislation.

It's a journey that's taken her from the engineering lab to the Houses of Parliament.

In 2007 Julia was appointed by Gordon Brown to lead the King Review, which looked at the vehicle and fuel technologies that, over the next 25 years, could help to reduce carbon emissions from road transport.

Then in 2015 she became a cross-bench member of the House of Lords.

She's now chair of its Science and Technology Committee, which is holding the government to account on its promise to make the UK a science superpower. And among many other hats that she wears, she's also a member of the Committee on Climate Change.

So it's a real privilege to have her on the show.

[STING]

Ivor:

Julia, I want to start at the beginning if I may, because I know your passion for science goes back a long way. Where did it begin?

Baroness Brown:

I came from a house where we made a lot of things. We did a lot of dressmaking when I was very young. And I then went to schools where we did some science, certainly at primary and secondary school. But I think at my secondary school, It was really where my passion for science really started to develop, and I think it was partly because we did Nuffield science courses, which were, in those days, they were experimental science courses, and they had moved away from science being taught through kind of lots of equations to science being taught through discovery.

So there was lots of getting the answers to things. Which I found is really useful, actually, because it's, it's about guessing how big things should be. That was, there was quite a lot of emphasis on that. To give us a sense of scale. And the more we use calculators, the more calculations are done for us by machines and things, the more valuable it is to have a sort of intuitive sense of scale.

So that you can tell whether, you know, is that a big number? Is that a sensible answer? And there was quite a lot of emphasis on, on helping us to develop that sense, which I think has been, was a very interesting part of the educational process. But certainly I had brilliant science teachers at secondary school, who were absolutely my heroines, and I was enormously motivated to try and please

them, actually, because I liked them so much, and they made science so interesting.

Ivor:

I'm curious to know what kind of student you were at school. I'm guessing you were pretty committed?

Baroness Brown:

Yes, I was a bit of a nerdy student, really. I liked to be ahead of where we were in, in classes, particularly in science classes. So I used to read the textbooks and do all the problems for the next, you know, Four or five lessons.

And actually, my physics teacher at one point got so frustrated she used to send me out of the class to go and read, uh, the Feynman lectures because I'd already done all the stuff she was about to teach. And so I was sort of irritating the others by knowing the answers to all the questions. So that wasn't, uh, that wasn't one of my favourite bits, really, because I liked being in the class.

Ivor:

Wow, I can imagine what that might have been like. Julia, I know that your curiosity eventually led you into the world of physics, and more specifically the study of metals. How did that come about?

Baroness Brown:

I went to Cambridge to study natural sciences. And I think at that stage, I thought I wasn't sure what I wanted to be. I had been brought up during the time when CERN was a very young institution and a new scientist used to report every week, the discovery of new subatomic particles at CERN.

And I thought that was all terribly exciting. I'm not sure it wasn't because New Scientist was always full of pictures of them all standing around drinking champagne celebrating, celebrating the discovery of their latest particle. And there was something rather glamorous about that, which I think I was rather attracted to actually.

So I sort of half thought I wanted to be a particle physicist. I really enjoyed chemistry at school. So I half thought I wanted to be a chemist, but I, when I got to Cambridge to do natural sciences, I discovered there was this sort of subject

in the middle, which started off as being crystallography, but then turned into, uh, material science and metallurgy.

And I absolutely got the bug for that at Cambridge. And tripos meant you could study three sciences in your first year and two in your second year and specialize in one in your final year. So I specialized in metallurgy, the study of metals in my final year.

Ivor:

Wow, fascinating. So tell me about your PhD research...

Baroness Brown:

My PhD was in the sort of engineering end of metallurgy and material science, and looking at the steels that potential reactor pressure vessels for nuclear reactors could be made of. And reactor pressure vessel walls are, are so thick that it's very hard to detect whether there is a defect.

And in those days, in the very thick walls of the pressure vessels that were being built at the time, you could have a defect the size of your hand. And depending on the orientation it was in, you might not be able to detect it by non destructive testing. So you had to assume that the vessel had defects of that size in it.

And so I was, my PhD was looking at what happens when we load defects in steels. At what point do those defects cause fracture to occur? What can we do to the heat treatment of the steel to improve its resistance to fracture, to make it more tolerant of those defects under stress? And what are the kind of effects of The exposure to high temperatures, to thermal cycling, and potentially to radiation on the steel in those reactor vessels.

How could the properties degrade over time, and could something that at the start of the life of the vessel was safe, could something like that become a defect that would cause Failure as the material degraded over time. So that was the sort of thing I was I was looking at.

