04 What Works...for Tim Shallice

**Sophie Scott** 00:00

Hi, my name is Sophie Scott, and today on What Works, I'm going to be talking to Professor Tim Shallice. If you could tell us a little bit about why you got into psychology and cognitive psychology? What led you as a student or as a young man in that area?

**Tim Shallice** 00:29

Well, I'm afraid that things were very different in those days and you're expecting a coherent intellectual answer to your question.

**Sophie Scott** 00:37

Not necessarily!

**Tim Shallice** 00:38

You're not going to get it. I got into psychology by a rather strange route. I got a scholarship to Cambridge to do Mathematics. But mathematics was appallingly taught at Cambridge. The lecturer used to come in the room, start scribbling lines on the board, equations and derivations, facing the board. He'd do that for one hour, then leave the room. What it was all for was completely unclear. I got very bored, turned my attention to bridge and chess. And after three years doing mathematics, in my third year doing mathematics, it was clear to me that if I could have a fourth year, I'd be president of the university Bridge team, which at the time seemed a major achievement, more so than getting good degree. So, I looked around for a subject to do which you can take for one year after my Maths degree. And I met on the Christmas post, I don't know whether Christmas post is a known term these days...

**Sophie Scott** 01:38

Not by me.

**Tim Shallice** 01:40

Well, at that time, with the mass amount of Christmas cards that were sent out by British people to other British people, they needed temporary workers on the post and students often did temporary work on the post just before Christmas. And I had the good fortune to be sorting letters with someone who was doing Psychology at St Andrews, who said it was a very interesting subject. I read a book on factor analysis which was semi-mathematical. I could follow being a mathematician. It seemed quite interesting. So, I went to see the Professor of Psychology, put my name down for an experimental psychology one-year course, intending to spend all my time playing bridge.

**Sophie Scott** 02:24

Did you get to play any bridge?

**Tim Shallice** 02:25

I played bridge. We lost to Oxford by the record margin that year. But my first lecture I remember was given by Richard Gregory. And he said we will take a basically materialist view of perception in this course. Somebody put their hand up and said, if you're going to make a statement like that, you have to defend it. Obviously, it was a setup arrangement, by Richard and this PhD student. For forty minutes, there was a debate between Gregory and the PhD student, which was absolutely fascinating. With a term of that sort of thing, I was much more hooked on psychology than I was on bridge. That's how I became a psychologist.

**Sophie Scott** 03:13

That's fantastic. You're the second person to comment on Richard Gregory's lectures as well actually, it's clearly an incredibly, a phenomenal thing to be part of.

**Tim Shallice** 03:23

Also, we had experimental subjects for him, which actually involved going off in a van into the Suffolk countryside where he'd found a viaduct which had, where'd you get up, climb 10 foot at one end, see down the hole with all these distance cues, and then had a massive [UNCLEAR] you put them on [UNCLEAR] at one end and then climbed up the other end. Then the control would be in a neighbouring field. So, this was far more interesting than mathematics lectures.

**Sophie Scott** 03:56

I can see that. That's fantastic. There should definitely be more of that. So, you'd done the extra year of psychology, did that...? How did doing further research or study work for you then? What did you do?

**Tim Shallice** 04:10

Well then, I went to UCL do a PhD in Mathematical Psychology. Halfway through that I got a lectureship in Manchester. I was the only applicant. A friend of mine was organising the interviews, so I got the job. 18 months later, a Research Fellowship back in UC came up and I came back to UC to do that. And I was told to study... Again, one of these random events, I was allocated to the study of memory, a subject which was very distant for my PhD, it was an extremely boring subject at the time, it was verbal learning. But after a couple of years of teaching memory, there was a conference organised by Broadbent in Cambridge, which was three weeks, where all the leading memory theorists from America came over, or two or three of them. And it was fascinating. And then as a result of that, Gus Craig, who was then at Birkbeck, and I set up a research memory seminar. And Elizabeth Warrington used to come to these seminars. And we couldn't quite understand why a clinician should be bothering to come to our memory seminars. But in the pub one evening, because in those days seminars used to be in the late afternoon, so we could go to the pub afterwards, and she mentioned this patient she had to me, who had, according to her, intact long term memory, no short term memory. I immediately told her that that was theoretically impossible, so she'd better look again. And she said, "Well, you better come and see the patient with me." The patient had an epileptic seizure the first time I saw him, but after that turned out Elizabeth was completely right, and I was completely wrong.

