Capturing the Past, Inspiring the Future

Dr Stephen Castell

Interviewed by

Richard Sharpe

15th November 2019

At the

WCIT Hall,

32a Bartholomew Close, London, EC1A 7JN

Kindly provided by The Worshipful Company of Information Technologists

Welcome to the Archives of Information Technology, where we capture the past and inspire the future. It is Friday the 15th of November 2019, and we are in the City of London, in the Livery Hall of the Worshipful Company of Information Technologists. I am Richard Sharpe, and I have been covering and analysing the IT industry since the 1970s.

[00:25]

And making his contribution to the Archives today, Dr Stephen Castell, is indeed a person who spans both sides of what we would call the IT industry nowadays, information technology, both the computing side and the telecommunications side. He has also been what I would call a user, a CIO, as it was then, no, it was a Manager of Group Management Services in an international merchant bank. And he also been on supply side as well, helping develop product. And more latterly, he has been an expert witness when things have unfortunately got into the courts because people can't agree, and that's something I really want to hear about, because, there are so many instances of systems that seem to be a failure. I wonder if he sees any patterns to them. Welcome to the archive Dr Stephen.

[01:21]

Now, you were born in Cairo in 1946, and your father was in the RAF. And you came back to the UK as a, as a baby, and, moved around a lot, because your father was still in the RAF.

That's right Richard. And thank you very much by the way for inviting me to be interviewed, something I'm very interested in, and interested in the archive, the idea of the Archives, as you succinctly put it, capturing the past and inspiring the future. Would that could do that, that would be great. Yes, I came back as a babe in arms from Egypt at the end of the war, to be faced with the, the life of being a son of a serving, serving RAF, then a sergeant, flight sergeant. Eventually he, my dad did become an officer. And we moved around. I went to, we did start off in RAF Kinloss eventually, up in Scotland, which is where I started my education, and I'm always very proud and honoured to be able to say I started my education in Scotland, because you're probably aware, Scotland has probably led the world in some of the educational innovations that it brought in, not least that my sister actually went to Forres Academy and sat for something called the Moray House Test. This would be around about 1951 I think. And that was the forerunner for the whole Eleven Plus

system. It was the test bed for this idea of an entrance exam to secondary education, which…

Did you enjoy school?

…which has been around for, ever since.

It has. Did you enjoy school?

I've always enjoyed school. In fact, I enjoyed the fact that we moved every two and a half to three years. Sometimes not so much as others, and I'll come to that, one particular posting we had, which was in Malta, when I was eight, and I wanted to stay eight and on Malta for the rest of my life, it was so idyllic. [laughs] But apart from that, I've actually liked the, the excitement of going to somewhere new, and having to make new friends, and being in a new class, and, and just discovering stuff, which has always been very enjoyable for me. So, yes, so I then moved around. I went to, eventually went to eight different primary schools and three different secondary schools. One notable one was, when we were posted to RAF Wattisham in Suffolk, and I can't remember the name of the school now. I did go and visit it again quite recently, it's still there. And on the day that we arrived, which was January, my father and my mother took me in to say, 'Well can we get Stephen into this school?' literally, because we had just arrived. And the headmaster said, 'Yeah, we'd be delighted to have him. I've got his past record. Oh, by the way, everybody else is taking their Eleven Plus exam today. Stephen could literally walk in and take it. I'd be very happy to sign the documents. Or, he'd have to wait another year.' So my mum and dad looked at each other, and, I don't think I, I had really understood what, what this was about, frankly. And so I was catapulted in to taking this, really exciting exam, which I thoroughly enjoyed. I didn't realise it was as important as it was supposed to be.

And you passed it.

I passed it stunningly well. I've always thought, supposing everybody just on a random day had to take it, rather than being anxious about it for months or weeks, the, the schools would probably improve dramatically.

The A Levels you took, what were they?

Eventually I ended up at a, a wonderful grammar school called Hamond's in Swaffham in Norfolk, which was wonderful. And, I took maths, physics and, well pure and applied maths and physics. I had taken I think eleven O Levels, and then three A Levels. We might draw a veil over that, because I didn't… I also discovered girls quite heavily at that point in time…

Ah.

…as one does. And, I realised what was more important. [laughs]

[05:10]
What did you think, what do you think now, in retrospect, your parents gave you, apart from your life?