Ivor:

Now I know Julia that your PhD research led to you making a transition over to industry, where you worked on the safety of aeroplane enginges at Rolls Royce. Tell me about what you were doing there.

Baroness Brown:

Well, after my PhD, I stayed on at Cambridge and did a, a postdoc research fellowship, and then indeed a fellowship that was sponsored by Rolls Royce. Then looking at the integrity of components in aero engines, which of course have not the same conditions of operation, but the same kind of safety critical, uh, features in a way that, that nuclear reactors have, you know, we have to know that they're safe because people's lives depend on them, on them being safe.

And when I'd been working for a while on this fellowship, Rolls Royce asked if I would be interested in coming and leading the materials department at Rolls Royce. They hadn't got an obvious successor for their role of head of the materials labs. And because I'd been working with them by then for a number of years, and had quite a big research group in the areas, of the sorts of materials they were interested in, they asked if I would be interested in coming and taking that job.

So I moved to Rolls Royce and started a career where I ran the materials labs for a couple of years and then I went to become director of advanced engineering for the industrial businesses and then I ran one of their manufacturing businesses and my final job at Rolls Royce was engineering director for their marine business.

So it was a bit of a roller coaster really, but it was It's a very interesting move from being a specialist to being a generalist and to learning how to be a manager and a leader. And learning that your skills were very applicable in a wide range of areas. And also learning to take risks in terms of your career, which was something I hadn't done before.

I'd had a very conventional academic career moving from a PhD to postdoc to teaching positions. And suddenly this was moving into industry and then discovering that, you know, industry expected you to move from jobs that took you out of your specialism to other roles and discovering actually how exciting that was.

Ivor:

It's absolutely fascinating the way that you describe that because I imagine that the imperative from an industry perspective is it’s about making those broader connections beyond some of the silos that you might have in academia. And I know, Julia you've spoken in the past about how passionate you are about the porosity between academia and industry and why a closer relationship between the two is so important. It sounds to me like that’s where your appreciation for that close relationship began.

Baroness Brown:

Absolutely, and I think it's recognising you have skills outside your area of expertise if you're in a university and that you can use those in other ways is important, but also getting an understanding of the constraints that people in different environments work under so that you can then understand their behaviour and their motivations.

Because when I was in the university, you know, I'd have contacts in Rolls Royce and those contacts would change fairly frequently. And I would find that enormously frustrating. Because you just have established good relationship with them. You'd kind of be thinking this is working, I really feel I'm supporting the company and getting the right information to do interesting research. And suddenly they'd be off.

And of course, when you're in industry, you realise that. If you put the best people into the interface with the university, of course those people are going to move quite quickly because you're moving the best people around every couple of years to develop their careers. But of course, timescales in universities are three, four or five years in terms of the research we do.

And it was just that recognising that actually, in a way, it was brilliant to have those people who were only there for a couple of years as your interface to Rolls Royce. Because that meant you were getting some of the brightest and the best people that Rolls Royce thought it had and that was your best opportunity really of explaining your research, but also making sure your research linked to what the challenges Rolls Royce were really experiencing were, and therefore making sure your research made a difference.

So it was that opportunity to understand the environments in different, in which different people work, the different timescales, the different time pressures they work under, the reasons why they do things, because it makes people much more empathetic. And in order for your research to be useful in a company, again you've got to understand the constraints that company works under.

And, you know, if I put myself into Rolls Royce, I remember talking to, uh, when I was in Rolls Royce, talking to a researcher at Imperial who had developed this fantastic bit of software and he'd clearly done something extremely clever. And he was, he thought, you know, it could produce quite significant improvements in performance.

But what he didn't realise was that of course we had invested millions of pounds in Rolls Royce in the design system for the whole engine, which integrates all of the different sections of the engine and their performance. And actually it's

really difficult to insert a bit of software that somebody in a university has written into a multi million pound software design system, you know, where all of the interfaces have to be updated at the same time and things.

And so it was, you just, I just felt at the time, really frustrated that had he talked to Rolls Royce and really understood how we did the design, he could have done something that fitted into our system and might therefore have been enormously useful rather than producing something very clever that probably wasn't going to get exploited.

It's actually making sure that people who are doing really useful bits of research, that we can integrate that into the way we work in a company is really important and can make a big difference. And so I think there's that porosity, that spending time in the company, people from the company. Spending time in industry, um, and indeed the same in government departments is hugely important for getting everybody communicating well and understanding each other and being empathetic to the different constraints we all work under.