**Sophie Scott** 04:37

I mean, that is a huge moment that you're describing, isn't it in terms of the sort of the history of where psychology started to go as a result of those seminars starting.

**Tim Shallice** 06:14

It started, along with John Marshall and Peter Newcombe in Oxford that helped to make neuropsychology a fashionable field. It was extremely fashionable then, until about 2000.

**Sophie Scott** 06:27

Can I ask a question that I suspect to you sounds stupid? But you mentioned that your PhD was in mathematical psychology. And for you what would be the difference between mathematical psychology and cognitive psychology or cognitive neuropsychology and not just the sort of clinical applications but the sort of the nature of it as a field to study?

**Tim Shallice** 06:55

Well, the theories in mathematical psychology tended to be much more formalised. So, you had to make mathematical derivations. And it was very fashionable in the 1960s. But didn't really get very far. Basically, the brain was a lot more complicated than we used to think.

**Sophie Scott** 07:19

So that feels like that was the limits was what we could, how far that kind of...

**Tim Shallice** 07:24

Yeah, we were dealing with things like reaction times and central discrimination and things of that sort. And the data wasn't really powerful enough to disconfirm theories. So, the theories got quite elaborate. It just sort of petered out. Well, they came back again, about 30 years later, when there was more powerful data. But at the time it was it was much less interesting than actually working with patients.

**Sophie Scott** 07:58

Yeah, what was it like working with Elizabeth? I mean, partly because of your background not being in clinical, you know, clinical issues but also because she was doing some psychology within a medical...She was at the neurology...

**Tim Shallice** 08:14

Yeah, she was in the National Hospital.

**Sophie Scott** 08:16

What was it like?

**Tim Shallice** 08:19

Well, I moved there in 1970. I was a lecturer here, well a Research Fellow from 65 to 66, then 60 to 72 I was a lecturer. Then I gave that up and became a Research Fellow in the Institute of Neurology or National Hospital. I was full time research, in fact, full time research from 72 until 1990 in various places. Being in a major neurological hospital with lots and lots of very different sorts of patients and especially working with Elizabeth was absolutely fascinating. All sorts of different disorders would be passing through the hospital. Elizabeth had two incredible skills. One was seeing a patient and realising there's some aspect of this patient, which was not what you might otherwise have expected and therefore it ought to be investigated. Secondly, she was extremely adept at organising the development of new tests in a couple of days with research assistants, so that you could be seeing a patient, she could see a patient on the Monday, if there was a patient that she thought I'd be interested in, she'd discuss it with me. Then the test would be developed particularly by her over the next two or three days and by the end of the week, we'd be testing the patient experimentally. Of course, you couldn't do that these days because no ethics committee or anything of this sort.

**Sophie Scott** 09:55

It's true when I was working with Andy Cauldron and Andy Young in the 1990s, that was pretty much what we were doing. I mean, there weren't clinics so there wasn't quite the rapid turnaround, but you've got some patients coming in and we want to test their vocal expression of emotion and something. Go and make some stimuli, go and do it now.

**Tim Shallice** 10:12

Occasionally you could meet a patient that was depressed by investigations of their condition. But much more often the patient was very pleased to be investigated, meant they were much closer to the medical profession. Their life was boring. This was an interesting episode.

**Sophie Scott** 10:31

And I think sometimes it is obviously very difficult to live with long term chronic conditions but not being ignored or just forgotten about is much, much worse than feeling like you're... This is interesting and there's some interest to be learned from this, you're, you know, part of that endeavour. And it's not a trivial path for patients.

**Tim Shallice** 10:53

I think that the majority at least will be like that.

**Sophie Scott** 10:57

Certainly my experience. What was the first big paper that you published with Elizabeth? Was it on the patient?

**Tim Shallice** 11:03

It was on this particular short-term memory patient.

**Sophie Scott** 11:05

And how did that change your kind of cognitive approach to memory?