Yes, well, exactly what we're talking about. My father, the first thing he always did was to research all the local schools, and make sure that both my sister and I always got into what, the best of the schools he could find. It meant, particularly my sister, who was already in the secondary system, she's five years older than me, they had to, they had to finance about five different school uniforms, because every, every girls' grammar school or high school at that time had a different uniform. One time it would be blue, the next time it would be green, another time it would be light blue. And they were always having to fork out. And there weren't any of these sort of, second-hand, pre-loved shops then. I mean it was, it was an enormous burden for them. But, they stuck at it, and they always regarded education as being the most important thing, which I think, it's a lesson which I have learnt, and it's a lesson which we all should learn.

[06:04]

You seem to have an attitude that you love new things, and you love continuing to learn.

Absolutely.

From looking at the pattern of your career, that seems to have been an energy force for you.

Definitely an energiser. We… You know there is this theory about the triangle of capabilities. You can either be creative, analytical, or practical, on a triangle. Most people can just about be two of them, but there's a theory that says nobody can ever be all, good at all three. I'm arrogant enough to think, I'm actually very good at all three. I'm highly creative, I have, you know, I think, six impossible things before breakfast every day. I'm very analytical. I have a PhD in mathematics. You can't be other than that, if, if you're not analytical. And I'm very practical. I have formed businesses, I have run businesses, I have sold businesses, I have assisted with putting in practical, practical, useful, commercial information systems for all kinds of industries. And, it's almost a, it's almost written in the stars that one would have ended up in the IT industry, which, as we know, is only limited by a person's imagination. So it's limitless. Software is only limited by imagination. And all the time you are discovering new things. And, one of the things that I find a little bit depressing about today's IT, where the industry tends to coalesce into people that know only certain applications, or tools, or even packages, or even just one industry, and if you try and say, 'But hang on, you're a professional, shouldn't you be considering, you know, doing a feasibility study looking at other things?' they get very nervous and very uncomfortable, and say, 'Oh no, that's not invented here. We only do this.' And this is happening in something I've got very involved with in the last couple of years, which we might go on and talk to, although let's not get too bogged down, which is block chain and cryptocurrencies, where you get this almost evangelical approach now of what I call the crypto-evangelists, who cannot be swayed by their belief like a matter of religion in this new thing, which, as you and I know, ain't so new. It's, it's kind of a list processed database with a bit of encryption thrown in. And we've been doing that for like, 50 years, but, because somebody wrote this paper on how this brilliant idea of, of a way of creating certain blocks in it by another

algorithmic process, which was pretty cute actually, it's, it's achieved this mystical status. But you try and get them to look at it from the outside, as professional IT systems people, and say, 'Well there are some use cases where it could be useful, but have you thought you could do that this other way?', you, you will get black stares.

Mm.

You will be frozen out. I find that very worrying, because IT is, is about the imagination, it's about grappling with new ideas. It's not just thinking outside the box; it's not even recognising there *is* any box.

[08:49]
You graduated from the University of London, where you took your first degree in mathematics and physics, I understand those, and psychology.

Yes. It was an unusual course at the time. Psychology was only just starting in many UK universities, this is the early Sixties. And, this particular college didn't… It was, it was an affiliated college to, it was actually West Ham College of Technology as it was then. It subsequently became North East London Polytechnic, and now it's University of East London. It's, it's transmogrified various ways. But it was a, a collegiate college of the University of London, as, London is a collegiate system. And unusually, they had started a new psychology course, I think only just the year I got there, or maybe the year before. And they hadn't got so far. They didn't have a professor in charge of it. They only had what they called a recognised teacher of the University of London. That being so, I had to enrol, because it was called a General Honours degree, and I, I definitively wanted to explore the psychology, there you are, looking for new things even then, as well as doing my maths and physics, which I was very happy with. They… You had to enrol therefore, because it didn't have a professor, as an external student at the University of London. The University of London, you may know, is the world's oldest distance learning, at graduate level. It's been granting degrees to people all over the world, particularly in Africa, for like, 150 years, 200 years maybe, all by distance learning, all as so-called external students, so effectively I was no different from one of those. Illustrious background.
[10:26]