Ivor:

Now, you eventually made another significant transition, this time into Government, which I'm sure came with a whole new set of challenges when it comes to joining dots and forging new relationships and finding common cause across all sorts of organisational silos and policy areas. What was that like?

Baroness Brown:

Well, I suppose my first experience of working very closely with government departments was when actually Gordon Brown invited me to lead the King Review, looking at the decarbonisation of transport.

And that's when I really got involved in climate change. And I had a team in the treasury of, I think, about five young civil servants who were drawn from the treasury, the department for transport, the business department. And we spent about two years sort of interviewing the car industry, looking at research, talking to researchers, looking at, you know, what were the options for decarbonising transport in the UK and how you might accelerate that.

And that, again, was a really interesting exercise in terms of understanding how policy worked in a government department and how policy was developed. And that's something, of course, lots of academics are very interested in. How does their research provide the evidence for evidence-based policy? And it's not quite the same in general as, as academic research.

It's much more the 80 percent solution than the 100 percent solution. So it is something that probably comes a bit more easily to engineers than perhaps to some of the pure scientists. But it's that kind of, how do you mix the best scientific research with judgment, with pragmatism or the best data with judgment and pragmatism to turn it into policy.

And so the King review, which was done between 2006 and 2008, was a really good introduction for me to working inside a government department. And, again, understanding the environment and the constraints on that, which was, which was fascinating.

Ivor:

Looking back now Julia, how well do you think we're faring on that journey?

Baroness Brown:

I think we've learned that we can do this much faster than we thought we could back then, and that it's cheaper. I mean, obviously the dramatic reduction in costs of batteries has been an absolutely crucially important driver of this. But of course, we've seen the same things in the dramatic reductions in the costs of solar and the dramatic reductions in the costs of onshore and offshore wind as well.

So we were quite cautious. I mean, we said you could decarbonise transport. We said, uh, we thought certainly for light duty vehicles it would be mostly batteries. But we thought that biofuels might play a role and even in certain situations, hydrogen might play a role. We've seen battery electric cars Develop and be adopted at a much faster rate than we dared to assume because we thought that the batteries would still be more expensive than they are now.

Hydrogen has probably developed more slowly than we thought it might have done, because I think at that time there were more demonstrations of hydrogen vehicles and more companies looking really interested in them than there are now. I think the reality of the cost of hydrogen has, and of course, contrasted with the rapid reduction in the cost of batteries has, has meant that, you know, batteries have become more dominant more quickly than we thought they would, and people have, have taken up electric vehicles and the cost of ownership is dropping faster than we could have predicted at that time, I think. So I think it's a very positive message in a way.

What I think is disappointing is that we, we thought that we would see a reduction in emissions from conventional vehicles happening to a much larger extent and much faster than it has done. So we thought there was a lot more to

come from reducing emissions from petrol and diesel cars. And that could have happened, of course, but what happened instead was that as petrol and diesel cars became more efficient, uh, people didn't stick with the same kind of car and get reduced emissions. People moved to bigger and bigger vehicles. And so we've seen cars getting bigger and bigger. And we've seen the emissions staying the same, but people able to drive much larger vehicles. And I think that's, that I think has been a policy failure because we could have seen a much more reduction in emissions from, um, from cars to date if we had reduced the emissions of, if you like, conventionally fuelled vehicles.

Ivor:

I want to change tack a bit and talk about our national infrastructure more broadly – and there's an angle to this that we're obviously passionate about at the Catapult, and that's the world of digital.

Where do you see the role of digital innovation when it comes to thinking about the resilience of our national infrastructure, particularly when we're having to deal with increasingly extreme weather events, whether its flooding or severe heat. Where do you see digital innovation playing a role?

Baroness Brown:

Firstly, I see it playing a role in taking something like the electricity system, actually in optimizing how our system works to make sure that we have the most cost effective and the most operationally effective system that we can. So I do think there needs to be much more sharing of data and finding ways to do that, that can work with all of the different commercial organisations and companies that are in our electricity system.

You've got to integrate enormous amounts of information and to optimise or to do your best to optimise that system. That's a real digitalisation and kind of big data problem or set of problems. But I think there's a special role in terms of resilience of our infrastructure more generally, which is why I get so excited about the, uh, the digital tools like Credo particularly, um, which is the area that, that so many companies I think are, are struggling with.

