Professor Nigel Gilbert

Interviewed by

Richard Sharpe

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By Zoom

Welcome to the Archives of Information Technology where we capture the past and inspire the future. It's 2nd February, a Friday, and 2024. My name's Richard Sharpe and I've been covering first of all the computing side, then the wider side of IT as a subject since the early 1970s, was a computer programmer, operator and all those types of good things, and later on a journalist and a researcher. And I'm very pleased to introduce to the Archive today a man who I think is really quite modest. He's in fact Professor Doctor Nigel Gilbert, CBE, but he just calls himself Nigel Gilbert. But he has, he should not be modest because of the amount of publication that he's done, and also the clarity of his writing, he's a very clear writer. You were born in Birmingham, Nigel, on 21st March 1950.

That's right. First day of spring.

Quite an interesting year, because Alan Turing proselytized his test for AI and at your university, the University of Surrey, there was rather a good sculpture of Turing, is there not, on the campus?

That's right, yes, because he was, rather briefly I should say, a Guildford resident.

He was. And they've just put up another statue to him in Cambridge – I don't know whether you've seen that?

No, I haven't, no.

It's appalling. It's by Gormley and you'd think he was a librarian. It seems to be a stack of books, it really is very bad. But he was also then working on his pilot ACE machine at NPL in 1950, and of course this is two years after the famous Baby machine in Manchester, the first stored-program computer, as Manchester would claim. You have a, your parents had an academic background, is that right?

That's right. My father was, or eventually became Professor of Biophysical Chemistry at the University of Birmingham and his interest was in the structure of proteins and this was, he was working, as it were, the same sort of time as Crick and Watson, and Max Perutz, who was one of the founders of the Medical Research

Council in Cambridge. And my mother was essentially his research assistant and they worked, you know, together for twenty, thirty years. And that's actually – if you'd like me to continue – how I got into computing, because my father was trying to understand the structure of haemoglobin. Now, that's the stuff that carries oxygen around in the blood and is red, and the question was, well, how does haemoglobin carry oxygen around. It's actually quite a puzzle because if you think about it, you have to have some sort of system which will grab oxygen out of the lungs, deliver it to wherever in the body it's supposed to go, and then let go of it. Now, it's quite easy to find a chemical that grabs oxygen, it's very much more difficult to find a chemical that will let go of the oxygen at the other end. And so he had a number of, essentially equations, to try and understand how this worked, what the structure was. He found that it was mathematically impossible to solve these equations. So he hit upon the idea of simulating what was going on using, well, basically a mathematical simulation, which my mother carried out using a mechanical calculator to start off with, but then the University of Birmingham introduced a computer, a KDF9, which was English Electric KDF9, which was one of the very first computers to use transistors rather than valves, and was an object the size of, yeah, a very large room. And in order to program this you punched your program on paper tape and fed it into the computer.

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And so my first job, summer holiday job, was feeding paper tape into this computer. And then I went on to, in my sixth form, I had to do a project, and looking back on it, it was quite extraordinary really, the project I did was to write a program to calculate the optimal school timetable. And I didn't realise at the time how difficult that problem actually is, you know, it is actually a very difficult problem, sort of ultimately not a complete effort, sort of thing. But yeah, I programmed this computer in a language which was a sort of precursor to BASIC, punching it into paper tape, handed in my project. I don't know what my teachers at the time would have thought because, you know, it was pretty unheard of for anybody to use computers, let alone a seventeen-year-old. But, and of course I got access to the university computer to do it, through my mother. I mean computers were not things which were common or garden or were lying around as they might be today. So when I applied to university,

what I really would liked to have done was to do a computer science degree, and I thought this was all fascinating. I used to read computer textbooks and things, so I was a bit of a nerd as far as that was concerned. Unfortunately, however, there were no computer science undergraduate degrees in those days. I could do electrical engineering if I wanted, and I did, I applied to Southampton to do the electrical engineering, or what actually happened is I went to Cambridge and did a general engineering degree. And so I learnt about, you know, soil mechanics and partial differential equations and aeronautics and… but what I wanted to do was computer science. I was utterly uninterested in all of these things. And in the third year I got to choose an option and, you know, there were various kind of engineering options available, and one called management studies, which was essentially a business course, it had courses on economics, management, sociology of organisations, operational research and things of that kind. And there was one course that I thought was really interesting was the sociology of organisations. So I graduated and my future wife was a year behind me, as it were, doing geography at Cambridge, and so I wanted to stay in Cambridge for a bit, so I got a job as an assistant to a sociologist who was doing some quite interesting work on social class and occupation and class – I won't go into that now, although it's fascinating – but he wanted to have somebody who could add up and he thought since I had an engineering degree, I could. So I went and worked for him for about nine months and he suggested, well, why don't you do a PhD? And eventually what I did is I went back to the person who was teaching the sociology of organisations course to the engineers and said, well, can I do a PhD with you. His field was on the sociology of science and so originally I was going to do a PhD on the sociology of engineering. I managed to get a grant to do that. And after about a month of that we decided that there wasn't such a thing as the sociology of engineering and I went back to doing the sociology of science.