This was really rather, really rather amusing in a way. When, when you did your Part I, you did all three subjects of Part I, and then you had to drop one of the three to go on to Part II. I decided to drop the psychology, although I, I, I'm still very pleased that I did it, and we can have a separate discussion about psychology, because that's quite interesting. It's… I had an affinity for it, and, it, it raised all kinds of things, which actually come into IT as well, the whole, the meaning of meaning, epistemology, philosophy. You know, all IT people should be philosophers as well. [laughs] And, so when I came to do my finals, having dropped psychology… There was one other lad who was doing exactly the same course as me, i.e…. The mathematics, also, you either did pure and applied maths or pure maths and statistics. And a lot of people who were doing, like, chemistry with it, or biology, did pure maths and statistics. But there was only one other gentleman on the course who, who was doing pure and applied maths and physics. So there was just two of us. And we did exactly the same course, exactly the same teachers, in fact for the applied maths we had a fantastic guy who used to sit round the table and play around with mathematics. There was just two of us, you know. Wonderful. When we came to take the final exams, because he had done, I think it was chemistry the first year as his third subject, for which there was a professorship, so he had enrolled as an internal student, he was an internal student, he sat the very same paper except it was headed 'Internal', in the college, in the East End of London; *I* had to go to Alexandra Palace [both laugh] and sit amongst thousands of people from all over the world, doing it as an external student. It was really quite… I mean it was exactly the same paper, but it was a different process.

[12:21]
'68, 1968, London.

Yes, indeed. The height of, well, just so many things.

The height of it. Yes.

The Sixties. Also…

Swinging Britain.

Al… Well swinging, but also revolutionary Britain to, in a way. I remember vividly we had, there was a guy called Tariq Ali, who you might remember.

Yes.

He's still around actually. Who was an extremely powerful speaker, and I went to many of his speeches. He wasn't at our college, but he was in one of the other colleges, I can't remember one. There was so much happening in London at that time, and I, I tried to do as much of it as I could, but, not, not quite as, perhaps as intensively as when I did my A Levels.
[13:02]
But anyway, I eventually ended up getting a First Class degree. In fact there's a funny story there as well. You may want to edit this out, because it sounds like I'm boasting, but it's true. When I went back, having seen… You, you go up to the end of Senate House in London, and consult this board where it tells you, and I, I was aston- Well I was predicted an Upper Second or a First, to be fair. But, you know, there I was, and an illustrious set of names, just half a dozen of them, at the top. And I walked away, and in fact I then walked [laughs] back again and had a second look, I seem to remember. But when I went back to the college, just to say goodbye to everybody, the head of the physics department, he said, 'Oh Stephen, just, just come into my office a minute, some people want to talk to you.' I said, 'What, what's all this about?' I walked into his office, and there was all, like, six other lecturers that had lectured us, all standing behind his desk, kind of, shuffling and beaming and smiling a bit. I said, 'What's going on?' He said, 'Well, we didn't want to tell you this, but we thought you would like to know.' He said, 'When we sent your papers in, before they actually came back with the mark, they sent us a letter from the,' from the university, you know, oversight department in, in the University of London, 'saying, this, "This student has gained an enormous score. I just wanted… We're just checking before we finally declare the score, that you have no qualms over any improper study or improper method of taking the, taking the exam that he might have…"' And he said, 'I said, said, "Stephen…" I wrote back, "he's always been a fantastic student, and we wouldn't be a bit surprised, you know, there's no, he's totally honest, totally straightforward."' I said, 'Oh, OK. So, so what…' Because

you don't… You just get a First. 'So what score did I get?' He said, 'Well they then wrote us a subsequent letter saying, "Thank you for that. By the way, his, he scored on his four papers,"' well it was an average of something like 165 per cent. Which sounds odd. But you may recall, in those sorts of exams, you usually have twelve questions for a three-hour paper, and it used to say on the top, 'Full marks can be obtained for complete answers, correct answers, to five of the questions.' I had trained myself in the three hours to just start at question one, go all the way to question twelve, and basically, make an attempt, usually a pretty good attempt, at doing all twelve questions in three hours, on every single paper. I was that well-tuned. [laughs] It's a bit of exam technique as well, as well as just knowing the subject. And apparently, on one of the papers I got nearly 200 per cent. And they said, in all the history of the University of London, this was a quote, I think I've still got the letter somewhere, 'In all the history of the University of London external degrees, we have never seen a score like that on a science paper, and we don't think we will ever see it again.' [both laugh]

[15:40]
You decided to carry on and get an MSc. You went to University of Nottingham for that. '68 to '69. And after that, then you went to, '72. What happened between '69 and '72?