And that's what we hear on. The climate change committee, which is that area of interdependencies that, of course, our communication system and our electricity system, are kind of fundamental to the working of each other, but also to the working of all of our other critical infrastructure, whether it's the trains, whether it's the water system, whether it's the road transport system, they're all integrated together by their dependence on being able to communicate and, and having electricity.

And it is surprising how little insight many key organisations have into the resilience of the people they are dependent on. And it was really brought home to me by talking to the boss of a small water company, UK, well, English water company, who was expressing his frustration because he had just been investing to make one of his sites resilient to a one in 200 year flood only to discover that the electricity substation he was dependent on was only resilient to, I can't remember what the precise, but for example, was only resilient to a one in 20 year flood.

So, you know, he was going to be taken out by a lack of power way before any of his investment to make his site resilient to flooding actually became useful. And it's that understanding who you're dependent on. And then that modelling that enables you, that the digital twin approach enables you to do to say, okay, here's your town or your city or whatever it is.

Here are some example climate events, whether they're, you know, something being taken out by overheating. For example, we had the biggest hospital trust in London guys and St. Thomas's lost two data centres in the the very hot summer, I think, of 2022, and they were working for weeks at Guy's and St. Thomas's on paper based systems. So they lost a huge number of appointments and, you know, at a time when the NHS is already under such enormous stress. And so it's understanding who you're dependent on and then knowing how resilient they are to, to weather and being able to decide whether that is enough for you, which again, was the challenge that, that guys in St Thomas's, you know, didn't, weren't able to have that insight.

And as the climate gets more severe, which it's going to, we're going to get worse flooding, we're going to get heavier rainfall, we're going to get hotter summers. Being able to integrate all of this into how you're going to maintain your operations needs this, this system's thinking, but this system's thinking enabled by models and data.

And, and, you know, that's the thing I really like about, about Credo. It does it in a very simple and visual way, which makes it very easy for us to understand.

Ivor:

You just mentioned CREDO, and just for any listeners who aren’t familiar with CREDO, it’s the Climate Resilience Demonstrator, which is basically a digital twin for climate change adaptation.

It basically connects data across a system of systems, and it can show what the effect of flooding will have on the performance and service delivery of energy, water and telcoms infrastructure.

It's a really powerful tool for owners and operators of these networks, and I'll include a link in the shownotes if listeners would like to know more about CREDO, as well as the Digital Twin Hub that we host at the Catapult too.

But the climate change theme is really interesting Julia because it sits alongside one of the other roles you have, which is holding the Government to account on its plans to become a science and technology superpower by 2030. I know it's an ambition that you're very supportive of, as were are here at the Catapult too. But I know that you've also expressed some concerns about that in the past. Tell me about some of the concerns you have.

Baroness Brown:

There are quite a few things. I mean, I support the ambition, although I'm not sure I like, I like the name of the ambition. I sort of think telling people you're a superpower is a bit in your face and perhaps not my style, but I do support the ambition. You know, clearly we have a really outstanding science and technology research base in the UK, but just a couple of the things that, that worry me.

One of them is the fact that to be a science and technology superpower, we've got to be, if you like, a preferred international partner for other countries, because we're not going to do it all ourselves, but we want to be the person they think of when they want a big international collaboration. And I think the things we've done with the Horizon Association hasn't been good for our international collaboration reputation.

And I also think the challenges we've had about for visas and immigration has also made us look unappealing. We now, the visa costs for, you know, young researchers and their families coming to the UK are much higher than they are for many other countries who are very significantly capable in science and technology.

So it's much cheaper for a young postdoc and their family to go to Germany, for example. So I really think we need to rethink that because if we want to attract the brightest and the best and we're in competition with, you know, with the US, with Australia, with the rest of Europe for these young people, then we have to make it easy for them to come and make sure they're not faced with very large costs.

And it did not make sure they're not faced with being told they can't bring their families with them. So I really think we need to think harder about that. And the other thing, of course, I think we need to think much harder about is, how do we grow our own superstars? And I don't think we are doing enough.

I don't think we have an integrated enough approach to supporting education and supporting science education, such that we are really inspiring young people with science from primary onwards and encouraging more of them to study science and engineering at university. But even those who don't study science and engineering at university, we want them to be passionate about science.

We want them to be sympathetic to the investments government will need to make in science and technology. We want them to support and to be proud that their taxes are going to be used for those things in their grown up lives. And, of course, we want them to be digitally literate citizens because they've got to operate in this world where AI and big data and large language models are going to be important and where they've got to be able to distinguish truth from alternative truth.