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And specifically what I did there was to look at the way in which scientists arrive, well, for my PhD it was an account of a particular specialty in science, called radar meteor physics, which started immediately after the war, because some scientists had observed during the war that radar equipment, which of course had been developed during the Second World War, was capable of observing meteors.

Of observing?

Meteors.

Oh, meteors, right.

Meteors. And you pointed up in the sky, looking for aeroplanes, but what you actually saw were the radiation coming out of meteorites as they passed over. Now, this was really interesting to astronomers because at that time there were no radio telescopes or anything of that kind, the only way in which you could observe the heavens was by pointing a telescope, an optical telescope. So this was the first time you could observe using any other medium. And so I tracked and interviewed these scientists who were involved in this, looking at the way in which they formed this field of science and what eventually happened to it. You know, what actually happened to it was that around about 1960 most of the people moved into what was then a completely new field of radioastronomy. So that was my PhD and then I went on to work again with my PhD supervisor on examining a controversy in science, actually in, as it happened, in biochemistry, in… which was a field in which there were two possible theories, or two theories being advocated, two contradictory ones, as it were. And what we looked at was how that controversy was eventually resolved. It was resolved in the end. One side got a Nobel Prize, the other side disappeared into… But what we were interested in there was, you know, the process of argumentation. So one example, to give you an idea, we called accounting for error, which was, how is it that scientists deal with experimental results which appear to support, for example, the other side in the controversy. And we argued that a technique that they used was to blame the problematic results on, as it were, the personal characteristics of the opposing scientist. They weren't just, they weren't really very competent scientists, they made mistakes in their experiments and blah, blah, blah. Now, because what we found when we interviewed these people about this was that, you know, scientist A accused scientist B of being incompetent, but scientist B accused scientist A of being incompetent, hence the idea of accounting for error. Anyway, at the end of all of this I managed to get a job as a lecturer in sociology.

When doing that, were you influenced by Thomas Kuhn?

Oh yes, very much so, yes.

The paradigm notion.

Indeed, yes. Yes, we wanted to go a bit further than Thomas Kuhn. Thomas Kuhn is essentially a philosopher, was a philosopher, so he was interested in how things, as it were, should be. We were interested in how things actually were on the ground with real scientists. Anyway, after, I wanted to become a, well, PhD in sociology, in sociology of science, so I started looking around for a job. I got a one-year lectureship at the University of York. And then at the end of that I looked around for another lectureship, a permanent one. Had a lot of difficulty in getting a lectureship.

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Nowadays it would have been quite impossible, because if you recall, I'd never actually done a sociology course, as such, in my life, and there I was trying to teach sociology. Eventually I managed to get a lectureship at this, what was then rather obscure university that had just been fairly recently created, in Guildford, at the University of Surrey, in a very small sociology department which had just been founded.

It used to be the Battersea College of Technology, did it not?

Indeed, yes. Yes, indeed. But Battersea College ran out of space because they were, you know, in the middle of London, wanted to expand and managed to get the county of Surrey to agree to give them a substantial chunk of land above Guildford and moved lock, stock and barrel to form the University of Surrey.

Hanging on to the side of Stag Hill.

That's it, yes.

With the cathedral on the top.

Exactly. We're just underneath the cathedral. So, I had moved into the sociology department at the University of Surrey, which was a splendid place because it was, as I say, very young, there were lots of, or several very ambitious but also young lecturers there. And so I taught research methods and one day, well, no, because it's slightly relevant to what I went on to do, I'll mention this. But I taught research methods and with another colleague, and the colleague said that one of the problems I have is teaching my students, my undergraduate sociology students, about survey sampling. The idea of sampling is that you often, almost always, if you want to do a survey you can't survey the whole of the population if you're doing a survey of Britain, you know, you can't ask 65 million people, so what you actually do is you choose a sample of them. And there are a variety of ways of choosing samples which have various advantages and disadvantages compared with each other. What you want to do, obviously, is to have a sample which is as close as possible to representative of the population as a whole. But there's quite a bit of statistics and mathematics in understanding sampling theory. These were sociology students who didn't know much mathematics and they'd probably done GCSE O level and nothing much more. So they found this really difficult. And I said, well, why don't we write a computer program to show what would happen if you chose different kinds of sample, in fact, to simulate a sampling process. And I mention this because as we got through my career you'll see the notion of simulation reappears many years later. But I wrote this program, it was written in BASIC, it was run on a teletypewriter, because the University of Surrey now had a timesharing computer. So these poor students sat in front of a teletypewriter and they got to choose how big a sample they wanted and, you know, who should be in it, and they got out at the end a distribution of the attitudes of the sampled simulated population. This was quite novel, certainly in sociology. Anyway, I went on, the next relevant thing, I think, I got involved with was I was sitting in a departmental common room, and at that time the department didn't just teach sociology, it also taught social workers, and one of the social worker lecturers was complaining that the benefit system, the welfare benefit system was so complicated and prone to error that people who were poor didn't know what to apply for, and even when they did apply, they didn't know whether the amounts of money

they got were the correct ones. And I thought to myself, well, that's interesting, maybe I should write a computer program to calculate welfare benefits for people.