Well I was still at Nottingham, doing, then, I then did a year of doing a master's degree in mathematics, computer science and fluid mechanics.

Right.

And then I stayed on for another two years doing my PhD in mathematics.

OK.

You only got a grant from the Science Research Council for three years.

OK.

So I hadn't quite finished, I had only done two years of the PhD; normally it's a three-year course. So I, I had done most of the work, but I hadn't finished writing up the thesis. So in fact I didn't get the… I had left Nottingham to start my first job with British Aluminium Company research laboratories in the autumn of '71. I didn't get the PhD awarded till July '72 Because it's a three-year course.

[16:34]
What was the first computer you met, and what did you do with it?

Well the very first one was the, one of the first, the first three I think of the company, KDF9, ICT as it then was.

Right.

Or was it even English Electric? No, it was English Electric, KDF9 wasn't it.

KDF was English Electric, yes.

Yeah. Which, Eric Foxley, who was the new professor at Nottingham, had got this wonderful new mainframe called, EE, KDF9, which we used to program on punch tape, and then submit it into a batch run, and if we were lucky it would get done the same day, depending on what the loading was, and then get a huge stack of printout the next day. And away you'd go. [laughs] Tell that to the kids today, and they won't believe you. [laughs] So that was the very first serious computer I, I came, well any computer I guess.

Right.

And using punch tape machines. When I was… No no, that's not true. Because when I was at, when I was at college, before Nottingham, there was this idea of programming, learning to program, and I went on a FORTRAN course, that's true. We didn't actually have… Did they have it at London? They must have had one in the, in the college, but it wasn't used just for science. I think it was partly used for

administrative purposes. It was an IBM machine, and you used to program it on punch cards, [makes mechanical sounds].

Yes. Mm.

And you got, you got expert at actually reading the cards, as you did the tape as well actually.

You did.

And… Yes, so actually, the very first programming I did, and the very first computer, was, and I can't remember what IBM machine it would have been… Because all we ever saw was the punch card machine, you'd just go in and write some FOR…

Yes.

And that was part of a FORTRAN course I did, almost extracurricular.

The 029 card punch.

It probably was an 029, yeah.

Yes.

Yeah. Yeah, the one we had was, was actually brand new, it was the latest one. It did, a couple of feet… Well a) it was quite fast, because even, just the speed of it going… Because the early ones went shhh… [makes mechanical sounds] But this one actually went, [makes mechanical sounds]. It was very fast. And it also… I think you could run it through for a parity check as well.

Yes, you could.

Because about one in ten cards often didn't punch properly.

Yup.

Anyway. So yeah, that was the very first one. Then the one I got to know about, in fact we, as part of the computer science course, we actually had to understand the whole architecture of the KDF9, and the whole, user code. It wasn't, it wasn't… It was… Not user code. What was… Not BASIC assembler. I'm trying not think what the assembler language was for the KDF9.

The KDF9? Oh, I don't know.

Because we used to have to program in that. Because we, we learnt proper computer science, we learnt about phrase structure grammars, and we learnt about how to write a compiler, and what is a language, and, what is a bug, and mathematical logic. Lesniewski and Mikhalevsky theorem, and *modus ponens*, and, you know, mathematical logic, which is fascinating stuff, mainly done by…

You also programmed in…

…Poles and, and Russians. [laughs]

[19:27]
You also programmed in ALGOL?

Yes, oh, and, ALGOL, of course. And in fact ALGOL 68 was just coming in then.

Right.

And we had many learned lectures and discussions about ALGOL 68, which was like, this weird new language. But it was, it was the precursor of all the sort of, 3GLs and 4GLs later in a way, as well as being a very powerful, dynamic and creative and flexible language in its own right. Yes, ALGOL 60 was the main workhorse. I suppose I became… The first, you know, programming language I became very proficient in was ALGOL 60.

Right.

And indeed, for my PhD thesis, which was very unusual, if not the first one for Nottingham, as a mathematics thesis at the time, I actually programmed a lot of my new equations and transformations around some simulations through it. I say simulations, they, they came out with rather jaggedy, like the digital graph plots. Which, which went into my thesis. I think, if… If anyone were to do a study on mathematics theses in Nottingham, not that anyone will, they'd probably find mine was the first one that actually included images of computer printout in it. As a mathematics thesis. Other people have done them…

No. I understand.

So, yeah. Yeah.