You know, we need them to be able to understand the kind of data that would help them to think about whether or not they wanted to be vaccinated against something, you know, we are so at risk from now from things like anti vaxxer movements and people corrupting election processes and things that we need a really technically literate population, I think, in order for actually for politics, government and democracy to thrive.

Ivor:
I know you're particularly passionate about physics. Do we need to up our game when it comes to how physics is taught?

Baroness Brown:

We are desperately short of physics teachers in our schools in the UK. I was looking at some data that, that was given to my House of Lords select committee. I chair the science and technology select committee in the House of Lords. We were looking at the people requirements, the skills requirements for the science and technology superpower ambition. And what one of our witnesses described as well-off schools have only half of their physics is taught by people with a physics degree.

And when you get to schools in more deprived communities, schools where there are a lot of children on free school meals, then only 16 percent of physics is taught by people with a physics qualification. So it's not surprising that the, you

know, we are not seeing the growth in the number of students studying physics to a level that we're seeing in chemistry and biology and other subjects.

Physics is really lagging behind and it is so fundamental to engineering to so much of science to actually to medicine people with a good qualification, you know, with good A level in physics, tend to make rather good medics as well, I think, in terms of their understanding of how the systems in the body work.

And there is so much data now, both in the UK and internationally, that shows that studying science to a higher level is a significant factor in social mobility. And we talk a lot about leveling up and social mobility. And I think, you know, here's a really important weapon, getting young people to study science, to be motivated by studying science for as long as possible at school. And knowing that that will help them to get better jobs.

Ivor:

Well, hear hear to all of that. Julia, it's been so interesting talking to you but before we finish I'd be really keen to know what would you say to a young person today, particularly a young woman, who might be interested in a career in science. Looking back on your own career and your own experience in those three worlds that we've talked about, academia, industry, and now government, what would you say to someone starting out.

Baroness Brown:

I'd say, well, do it. If you want to make a real difference in, in terms of delivering net zero, if you want to make a difference to the, uh, the biodiversity crisis, study science because that's, that's the best way you're going to be able to do that.

Be prepared to take risks. I think there's something about the way we bring up girls in this country still that makes them less likely to take risks with their careers. I don't mean take risks with people's lives, but I mean be prepared to, step out of your comfort zone. Do things people tell you you can't do.

And, particularly if you're going to do that, it really helps to have a mentor who is somebody more senior than you, somebody who believes in you, and somebody who will support you to do those kinds of things. And I've had some brilliant mentors, um, through my career who've really helped me step into roles where I thought, crumbs, can I really do this?

And having their confidence was enormously helpful in helping me to do that. But I would say to them, yes, if you want to do it, do it, you know, you can do all

sorts of things and don't let other people constrain you, I think equally important.

Ivor:

It's interesting, people are a lot more honest these days about struggling with imposter syndrome. And I know you've spoken about it too, so I guess even for someone with a CV as illustrious yours, it can be a challenge for all of us sometimes to maintain that self-confidence, particularly in the complex environments like we work in.

Baroness Brown:

I think it is and I've heard, I've heard it and I was in the States doing a session with young academics and there was a young woman in my group and I was talking about it and she said, Oh, I'm so glad you said that because that's something I suffer from.

And then one of the young men actually said, but so do I. And it was, it turned into a really positive, supportive conversation where everybody was reassuring everybody. So yes, I think it's not, you know, it's something that many people suffer from and, uh, and that's, we kind of need to recognize that we're all humans and humans need support and encouragement.

Ivor:

Professor Dame Julia King, Baroness Brown of Cambridge, thank you so much for being on the Connected Places Podcast. It's been fascinating talking to you.

[Long sting]

Ivor:

Well, that's all we have time for in this episode. Don't forget you can subscribe to the Connected Places Podcast on iTunes, Spotify or wherever you get your podcasts. If you'd like to find out more about the Connected Places Catapult, visit our website at cp.catapult.org.uk.

Also – don't forget that we're running the first Connected Places Summit on 20/21 March 2024 in central London.

Across two days we'll be featuring interactive content, live project showcases, inspiring thought leadership and opportunities to connect with peers from the worlds of technology, transport, mobility, cities, academia, and Government.

Registration is now live, so do put 20-21 March 2024 in your diary now, and check out the link in the show notes to register.

Theme Music on this episode is by Phill Ward Music

This is Connected Places.

I’m Ivor Wells.

Thanks for listening.