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And at that time the university had a kind of internal funding system where you could apply for modest amounts of money to prototype or to start new ideas, and I applied, and what I applied for was a, what was then called, a microcomputer. The microcomputer was just about coming on stream. That was actually a North Star Horizon microcomputer which had a Z80 chip in it, two five and a quarter floppy disks. I forget how much RAM but, you know, possibly, would it be 64k? Is that a feasible… I can't remember. And this was basically the reason why I wanted to do this, because I really wanted a microcomputer and it was in today's money, and I think it was probably worth about £15,000 or so, nothing a lecturer could afford. At that time, there's been a lot of inflation since then, it didn't cost £15,000 then. So I proudly got a microcomputer. I wrote a program to do the job, and then we took it down to a portacabin in Brighton to try it out, to get some real public and some real claimants to use it. We had to start off, when we were trying, showing people what to do, by teaching them what a computer was. How to type things in, and so on, because that was completely unknown in those days. And it was so extraordinary that the local paper picked it up and put it in the Brighton *Evening Argus*, they had a feature about the electronic brain which helped you claim your welfare benefits. And then what happened, *The Guardian* saw this item in the Brighton *Evening Argus* and thought it was really interesting and put it at the bottom of the front page of *The Guardian*. So I was nationally famous. And then, the Minister for Social Security, as was, saw it and so - a lady called Lynda Chalker – and said this is really amazing, asked her officials to summon me to Westminster to be interviewed by the Minister. So it all kind of snowballed, really. Anyway, that was that, except that this was, the British government were beginning to get worried about computers. The Japanese seemed to be building, you know, taking over the world with Fujitsu, which still exists and still in the news, and other Japanese computer firms were doing really well. And so they set up something called the Alvey Programme, after, called the Alvey Programme because it was chaired by a man called John Alvey. And the Alvey Programme…

From BT, wasn't he?

That's right, yes. And they gave, the government gave the Alvey Programme a fairly substantial amount of money and said that this should be used for, to fund five kind of grand challenges. I forget what these actually were, other than one of them, which was to use the up and coming, well, expert systems, as they were then called, to help with the administration of social security. And ICL, International Computers Limited, which was at that time the, well, basically the only, I think, significant computer company in the UK, wanted to bid for this. So they gathered a set of academics and others and they came to me and said we think, you know, we're in this bid, we need to say something and do something that will help the ordinary people, not just help civil servants. So what we'd like you to do is to develop a more sophisticated version of the thing that you'd written on your microcomputer.

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So I said that sounds an interesting idea. And I went to a few meetings, was a bit astonished about how it all worked out, but ICL won the bid and I found myself with a research grant from them of three-quarters of a million pounds to do this, over five years. Which was much more money then than it is now. And I went to my vice-chancellor and said, well look, I've got this research grant, and he said, that is the single largest research grant this university has ever received. And I was a lecturer in sociology. [laughs] It's the engineers who are supposed to get huge grants to do things. So this was really fascinating stuff, because what we did was to, well this whole project was founded on using Xerox Lisp machines. So the project bought about, I don't know, a dozen of these things. And we wrote our programs in Lisp, Interlisp. Now, this was, these were amazing machines at the time, because they had a graphical input, they were, essentially when Steve Jobs went and, designing the first Apple Mac, his inspiration was the Xerox machine.

Well, it was the Lisa, wasn't it?

It was the Lisa, was it? Okay.

Yeah, quite right.

Yeah, sorry. So this was… so we had, I managed to persuade – the university didn't have much space – so I managed to persuade the university to install some portacabins, essentially. So we had in our portacabins three or four of these Interlisp machines and, which are absolutely lovely things. They had a graphic screen which had about a million pixels on them, which in those days was extraordinary.

It was.

Nowadays not so much so. So that project went on for about five years. I had six researchers working with me, and after that finished we then started a number of projects which were mainly funded by the European Union and the forerunner of Horizon and various framework programs. And moved, well, the most interesting one was on speech understanding. And, actually looking back on it, it was entirely misplaced, because what we were doing was trying to develop a speech understanding system using grammars, rather than… and syntax, while nowadays speech understanding is done using neural networks, neural networks were hardly known about in those days. But what we were trying to do was to develop a system which you could phone up on the telephone and ask about the times of flights arriving at Heathrow. Which was really difficult in those days, you had both a speech understanding and a speech generation task and a question and answer task. And this is the Q&A bit that we contributed to, because sociologists had done a lot of work on the structure of conversation. On conversation analysis, as it's called.

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So, for example, if you ask the… ask somebody, you know, what time is the flight from Barcelona going to arrive, and they say, you know, twelve thirty. And then you say, isn't that late? Is there a delay, or something. Then it's obvious to you and me that what we're talking about is the flight from Barcelona, but for a computer it has to be, as it were, know that those sorts of interconnections are what are required. And equally, it has to know that there are, the conversations take place, you know, one

person, then another person, then the first person and so on, alternating. These structures of conversation have to be thought about and built in. So we spent quite a lot of effort on that, another big consortium project. And a number of other things which are less interesting, which I won't go into. And, but at the end of all that, we fast forward to the early nineties…

Can we just pause on Alvey?

Yes.