[20:48]
Then in 1971, according to your own CV this is, obviously you're proud of this, you are photographed on the Data General stand. This is this US minicomputer company, rather gutsy little computer company.

Yes.

With Kenny Baker.

Yes. Well, Data…

Now Lord Baker, who was in the…

Data Fair weeks used to run every two years I think at the time.

Yes.

It was *the* main, UK anyway, exhibition and conference. And it just happened to be at the University of Nottingham that last year when I was there. And, being a research

student, I somehow managed to lig my way into it for free, getting some student pass. I don't know whether I was supposed to, but I managed to convince somebody I ought to have, since I was a student there, I could get in for free. So I was able to go round. And it was my first exposure actually to the, if you like, the commercial world of the selling. It was mainly hardware then to be fair. And in fact the Data General computer, which I then, subsequently recommended a couple of times, it was, it stood head and shoulders above many others that were around at the time. I spent quite a lot of time on the stand, talking to the guy. And, I always used to have a little routine I would write in, well it used to be an ALGOL but then would come in BASIC, so I could easily write it, just to test how fast the system was, which was actually… What was it? Well, it was finding the, it was the, the formula for finding the sum of the first ten numbers. And you put in a bigger and bigger number, and just see how long it took for the answer to come out. I mean [laughs], again, it's amazing what difference there was between…

Yes.

All these salesmen saying it's the best thing on the market, and it was quite…

Was this the Nova?

Yes.

DG Nova.

[hesitates] Was it the Nova then, or were they just about to launch the Nova? I can't remember in '71 whether they had quite launched it.

OK.

Yeah. But anyway. But as I was standing there, talking to the salesman, getting on quite well with him and really getting to know the data as it were, suddenly a big entourage came up, and there was this new MP, I think it was the first year he was an MP, beaming Kenneth, Kenneth Baker, whom we all know and love. And he came

up, and he immediately started… And he, he saw that I was talking to the thing, so he kind of came up, he thought, well this is a good photo opportunity, not just me talking to the salesman but some… So there we were. And I have a, still have a black and white photo of him beaming and me looking very studious, and… [laughs] That was my first, my first celebrity selfie as it were. [laughs]

[23:07]
So you, you moved sideways into industrial research, but mathematics in industrial research…

Indeed.

…for BACo, which is the British Aluminium Company?

Yeah, BACo. Yeah, British Aluminium Company, which had just become part of Tube Investments, which was a…

TI.

TI. A holding company for a lot of the metals industry of this country.

Right.

All now sadly gone. I think every single company in TI doesn't really exist any more. I don't know, they may do, but I… Anyway.

And you worked on a, then, it will be an ICT then, ICL…

No, it became ICL.

…14…

ICL 4120.

4120.

4120, which meant it had 20 kilobytes of core store.

Right.

Wow. And lots of tape machines. And, I worked on process engineering problems in the aluminium industry.

Oh OK.

Particularly looking… Again, this was in the days of Harold Wilson, Labour government, when they were trying to do some major industrial reorganisation. And part of it, they had helped, the Government had helped to fund a brand new aluminium smelter, weirdly back up at Invergordon in Inverness shire again, which I was very excited about. And, and they put a pier out, and it used to bring the, the, the, what's it called? The bauxite, from, in that case Africa as it was, and put it straight into the, offload it on a pier in the Firth there, and into the, into the smelter. Aluminium smelting by the so-called Hall–Héroult process is basically a huge bath about twice the size of this room, in which, which is lined with a carbon cathode surface, and then you hang these huge hangers of big blocks about, eight foot cubes, in the… and you pour in this bauxite, and you make it into a slurry. I think it had just got water with it. And, you hang these things in it, which are hanging by big thick metal iron hangers so that they're very low resistance. And you pass about 7,200 amps through it. And wait. And basically what happens is… And the electrolysis process goes on. The whole thing starts to swirl as well, because you've got Faraday's rule, or the motor rule or something, you got conducting fluid in the presence of electricity and magnetism. And the whole thing swirls round, and gets very very very very hot. And eventually, aluminium, molten aluminium starts to precipitate out at the bottom, which you then draw off. I was working specifically on modelling the voltage drop inside these carbon baked anodes, and the, the, the equation at the time was that every millivolt that you saved was worth about £50,000 a year in electricity costs. They had put it up there because it was near Dounreay, which was the, the recently-opened…

Right.