**Tim Shallice** 11:08

Well, before I'd been what you might call a devout [UNCLEAR], I saw activity in cell assemblies leading to the formation of long-term traces. And therefore, I didn't see short term memory, or memory, as subdivided into different domains at all. And this made it clear that at least phonological short-term memory was a quite separate process from typical episodic memory, as we would now call it in other domains with one being. And at the same time, Alan Baddeley was working with Elizabeth on amnesiacs, showing that the sort of tests that our patients had great difficulty with could be done perfectly well by amnesiacs who could remember nothing virtually of what happened 20 minutes before. So, it showed that the two types of memory system are very different. And then of course, this has been developed much more with a whole variety of different memory systems.

**Sophie Scott** 12:16

So when I was a student, one of the things that seemed really impressive and exciting about kind of cognitive neuropsychology and approaches, being able to draw these distinctions across patient groups, you can find these dissociations of how the disorders apparently can break down, it did seem to tell you something about how the system seems to be working. I'm not certain, functional imaging has been quite good at supporting some of that, but I've always been of the view that if the functional imaging is inconsistent with the patient data, then something's wrong with your functional imaging. The gold standard, I think is the neuropsychological.

**Tim Shallice** 12:55

In some respects, functional imaging has gone farther. For instance, Karl Friston's ideas of the top down process going on at the same time as the bottom up. Ideas related to that didn't really come out of neuropsychology. But in many respects, I think you're right that the neuropsychology provided at least a broad overview of how the mind was organised, which functional imaging has shown to be basically right. The process hasn't developed greatly.

**Sophie Scott** 13:28

And of course, I'm being unfair.

**Tim Shallice** 13:29

From a cognitive point of view, obviously from the anatomical point of view [UNCLEAR].

**Sophie Scott** 13:32

You moved to the APU at some point, was that...?

**Tim Shallice** 13:43

In the late 1970s, my research fellowship finished and after a rather complex [UNCLEAR] with respect to Oxford, where Elizabeth and I resigned potential positions on the same day for various complicated reasons. I went to the APU, which was a very, very good place to work during the period when I was there from 1978 to 1990. But I used to come back to London, sort of, I used to spend three days a week in London and two days a week in Cambridge.

**Sophie Scott** 14:21

Was that to keep up the clinical links, or?

**Tim Shallice** 14:24

Because my research is basically neuropsychological, I needed to be with patients in some way.

**Sophie Scott** 14:32

And what was it like being at the APU? So, this is the Applied Psychology Unit , now the Cognition and Brain Sciences Unit in Cambridge. And it must be coming up to 60 years old now as a unit, it's quite...

**Tim Shallice** 14:44

I think it's more. It was founded I think in 1948.

**Sophie Scott** 14:49

So, it had roots in an extremely applied approach to Psychology. It was being faced with technical issues that needed to be solved in terms of human behaviour.

**Tim Shallice** 14:57

Particularly with respect to the armed forces, and Post Office and things like that.

**Sophie Scott** 15:02

And they used to be sailors.

**Tim Shallice** 15:03

Yes. The Armed Services. Because a lot of these applied questions came from the armed services, there was this arrangement by which sailors came along and they were subjects. So, for instance, they'd be working on the effects of heat or sounds or something like that.

**Sophie Scott** 15:20

Yes. If you remember Priscilla Choi when she first moved to Nottingham, her landlord had been one of the sailors. It was the happiest time of his life. He loved it. It was interesting.

**Tim Shallice** 15:30

It was a very nice place. It couldn't be more different from Alan Baddeley's time than being in a clinical department where patients are coming all the time and everybody's under great pressure to produce reports and things. While in the APU, we could sit around for two and a half hours at lunchtime, having a seminar on some theoretical issue. It was chalk and cheese.

**Sophie Scott** 16:00

It must have been quite an extraordinary time to be there because it did develop into a real kind of powerhouse for a lot of psychological cognitive psychology theory. When you were there was Don Norman visiting?

**Tim Shallice** 16:12

Don Norman was there in the mid 80s. Yes, yes. But, for instance, there were people like Martin Wilson, Johnson Laird was there. Geoff Hinton was there. John Morton, Tony Marcella, Carolyn Patterson. There was a gamut of people there. So intellectually a great place to be. And also, Alan Baddeley ran it very nicely. It was a very nice place to work as well, as you will remember.