Can we just pause on Alvey. There's been a lot of criticism of the internal organisation of Alvey, and there are quite a number of people who say that was a considerable waste of money. What's your view?

I never got to… I was not, as it were, high enough in the hierarchy to have any direct interaction with Alvey as such. So I'm not sure I can comment. As far as we were concerned in this particular, well, it was called DHSS Demonstrator, I think it was… it was a really interesting project. I think, looking back on it, it was probably a bit ahead of its time. We were doing really some, you know, state of the art stuff here and I don't think the civil servants actually were in a state to take it, to take receipt of it, as it were. But a lot of the stuff that we developed probably had an impact, you know, ten years down the line, twenty years down the line even. I would say it wasn't a waste of time at all, or waste of money. But that's just the particular bit that I was involved with, and as far as how the Alvey organisation worked out, I didn't have any contact with that. I just got [incomp 33:11], as it were.

But while we were, well, while they were and you were burrowing away on Alvey, and the Japanese on their Fourth and Fifth Computer Generation, and things were happening in Silicon Valley which were going to completely sideline all of that, which, who saw?

Well, indeed, yes. I mean hindsight is a wonderful thing. I think we'd have been in an even worse position if we hadn't had these kind of things happening. I mean, it is really important in research that you don't only back winners and that you do back

research that is going to, that could have an effect in twenty years' time. Much of, I mean one of the problems with current funding is that we're increasingly required to do things that are going to have an impact tomorrow, or next year. And…

What do you think is the state of research in the UK at the moment in your field?

Goodness, I'm not sure I want to answer that question because it would take me the rest of the hour to do it. [laughs]

[00:34:46]

Okay. You were then, in 2008, you had this Agent-Based Models *or booklet published by Sage.*

Let me back up on that, because in the early nineties I was, I'd been doing all this stuff where I was essentially importing sociological ideas into computer science, or into information technology more precisely, and I thought, well, maybe what we should do is think about it the other way round. What can computer science do for sociology. And so that is how I got into what eventually became agent-based modelling. It didn't start off called agent-based modelling, I thought that what we ought to be doing is simulating societies. Now the university, in fact my department has had a scheme whereby each year one of the lecturers in the department can suggest a topic for a small meeting in which, you know, a workshop in which people can be invited on some kind of state-of-the-art issue. And I said, well, what I – when it came round to my turn – what I'm going to do is I'm going to invite people to come to a meeting about how one can computationally simulate society. And I advertised this quite widely, not knowing whether there was anyone in the world who had anything to contribute to this. But actually, I got about twenty people, literally from all over the world, from the States, from Russia, from Australia, who came and talked about what they were doing. That, those twenty people were basically the twenty people in the world who were doing anything in this area. But we got on really well. We eventually managed to get a publisher to publish the proceedings, as it were, the papers that were presented at this workshop and a book titled *Simulating Societies*. We did it again two years later in a different place and published a book called

Artificial Societies. We tried again a year later, we had a collection of papers, we went to the publisher and said, can you publish these, and they said no, we've had enough of this, we can't keep going like this. So we went to other publishers and said, well, will you publish this, and they said no. And then we thought, well, how about starting a journal. And so we went to journal publishers and said we've got a stream of papers here on this really fascinating topic, will you start a journal, can we start a journal. And they said no. The reason they said no was, it was too interdisciplinary.

Oh dear, oh dear.

And in those days, and possibly now, the way that publishers advertise journals is to say, well, you know, this is a sociological journal so we'll bombard sociologists with it and get them to buy it. But they didn't know how to do that with something as interdisciplinary as this, because we had computer scientists, geographers, psychologists, sociologists, economists, you name it, everybody. Not to be dissuaded, we started our own journal. I should say that, perhaps backtrack a tiny bit, because we'd actually started, I'd actually started a journal, a sociological journal, nothing to do with simulating societies, two or three years earlier which was interesting because it was one of the very first online-only journals. We published it on Wiley, it was funded by a scheme run by the British Library, which was interested in innovations in academic publishing. So we started *Sociological Research Online*. And we learnt quite a lot about how to do, creating a journal and therefore we used that expertise to start the *Journal of Artificial Societies and Social Simulation*. Both of those academic journals are still going today. JASSS, as it's better known, is *the* journal in social simulation, agent-based modelling and so on. So we started a journal and it was free. There was no charge to read it and no charge to contribute to it. It could be free because we had no costs of distribution, no paper costs, no printing costs, and all the editorial work was done mainly by me in borrowed time. And that is still the case. I'm no longer the editor, but it is still free to…

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So we set up a journal and then we, there were bits we thought we ought to have, because the number of people interested was growing rapidly, we set up a learned society, the European Association of Social Simulation. And so, and then I wrote a textbook and then I wrote a little green book, as I call it, a kind of shorter book, and so on. And so by 19… well, 2000 or so, I suppose, the number of people round the world who were interested in this kind of computational sociology had grown from twenty to probably 10,000. So, that was that story. And anyway, so…

What got you interested in agents?