[26:05]
Yeah. Very very, very very cheap electricity, nuclear electricity power station. I'll go on about this for a bit more if you don't… If you want me to stop, I'll stop. But… Because it's very, it, it's instructive of so much about British industry, and about commercial realities. Quite apart from the fun of actually doing the mathematical modelling of, which is basically like classic equations with some really pretty funky boundary conditions. Which you then have to digitise and run on an ICL 4120, which meant every time you did your iteration, with a 50 by 50, just 50 by 50 lattice points, you actually had to write all the answers out to tape each side, and then write them all back in again to do the next… Because you didn't have enough to store them for the next step of the iteration. So you would be writing this thing. And we'd be sitting having coffee in the next room, and you'd have the little amplifier on the, on the side, and you'd listen. And you knew the, you knew the equations were converging when the note would go up and go, it would go, [makes electronic buzzing sound]. Oh, it's nearly cooked, go up there. And you'd get your next set of results. Amazing. But… So we did some analysis of this, and we tried some, changing some of the boundary conditions, including, assuming you could get better conduction. Because you used to have to put in solder between the metal bit and the, and the carbon. And often you'd get air bubbles in there, which created resistance electrically. So we certainly made some recommendations about the engineering of these carbon blocks.
[27:41]
And by the time I had left about a year and a half later, we had actually done theoretical calculations on the computer, and proposed engineering modifications to the thing. Which they did do, and it saved them about 50 millivolts a year, which was like, £250,000 a year. Which was a lot of money back in 1971.

Sure.

[28:01]
The other thing I, I started to work on, but it was a very complex problem, and, and was right in the heart of my own PhD thesis, which was in magnetogasdynamics,

actually tried to model the way that this molten conducting fluid swirled around this tank. Because what it does, it eventually wears away the cathode, and about once every so many weeks they have to shut each, each pod down, clean it all out, and re-line it with a cathode. So, if we could have found a way of maybe, if we knew exactly where the, the biggest swirl was going to come, which you might be able to model by, through the very complex equations of magnetogasdynamics, you might be able to build, do, again, an engineering design, build up the cathode there, so you had more of it to bear… You wouldn't have to shut it down so often, is the idea. And I did start working on those. But to try and numerically analyse and digitise those equations, I mean, by the time I had written the paper and, I realised I wasn't do it on the ICL 4120, even if I thought I had got it right in the first place, which I wasn't sure about. But, what's int…

You moved on to…

Can I just talk about that a little more?

Yeah, yeah.

[29:12]
Is it all right? Off my own bat, because I didn't like just working theory on this thing, I said, 'I would really like to go and *see* this smelter. Is that all right?' And they gave me a couple of days off, and I went during my Easter holidays. And me and my wife drove all the way up the east side of, of the UK, and then across to Invergordon, where we had a game of golf by the way. And if you ever go there, it's got the most charming little nine-hole golf course, where you basically go to the door of a hut, and you go to somebody in this town and get the key. You open the hut, and make yourself at home, do the thing. Leave it, leave it as you found it, and bring the key back, and leave your green fee there. And then it's got, it's got a distillery, a golf course, and the smelter, or it had the smelter because it's no longer there. And I went, was taken all round the smelter, and saw it, which, and really got, I finally experienced what I had been mathematically modelling. Which I thought was quite important actually. And, and then we came all the way down the, sorry, west side, came back down the east side.

[30:13]

But the story that comes off this is, it's almost like a double, a double irony in this. Because… OK, so when I left, we reckon we were saving about 50 millivolts, which is probably about 250,00 a year in, then, electricity costs. Roughly. Afterwards, I heard that the commercial procurement arm of British, BACo, possibly Tube Investments, had managed to do a better deal on buying the electricity from Dounreay, and at a flash, they had cut their electricity bill by about a million a year. You see? I mean it was this kind of chortle. You see, who's really important, the scientists or the commercial people? And I thought, yeah, I thought, that's an interesting lesson. Yeah, who *is* really important? You know, there's an awful lot of technology and science and engineering you could do, but, if you're, if it's about serving a commercial interest, where should you put the effort? Isn't it better to have better trained procurement professionals, maybe, than scientists? An interesting question. So I kind of ruefully said, well, maybe, maybe, maybe they're right. But then the double irony comes, because a few years after that, and this isn't so very long ago, during Maggie Thatcher's time I think, it transpired that, the new Government, and the new, whatever electricity was, had it quite been privatised then? don't think it had, decided that the electricity's being sold far too cheaply. And this time, the salespeople from the people selling the electricity did a much better job with Invergordon, and insisted they sign a new contract, which put up their electricity cost massively, to the extent that, eventually it became uneconomical to produce aluminium, and it shut down. And we don't have an aluminium industry any more. Because, they couldn't do… And you may argue, well if they'd gone on funding engineering and research, maybe they could have really, re-engineered these things so they could have run it at a fraction of the cost, actually. So it wouldn't have mattered if you put in a… You know, so, again, it's a kind of double irony.