**Sophie Scott** 16:45

Well, yes. I mean, obviously, it's slightly out of phase with you, but followed the same trajectory between UCL and Cambridge. The thing that really seemed striking to me, having been at UCL for PhD, and then going to the APU was actually that, at that time the similarity in the approach, there were very similar feeling seminars, like okay, let's get to the questions, come on. Now that's the real stuff starts when we'll put you on our toes. And that felt quite similar.

**Tim Shallice** 17:14

That was a characteristic of the best British Psychology at the time. When someone gave a seminar, you don't ask the polite questions, you ask them questions that are not open ended and easy to answer , you ask difficult questions put in a polite fashion.

**Sophie Scott** 17:34

Yeah, yeah. I can remember being sort of simultaneously horrified and very thrilled by it, because it seemed like the level of discussion was quite dizzying, and sitting around when I was first at the unit realising I was going to have to start asking questions after a seminar and waiting to get to a seminar where I could ask a reasonable question and not sound like a fool. And it was a massive deal. And Tony Marcella came up to me afterwards and asked me who I was, and I was like, "Yes!"

**Tim Shallice** 18:04

He always asked about 20, except when I was chairing, and he wasn't allowed to ask more than two.

**Sophie Scott** 18:12

And so, for you in terms of the kind of development of theory, how are things changing for you in that time?

**Tim Shallice** 18:18

Well, they changed a lot as a result of the influence of Geoff Hinton, who came from San Diego. And he was there from 1980 -1982, I think. But he at the time was just developing multi-level neural nets with Sejnowski. They'd seen the effect of removing one neuron from their network. This was a reading network and it produced both tiny rate of visual errors and tiny rate of semantic errors. So, I said, well this is very much what occurs in the syndrome deep dyslexia. So, he and I then tried, or he basically did all the technical work, but he and I then worked on dyslexia and tried to simulate it. And then David Plaut, who was a student of Hinton's, and I then continued to work until about 92/93. So, the way that I thought theoretically changed a lot, essentially as a result of his influence.

**Sophie Scott** 19:34

The kind of supervisory attentional system and executive function?

**Tim Shallice** 19:37

That was another of these freak events. I was friendly with George and Jean Mandela. He was an Austrian emigre in the States, but he spent a lot of time in London. So, I got to know them in London. And there was a meeting in San Diego, and I was stayed with them. John Norman came to dinner and for about half an hour before dinner, we were discussing consciousness. And the following day, I was due to go off with a couple of postdocs and John Norman's wife, to go to the south California desert for a couple of days. And she appears with a sort of reams of paper, John apparently had been up all night, sort of putting down the ideas that we casually discussed before dinner. I then went off to the Grand Canyon, came back from the Grand Canyon to San Diego, spent another day with him working on it. And this sort of started up our collaboration. And it was, in fact, that paper with him was the oddest paper I'd ever written. Because we never sat down and actually decided what we thought. He would sit... in the basement of his house looking at the surfers in the Pacific near San Diego for 13 hours a day, for about two weeks. We'd just start at the beginning of the paper, work through it, when we came to a disagreement, we'd put it to the end of the paper. We went round and round and round and round. And eventually we had a paper. Without ever having decided that that's what we thought before.

**Sophie Scott** 21:30

It's a really nice example of the whole kind of theory about writing is that it's actually a creative... You're putting words onto the page, you know. That is the thing, actually it's a cognitive process. You're not thinking it all and then just expressing it.

**Tim Shallice** 21:46

I went back to Cambridge, and we had another couple of... We sent letters to one another in those days. And then that was the paper, which of course we couldn't publish it in a journal.

**Sophie Scott** 21:59

Where did you publish it?

**Tim Shallice** 22:01

It was published in a book. Michael Posner about 20 years later came up and apologised. He gave a talk which referred extensively to our model and said, "You realise I was one of the referees that said, if you did a year’s empirical work, it would be worth publishing."

**Sophie Scott** 22:22

That's always 20/20 hindsight, isn't it? That's fantastic. And so, what... Before we come back to UCL, was there anything else that sort of strikes you about that time in Cambridge?

**Tim Shallice** 22:38

Well, just how different it was from the research world now. For instance, I was there for 12 years. I never had to present my work to any committee, never had to write anything for a committee. Alan Baddeley would go along to head office and he would say, "Well, Shallice has done X, Y, Z, W." That would be sufficient, as far as I was concerned. I think for most of the stuff, it was rather similar. So, provided that you were producing things, no one asked any questions.