Well, it was kind of the obvious way to – well, at least seemed to me to be the obvious way – to think about simulating societies which are, you know, essentially interacting agents, interacting actors as the sociological jargon would have it. The first project we did was rather weird in a way, because what we were looking at was the emergence of complexity in neolithic society 20,000 years ago. You may have come across the paintings in caves in the south of France, which are one of the signs of the fact that hunter-gatherers, who used to be before then very kind of isolated in the form of tribes, but began to form communities, and there were a number of theories about why this should be. And the thing about forming communities, then you get rituals and painting and burials and all this kind of stuff. And there are theories about, for example, about the effect of the ice ages at that time, which much of Europe had become ice-bound, and the effect of that was to, as it were, squeeze a very low-density population together into the bits of the land that weren't icy. And so we were interested in, you know, just how that worked. And so I was collaborating with an archaeologist at Essex building this very first agent-based model. It was actually written in Prolog and I'm not sure that we really cracked that particular nut, did find some interesting things. But, you know, we had to work out the methodology as we went along, there was nothing really to guide us. So that's how I got into agents. So then I did agent-based modelling using Lisp, and it was somewhat easier to do than Prolog. And then we discovered a programming system called NetLogo which was the brainchild of an American, called Uri Wilensky, who was developing software for schoolchildren to use in the tradition of Marvin Minsky and Logo. But he'd sort of

taken that on and developed it a lot and we realised that the way that he'd done this made it actually very good for programming agent-based models. The 'turtles' were agents.

[00:45:24]

So you have got from this book, Agent-Based Model, *you looked at Swarm, RePast, Mason and then NetLogo.*

That's right, yes.

And NetLogo came out rather well in comparison.

Yes, yes. Well, Swarm was the first one and, as I say, programming system put together, add to SFI, the Santa Fe Institute in… well, in Santa Fe in Arizona. Is it in Arizona? [New Mexico]

I think so.

Yeah. Again, that was very much a prototype, it was written in Java, I think, or was it written in C? I forget now. And it was quite difficult to use. The delightful thing about NetLogo is that it was written for schoolkids, it was really easy to use and there was very good documentation and so on. It didn't go very quickly, but we didn't really care about that. So, but other people simply in the States took Swarm and rebuilt it and – in Java – and there's a kind of tradition of using that for agent-based modelling. But you have basically to be a pretty competent programmer to use those systems.

You illustrate this with a number of very interesting examples. I want to pick on two of them. Urban models – could you explain that?

Urban models?

Yes. You've got red people and blue people. Remember that?

Is that the segregation model?

Yes.

Oh right. Okay, yes. That's interesting you chose that one because it's both one of the simplest and also one of the first agent-based models. And in fact it was invented, as it were, before computers came along, during the Second World War the guy who invented it developed this model using coins on a chessboard. The idea is that if you have, well, let's say red households and blue households and the blue households would prefer to be surrounded by other blue households, and similarly the red households, and then you get each household to move to somewhere else, chosen, if you like, at random on a grid, if they are unhappy about their local neighbours, the other households immediately around them. After you've had this sort of running for a bit, you find, perhaps not so surprisingly, that you get clumps of red households and clumps of blue households. The surprising bit is that you get that kind of behaviour even if the households only have a very slight preference for red or for their colour. So even a slight preference, nevertheless, ends up with a highly segregated arrangement. And this is not what you kind of expect from intuition. You'd think that you'd have to be pretty kind of racist in order to have these kind of segregated neighbourhoods, and that's actually not the case. And you can demonstrate this quite nicely.

[00:50:08]

It's a good model in a number of ways, because it's a sort of thought experiment carried out by computers. Nobody is saying their households are actually red or blue, and nobody is saying that the only reason why households move is because they either like or dislike their neighbours, there are obviously much more important reasons for migration. But nevertheless, this is an interesting and slightly unexpected consequence that makes you think about societies.

Well, I was particularly interested in that because my wife comes from Detroit and I used to go and visit it quite a lot. And well, I mean you just see it there, don't you, in Detroit.

Indeed.

The other very, very interesting one, which I think is - the example that you have here – which I think is really pertinent today, is opinion dynamics.

Oh yes, right.

Can you explain that?

Yes. Well, suppose that you have, for simplicity, a political opinion, ranging from, let's say, from left to right. And you have a population of people and each of them has an opinion somewhere on the scale between left and right. So they're kind of distributed along this scale. And if people talk to each other, and in talking to each other they tend to influence each other. So somebody, you know, you talk to your family or your friends and so on, what your friends think influences what you think. Except that you don't talk to people who are very far away from your own opinion, or you talk to them but you aren't influenced by them, you know. Now, what you do with it, that's the basic kind of idea, that's the basic interaction, if you like, between our agents. So let's, as an experiment, put these, distribute these people and their opinions all the way across the scale, and then get them talking to each other, what do you think is going to happen? Well, under, quite a lot of, some circumstances, not everything, but under some circumstances what actually happened is that they polarised. That as a result of these influences, you get people drifting either to the left or to the right. And so you end up, instead of having a distribution all the way along the scale, you end up with everybody being at one or other of the extremes. Now, there are other kinds of patterns that you can get if you change the parameters model. You can actually get people to converge in the middle as well, or you can get people to converge on to a number of positions. But it's an interesting model because it, a bit like the segregation model areas talked about it, it's an interesting kind of thought experiment about how opinions change, how opinions polarise. And, yeah, there are

lots of examples all the way from, yeah, Nazi Germany through to Facebook where this sort of polarisation can be observed.

Yes. I mean it really does begin to explain the rise of Trump, does it not?

Yeah, that sort of thing. Yes.

[00:54:17]

If we could…

But I wanted to say, because there may be people listening to this who think that that's all that agent-based modelling can do.

Oh no, no.

These are two very theoretical examples. To counterpose that, let me mention a model that I'm actually working on at the moment, if I may, which might appeal to people too. A lot of us are interested in the housing market and what's happening to house prices. Can we afford to move? Why, you know, why are mortgages going up and down? Things like that. And also, if we went back to what we've just been saying, what about gentrification, the idea that particular areas that may be poor in the past get taken over by rich people. Well, what we're doing at the moment is developing a model of the English housing market in which the agents are households and these households have an income and they have a house in which they live and they may find themselves wanting to move house, they may be either renting or have a mortgage, they might even be landlords, they've bought a buy-to-let house, rent it out to other people. Now, that's the sort of starting position. Some of the households want to move, because their income has increased, for example, or they manage to get some savings, or their income has decreased and they need to move because they can't afford the rent, and they look around this virtual world and try and find another house to move to. If they're buying then they make an offer, if the offer is accepted then they may move if the house that they're moving, the owners of the house that they're moving into has managed to find a house that they want to move into. So we

model kind of housing chains that if you've ever bought a house you will be very familiar with. And we can- so what we have is people or agents moving around, and we have programmed these agents with the way in which they buy and sell and move, and what we observe is the behaviour of the model as a whole. So we can look at what happens to house prices as there is an increasing demand, for example, house prices go up. We can look at what happens to the rental prices, and are they going up and down as demand increases or reduces. And we can test, for example, the effect of increasing mortgage rates. A nice example of this is we can test what happens if the Chancellor of the Exchequer wants to encourage first-time buyers to buy houses by reducing or abolishing stamp duty for the lowest tier of houses. And I can tell you that, because we've tried this, it does nothing.

Nothing at all?

It's almost completely ineffective. And the reason for that is if you avoid stamp duty on the cheapest houses, the stamp duty is a few thousand pounds, the constraint is not that, the constraint is the amount of deposit that you have to have, so-called loan to value, to make up for that. And, you know, the Treasury keeps on trying to have these sorts of schemes to reduce stamp duty, it costs them an awful lot of money, because they're not getting the tax in, it has actually no effect on the market, I would argue from this model. Just to give you an idea, you know, the sort of things we can do with these kinds of models. I've got a paper coming out about it in the next month or two.

[00:59:02]

That's good. Now, because of its time, Agent-Based Models *from 2008 does not at all mention AI.*

No.

Which becomes a subject of yours a little later on, does it not? A great interest of yours.

Well, sort of, yes. I'm never quite… no, I wouldn't say that I'm really an AI person. I was involved in AI in the good old days, before machine learning and neural networks, but what those kind of things, which now completely dominated AI, of course, I kind of moved out of that before…

But I'm sure you have a view of it.

Oh yeah. To be honest, I'm not sure I should say this, one of the reasons I moved out of it was I thought it was actually not very interesting. It's really dramatically effective, but from an intellectual point of view, because we still don't know, and probably never will know exactly how these things work, it's a matter of trial and error. I mean if you look at how people developed Large Language Models and so on, it wasn't because they sat in their study and thought, hm, the way that we ought to build this model is with so many, so many nodes and these kind of interactions and so on, it's because it's a kind of, logically, that's the way it should be done. What they did is they messed around, tried, they tried different ideas and found one that worked. And that is exactly what people are still doing, there's, you know, a lot of kind of kitchen sink trial and error going on, and I don't find that very interesting. I'm impressed by it, but I'm the sort of guy who's much more interested in actually working out how things work, rather than…

You want more rigour?

Well, not necessarily rigour, I just would like to understand how things work. And I don't feel that most of the neural network stuff, machine learning stuff, you don't really know how it works. Everybody says it's a black box. Well, it is a black box, it's a black box not just to the users, but to the creators as well.

Isn't that the danger of them?

Well, that's a whole new story, you know, what you do with them. I was only talking about how you develop them. What you do with them is another thing altogether and I'm not, neither a pessimist or an optimist here. I mean I've been through too many technological revolutions to think that the world is going to end tomorrow just

because we've got AI. I think what we'll do is there'll be a lot of uncomfortable things happen, but we'll soldier through eventually.

Tell me about complexity science.

Right. [pause] I, I mean I used to think that complexity science was a bit of hype and it took me a long time before I would freely admit that I was actually involved in any way in complexity science, or complex systems. I'm not sure about complexity science still. But certainly the complex system. But as you will know, Santa Fe Institute was founded on the idea of complex adapted systems, and as I've already mentioned, they were also quite involved in [incomp 1:03:22] for agent-based modelling, so there is a connection there. I suppose I have to go back to my biography, if you don't mind. By 2015 or so, I'd been doing agent-based modelling for twenty-five years, I was beginning to feel a bit restless. And through a series of accidents I became director of a research centre, with an impossible name. It's called the Centre for the Evaluation of Complexity Across the Nexus, or CECAN for short, I always call it for short, CECAN. And what this is, is a research centre that's aiming to help with the evaluation of public policies, particularly ones concerned with the environment. So, if the government says we're going to do this, bringing it really up to date, the government are setting up environmental land management programmes to help farmers farm in more environmentally friendly ways, okay, they're spending a lot of money on it, is it money well spent? That's what we're talking about in the evaluation of complex public policies.