**Sophie Scott** 23:21

I might... This may be an incorrect perception, but my impression when I was at the unit in the early 90s, was that it was very top heavy. The weight of the numbers of stuff was towards PIs, towards senior scientists, and there were junior staff there. But I know that... Because that did change over the next few years quite considerably.

**Tim Shallice** 23:44

What happened was that essentially, there were about 20 Senior Scientists, and they'd have at most one research officer working with them. They were all independent of each other. And quite a number of them would have a considerable amount of applied work to do. That was decided by Alan who they would be, the others were just allowed to get on with what they were doing. So, I had when I was there, one research officer, who was stationed at the National. That was it. It worked very well.

**Sophie Scott** 24:24

Yeah. It does seem quite idyllic in retrospect. I don't know how people cope without the research support now, but just the terms of the number of senior...

**Tim Shallice** 24:34

There was technical support, there was excellent technical support, excellent secretarial support, that sort of thing. That was provided collectively.

**Sophie Scott** 24:44

And what brought you back to UCL?

**Tim Shallice** 24:47

Well, as you say, it was quite idyllic, but I needed something different. I also lived in London. So, splitting my life between London and Cambridge was not ideal domestically. There used to be two Chairs in the Psychology Department, Head of Department and someone whose basic role was to encourage research. So, it was a nice position. And then that developed, thanks to Derek Roberts, who was a Professor at the time splendid character, into the ICN.

**Sophie Scott** 25:33

So, what was the route for that, because...

**Tim Shallice** 25:35

We had two lines of origin. One, Roberts himself was an electrical engineer, had been Research Director of GEC, a big electrical company, electronics company. So, he was interested in the brain as a computing device. But also, he knew David Sainsbury quite well, Lord Sainsbury and knew that Sainsbury was interested in setting up a unit somewhere, which would be related to the interface between cognition and machines. So, the ICN was set up both to do... Also, Roberts wanted to integrate in some way, at least in some areas, UCL's diverse, geographically diverse, and administratively diverse Institute of Neurology Institute of Ophthalmology. He wanted a cross-departmental, cross-institution institute, which would take a particular topic, so he decided to set up the ICN, the Institute of Cognitive Neuroscience, so that it would be a possible home to link up with a [UNCLEAR] unit if that was created by Sainsbury, which it then was. And since I'd worked with Geoff Hinton, and he was an ideal person for them to try and recruit, this all worked very well until he decided to go back to Canada, for various reasons to do with his children.

**Sophie Scott** 27:19

So that was... The ICN started in 96. Was it a sort of virtual institute for a while?

**Tim Shallice** 27:26

It was a virtual institute of nine seminars. But then, this building, the Alexandra House, which had been a company of solicitors, came on the market for one week. Roberts had to decide whether to allocate 15 years’ worth of rent to UCL to take it over, to put us in it, the ICN. He was that sort of character that he was capable of making decisions like that so quickly, which he then did.

**Sophie Scott** 27:57

I gave a talk in Manchester a few years ago. And somebody came up to me and said is that Alexandra House, because I had pictures of the ICN on my first slide, and I said, "Yes." He said I was born on the fifth floor. His dad has been the caretaker when this was the RAF building. He went to school at St George the Martyr on the corner where my son went to school, but he was a schoolmate of Trevor Robbins.

**Tim Shallice** 28:22

I thought Trevor Robbins was from South London?

**Sophie Scott** 28:24

Well, he claimed to have been to school with Trevor Robbins, primary school maybe. Anyway, that was an anecdote. It was a hospital originally.

**Tim Shallice** 28:33

I'd no idea what it was before the solicitors. I didn't know that it was RAF.

**Sophie Scott** 28:38

The officers mess was the third floor. The third floor was offices and the second floor was the map room. So that has been a huge thing though. Because the ICN, obviously, I'm biased because I'm here but it's sort of without peer in the UK and in Europe really. It very quickly became...

**Tim Shallice** 29:00

As far as we know, there was maybe one other Institute of Cognitive Neuroscience in the world, when we set it up. I don't know where it was, I don't think it was Leipzig because Leipzig you've got about four Max Planck Institutes, but they're not... One of them is straight functional imaging, for instance. And what really helped to make it now of course, was the FIL just three or four doors down, so you had what was undoubtedly the leading functional imaging lab in the world at the time, whether it still is, I don't know, but still pretty strong. And we were four doors way. Then we've got the National Hospital and patients across the square. So, it was an absolutely fantastic location. And that is enormously important.