[01:05:00]

And what used to be, as it were, called the gold standard of evaluation, is to undertake a randomised control trial, which is the idea that is used in medicine, in drugs, for example. You give a random sample of people an aspirin, and you give another sample of people in the control group a placebo, a non-effective pill, and nobody knows which is which, and you see whether the treatment group gets better faster than the control. And there was a lot of effort put into using RCTs, randomised control groups, treatments, to evaluate public policies, such as environmental land management. But, actually, that's a complete non-starter. You can't do it. And you

can't do it for practical reasons, but you also can't do it for theoretical reasons because what you're doing is you are treating, if you like, a whole society, or all farmers. And therefore there's no control, and no possibility of control. So what the CECAN is essentially doing is working out ways of dealing with evaluation where you can't have a control group and where what you do has all sorts of different effects. So, you know, if you help farmers, you know, farm in a more environmentally friendly way that has all sorts of consequences on the price of food, the availability of food, on your supply chains, on energy use, on flooding. There's a long list. So, how do we do this? Well, one of the things that we rapidly got into was the idea that, you know, thinking seriously about complex systems, that public policies indeed are complex. And by that I mean not complicated, but they have non-linear effects. And they also have all sorts of – as I've already indicated – all sorts of consequences and all sorts of causal links to other parts of the system that you need to understand. So we've done quite a lot of work to help civil servants, essentially, to think in a more systems approach. And we were kind of well placed for that, because we started about seven or eight years ago, and since then there actually has been an increasing recognition amongst government, in government that you need to think in a whole systems way, rather than each policy in a silo. So we've been pushing at an open door to some extent. And one of the practical ways in which we've encouraged this is to suggest to policymakers that they engage in what we call system mapping. And system mapping is the idea that you want to change a particular policy or you have a particular policy problem, let's map out on, to start off with, on a sheet of paper with some Post-it notes, all the things that are related to that policy and domain, what influences it, what it influences. So we have a set of boxes and arrows with the boxes are factors, things that change, and the arrows are causal links, this changes that. And you may think that this is kind of obvious sort of approach, it was quite a novel idea amongst policy people. And we ran some very influential workshops with Defra – that's the Department for Environment, Food and Rural Affairs – with what was then called BEIS, which is the Business, Enterprise [Energy] and Industrial Strategy department, now split into several other component departments. And so on and so forth, doing this.

[01:09:55]

And the way we did it, it was literally to get them around a table with large sheets of paper and some Post-it notes. But then came Covid. You can't get people round a table after Covid. So we translated the whole thing online, and there's another bit of computational stuff, because I thought that maybe the way to do this would be to write an app, which people can run in a web browser in real time, collaboratively, to generate these kinds of system maps. And it had to be something that people who are non-computer people could do. We're talking about policymakers. Not actually MPs, but the people who are supporting the MPs. So I wrote pretty much in my spare time this app, it's called Prism – PRSM - and it's doing quite well actually, there are a lot of people using it for all sorts of different, in all sorts of different areas, and we're getting a kind of, developing the experience and methodology for how to use it and what to do with the maps that people produce. So that's all written in JavaScript, it's about 20,000 lines of JavaScript. And yeah, that's quite fun too. So I'm carrying on doing the same sort of thing…

You're not slowing down.

[laughs] Yeah.

I've got some specific questions for you.

Sure, please.

You have been Pro-Vice-Chancellor of the University of Surrey.

Yes.

What was your responsibility doing that?

I was in charge of staff development.

Right. What are you like…

It's a bit like being on a board of directors, so you just do one little thing.

Now, you studied this, so I wanted to know, what are you like as a manager?

[laughs] Well, I don't know, I'm not sure you should ask me that. Well, ever since the Alvey stuff, the DHSS Demonstrator, I have had a team of postdocs for many, many years, so I have a huge, you know, in the way that British universities work is you kind of hire postdocs and they come and work for you for two or three years, typically, sometimes a bit longer, and then they go off to do- they get lectureships or proper jobs. So I have actually got a huge number of ex-postdocs who are now doing all sorts of things, professors or directors or whatever, and we do keep in contact with many of them. What am I like as a manager? Well, rather hands-off, I might say.

You're not a hands-off?

No, I am a hands-off man.

You are hands-off.

Yes. I think people seem to think. I… I don't know, people seem to like working with me.

Can you be ruthless?

Well, I have been fairly ruthless, but not to my postdocs, on the whole. Tend to be ruthless with my managers rather than my subordinates, if you like. [laughs] I remember one particular occasion, I was, a boss who shall remain strictly anonymous, who was trying to persuade me to do something and I was resisting this, and he was getting very cross with me and being very rude, and I went along to a meeting with him and I brought a Dictaphone, portable tape recorder, and plonked that on the desk and said, yeah, we'll have a conversation but I'm recording every word of it. Didn't go down very well, but I got my way.

[01:14:27]

Where did you learn to write so clearly?

My dad.

Go on.

Well, he taught me to write. I mean, as you remember, he was a professor of biophysical chemistry, he was also a Fellow of the Royal Society, and he taught me about how to write succinctly, because that's what you have to do if you're a scientist, if you're writing papers for *Nature*, every word counts. And also my PhD supervisor who was also very good at writing clearly, for my PhD I - I don't know whether this was my idea or I was told to – but I was told that I was not allowed to write any word in my PhD that had more than five syllables. Which is odd. And there's another rather nice anecdote which I tell my students, is that in the bad old days in what I was writing, I think the first textbook I wrote, and I got a contract from the publisher, and the contract said that the book was to be no more than 80,000 words, which is, you know, a typical sort of length for a book. And I was writing this actually on my North Star Horizon using WordStar as a word processor, and it had in it a feature that counted words for you, and so I wrote my book and I counted the words and it came just less than 80,000 or something like that, and then I discovered that there was a bug in this word counting, it was counting full stops as words or something like that. And so actually – no, the other way round, would it be – because actually I had written about fifteen per cent more words than I was allowed. So I had to go through my manuscript and cut out ten per cent of what I had written. And actually, this was a lot of work, but I realised at the end of this that the finished product was much better than before I started. That cutting out ten per cent of the words increased the clarity of the explanation.

You do write very, very well. Very well. And I should know, I was a professional writer. Do you track your own mistakes?

Not explicitly, no. I'm not very good at diaries and things.

What are the biggest mistakes you've made in your career?

Oh dear. I suppose I ought to have a ready answer to that. It's the sort of question you get asked in job interviews, but as you may have noticed, I haven't ever had a job interview since I joined the University of Surrey. [laughs] Well, actually that's not quite true, but… Yeah, biggest mistake? I don't know. I don't go around thinking about my mistakes, I'm sorry. No, I'm not going to answer that question. Maybe I should ask it of you. You know, what were my biggest mistakes, do you think?

Oh, I don't know. I don't know you well enough, sir. You are a very prolific member of learned societies. What is this instinct that you have that needs to join?

Oh, you don't join, you get asked.

Oh, good. The degrees then.

[laughs] Well, the degrees. Okay, well, all these letters after my name. The PhD is obvious, I've got a PhD, I've got a doctorate. There's another one which is a bit rarer, which is ScD, which stands for Doctor of Science in Latin, so it's the wrong way round. There is only one reason why I've got that, it's because my mother asked me to. And the reason, how you get an ScD is all you do is you collect together your accumulated publications, in a box, and you send them off to the university, University of Cambridge in this case, and if they think that you've done enough work, you get an ScD. And I think you pay some money. The reason why I have an ScD is because – this is a lovely story – my father has an ScD, got an ScD, and if you get a degree, you are allowed to have a rather splendid gown, which is in red silk. It cost a lot of money. And my parents, or my mother bought my father this gown when he got his ScD. And my mother said, I want you to inherit this gown, it's a waste otherwise, so go and apply for an ScD. So I did.

[01:20:24]

And actually, the college, because I went to the same college as my father, I'm not quite sure how that happened, the college was rather impressed, because there were

not very many fathers and sons who have ScDs. There were a few, but not very many. So that was that one. I got a CEng because – chartered engineer – because I got an engineering degree. I got, I'm a Fellow of the British Computer Society because I'm a computer scientist. I'm a Fellow of the Academy of Social Sciences because that's a bit of the story I haven't mentioned, is that I was instrumental in setting up the Academy of Social Sciences, which is essentially the learned society equivalent, but of less status, than the Royal Society for scientists and the Royal Academy of Engineering for engineers, this is the Academy for Social Science. I'm Fellow of the Royal Academy of Engineering because they came along and asked me, essentially. And I was really impressed by that because I am the only social scientist, as far as I'm aware, to be a Fellow of the Royal Academy of Engineering.

Do you think that English, particularly university, education is too narrow?

Hm, probably. I'm a bit of an oddity because I do all these different things. But, well, increasingly it isn't, you know. I mean if you go and look at, it used to be the case that engineers did engineering, but nowadays they do all sorts of things. Undergraduate engineering, it's not just engineering by any means. And, more physicists tend to do just physics. Social scientists do an awful lot of different kinds of things. So yeah, the message has got through, I think, that just doing a narrow degree doesn't get you very far in real life. So I'd say that, yeah, perhaps there's further to go, but we've made very considerable strides over the last thirty years or so.

And Robbins really tried to start that, didn't he? The Robbins Committee?

Yes.

Because it wasn't only just more people, but also more experiment in the form of curricula.

Yeah. Yeah, I think that's, that message has really, yeah, come home now.

Thank you very much. This has been fascinating. Professor Doctor Nigel Gilbert, CBE, thank you very much for your contribution to the Archives, it's been fascinating.

It's been wonderful, thank you very much, to have the opportunity to talk about all these different things. I hope it's been interesting.

Oh, it certainly has.

[recording ends]