**Sophie Scott** 29:49

I think so and I think it's remained so. It's a really important part of the Queen Square community.

**Tim Shallice** 29:55

So, for instance, the new Gatsby Wellcome building, the other side of Tottenham Court Road. Maybe half a mile away, but the number of times you go there is so much less.

**Sophie Scott** 30:04

Might as well be on the moon.

**Tim Shallice** 30:05

Not quite, but almost.

**Sophie Scott** 30:07

Yeah, it's not that kind of mix.

**Tim Shallice** 30:11

Well, being able to go to the seminar in the FIL without thinking about it.

**Sophie Scott** 30:14

Yeah. And how was that as a personal experience for you because now you're directing a unit.

**Tim Shallice** 30:23

I had this extremely supportive Provost, Derek Roberts, who made some mistakes. For instance, I wanted to offer Daniel Walpert, who was in neurophysiology in the Institute of Neurology space so as to get him, an extremely powerful researcher. Roberts refused to allow this on the grounds that he wasn't giving space to the Institute of Neurology, a couple of offices, that was all. But in general, he was incredibly supportive. So, I was allowed to select all the people available in UC, those that would come here. Without having any responsibility to organise teaching. So, it wasn't like the standard Head of Department job, which is much more bureaucratic. So, it was a very attractive thing to do for a few years.

**Sophie Scott** 31:19

Yeah. I think it's certainly; it really has... Well, it's a testament to everything involved in terms of setting it up and, again, I'm biased, but for me, it's one of the... I can't quite... I tried working in other places and it's not the same. It's not got quite that mix of sort of, it's collegiate, but also separate. You know, it's definitely...

**Tim Shallice** 31:45

Some of it was modelled on the APU, but the director doesn't direct the research, which he could in the APU. So, it's not like working in an NMRC lab or anything. On the other hand, for instance, setting up like having tea or coffee available where people can meet, this was modelled on the APU.

**Sophie Scott** 32:09

One of the things I really missed at the APU was simply being near students, feeling like part of a university. And here although we don't have undergraduate teaching on the side, we have master students, it feels like a comfortable middle ground between no students whatsoever and absolutely overwhelmed with undergraduates. There's a real sort of separation.

**Tim Shallice** 32:30

That's what we planned.

**Sophie Scott** 32:31

Exactly, I realised that.

**Tim Shallice** 32:33

The other thing that worked was the selection of staff. I had extremely cooperative and brilliant people who came to work, Uta Frith, John [UNCLEAR}, Neil Burgess, etc. Because it did appeal to people to be in this particular location.

**Sophie Scott** 32:59

Slightly different, so, you know, a good number of PIs, but also lots of space for more junior people, again gives that slightly different, you know, more like the FIL, that kind of...

**Tim Shallice** 33:11

Yeah, but at the FIL everything's open plan.

**Sophie Scott** 33:16

Thank you for not doing that. All the evidence is in now and everybody hates them, open plan offices, they're disasters. Donald Broadbent, I'm sure could have said this easily, but it's not... I'm not adding anything new to this debate, but they are an absolute disaster acoustically. I was thinking about something that you said at the centenary celebrations for the psychology department in 1997. And Peter Fonaghy had stood up and said, you know, psychology has no dominant sort of constraining theory and that's what psychodynamic approaches give you. And you said, well, we've got the brain now and the brain is giving us these sets of constraints for our theorising and our modelling, that's giving us sort of a meaningful framework to work in that we didn't have before and is there through the patient work and the functional imaging work. Does that feel to you... Have I misremembered that completely? Or does that feel that there has been a very positive outcome from this kind of development of cognitive neuroscience as a standalone discipline? Obviously, for collaborative discipline, but you know, as a new discipline.

**Tim Shallice** 34:28

Well, I'm very pleased that I said that. I don't remember saying it for a moment. I can imagine myself saying it. I think this is right that, as I said, mathematical psychology in the 1960s really wasn't getting anywhere because there were no strong empirical constraints to theorising, there were rather week empirical data, which could be fitted into all sorts of different theories. And the brain provided strong constraints, so that at least the first stage of theorising, the sort of thing you get in something like Alan Baddeley’s working memory model, which is rather simple separation of different subsystems, that's stood the test of time. Whether we've got beyond that in more computational modelling seems to be less clear. But at least we've made one major step forward.

**Sophie Scott** 35:29

I also have one, I'm trying to ask everybody this question, but one of my favourite papers from when I was an undergraduate and PhD student is Allen Newell's commentary, you can't play 20 questions with nature and win.

**Tim Shallice** 35:50

This is essentially saying the same thing. If you start from some abstract idea and then develop that idea without any strong empirical constraints, it doesn't work. You have to have, well, in his case, he was arguing for the importance of a theoretical mechanism like production systems. But I would argue that the constraint from what we know about the brain provides an equally important, possibly more important constraining factor so that you can't just do everything just from clever thinking about things in the abstract, which would be obvious to scientists in most fields anyhow.

**Sophie Scott** 36:44

I suppose one of the things that was interesting in that commentary paper was he says, you know, with all these lovely studies going on, they have nothing in common with each other, exactly as you say, because there's no kind of, from his perspective, the sort of organising framework isn't in place. Sometimes if I'm feeling depressed about functional imaging, I look at functional imaging papers and think if we just recreated it, we're still not reading each other's papers, we might be working the same constraints but we're not necessarily... Is there enough synthesising across what's going on? Are we taking enough advantage of the fact that we have this common framework that we're working with?

**Tim Shallice** 37:22

I think that's to be explained more sociologically than intellectually. When I described the way that life was in the APU, sitting around for two and a half hours having an interesting theoretical discussion, people can't do that anymore. Because they have to get the next paper out in six months. Otherwise, the possibility of moving up the academic hierarchy, getting grants would disappear. So, everybody has to have their nose to the grindstone. And if you're writing two papers a year, you have more time to think of something really original than if you're writing ten papers. I mean, I look at my own productivity, until about 1990, I was talking to Uta Frith about this two days ago, each of us had about one or two papers a year till about 19... John Duncan is the same, after 1990 getting 10-15 papers a year. The quality may not be quite the same.

**Sophie Scott** 38:25

It is true. And I think the rise in the sheer amount of administrative duties people have to do as well. As you say the technical support is different.

**Tim Shallice** 38:34

This is ridiculous. I remember towards the end of my period at the ICN, I got a memo from the personnel department or something similar, to say they wanted to know the ICN's policy on 64 different issues, which went from health and safety, cleaning, up to for instance, production of papers and the like.

**Sophie Scott** 39:02

I have one last question for you. Which is... Science is a fantastic job, and one of the things that's almost too engaging about it is it can catch up, you know, you can be thinking about it, doing it in all sorts of situations. What for you is something that you enjoy doing and have enjoyed doing that's not scientific? Any hobbies or other interests?

**Tim Shallice** 39:27

I would say well, lots of things like going to theatre and cinema, but everybody does that. My two main... All my life I've either been a rock climber or mountain walker. So, I've been in the Alps, in the Andes, in the Himalayas, and this is from being, one thing you haven't asked about, is I come from Lancashire, a county that you may have heard of. This is surrounded by little mountains, the Peak district, the Lake District, north Wales. So, from a five-year-old, I was going up mountains. I'm obsessed by mountains. But I'm even more obsessed by chess. When I was a student at Cambridge, I was only on the second chess team, but I was on the first bridge team. I gave up bridge very quickly, but I've never given up chess. I'm completely addicted to it. I shall be playing in a tournament on Saturday, another one on Tuesday.

**Sophie Scott** 40:23

This is excellent. So, this is still really a big part of your life. I just want to say thank you very much. For me, when I started at the UCL psychology department for a PhD, I could not believe that you were there because I've come from a polytechnic, and there were names floating around, I'd heard people's names. I'd been reading your papers and then you were there on the first day taking us through and teaching us. I think some of my best things I did in the first year of my PhD was doing those theoretical seminars that you used to run with the PhD students. I think I learned more about psychology and science from that year than anything before or since, it was transformative for me. So, I don't often get the opportunity to say thank you, but I would say thank you a great deal for, obviously all your work, but particularly personally for me, for that, it was amazing. It was wonderful. Thank you very much. Thanks for listening. This has been What Works. My name is Sophie Scott.