[32:16]

It's a tension there between commerce and technology.

Yeah, it's a tension between…

You seem to have worked on that fault.

…doing the elegant and optimum outcome for a technological project, versus, well OK, yes, but, you know, what, what… Yeah, what does it do to the price of fish, kind of thing. And so many, you know, geeky nerdy types in technology get excited about, having solved a problem, and, and engineered a piece of software to do a certain thing, and you think, yeah, and? And a lot of our… Having said that of course, again, there's another irony, because a lot of the world we now live in, with these huge unicorn companies which run off the back of software, the Facebooks, the Amazons, the, Telegrams, the Instagrams, et cetera, and so on, a lot of them were driven, not so much by a market need, but by the fact they could, with this new range of tools and the Internet in particular, you find you can do new things technically. And, OK, for every Facebook, there must have been, 1,000 other companies, or 1,000 other little projects certainly, that started that never quite got it right. And it's very random, very stochastic.

[33:37]

We used to have a thing back in the early days of, even before WCIT, called the Electronic Entrepreneurs' Group, and we also had a, a City group of IT. And we used to meet… I don't know whether you used to come to those, over in the City, where we used to get together professionals, accountants, lawyers et cetera, IT types who were very young and, young and nerdy and geeky ourselves at the time. [laughs] And… But were in commercial business mainly; there weren't too many academics. And then, so-called venture capitalists, which was only a handful really, at the time in the UK. And these were the sorts of, you know, insights that emerged, that, how do you try and pick winners in IT, in a commercial sense, in a business and an infrastructure sense? It's very random and very stochastic. And you, you, maybe you can't do it. What you had to do is foster an environment where people can do exactly what I'm saying. Geeky people can just, have the joy of solving some, almost artificial, academic problem, because you never know quite what the commercial or social or business impact of that will be. And, I don't think we've ever quite… And that was the, the basic thing that came out of things like the, the Real Time Club, and this, this connection, that came out of that, trying to get governments to foster just a better environment of risk-taking. And, and funding people where you know you're going to lose… 90 per cent, you know, the typical venture capital portfolio of 100 projects, 80 of them go phut. You know, fifteen of them might stagger along, leaving you about five, a couple of them you might sell out, and if you're lucky, one of that

100 will become a fantastic thing which will get, not just your money back, but, but you know, 100 million times over. But you can't find the one unless you do the 100. And we've never been very good in this country of having the right structures, either supported by a tax system or an investment culture, that will splatter this money around, in the way they do so successfully in Silicon Valley. And it's a model which is unique actually. I mean, other, other countries and cities have tried to emulate it. And there's something about northern, well southern and north California, and the people it attracts from all over the world, and the culture, which, you can't reproduce anywhere else. [laughs]

Right.

I actually have a base in California, I know what, I know what it's like, when you're there, you feel as if you really are somewhere special.

Even Cambridge, not even Cambridge? Here.

[pause] I don't want to get started on Cambridge. I actually refused a place at St John's College when I… [laughs] I'm one of the few people that have refused to go to Cambridge. They actually offered me a place on their diploma in numerical studies, rather than going to Nottingham. And I looked at the course; I thought, do you know, if I come here, I will get so, so enamoured of the mathematics and numerical studies, which was in its early days then, that I probably won't ever… And it's such a lovely place. Because I'm an East Anglian anyway. It's such a lovely place, Cambridge. That I probably would end up being a don in Cambridge for the rest of my life. And I thought, no, that's not really what I want to do with my life. I want to be out there, at the raw and rough edge of things. So…

That was a very conscious decision of rejection on your part?

Yeah. Yeah, I had had, I had the offer from Nottingham, which was a much better course as well, it gave me both a pure and applied…

But that was before the Cambridge phenomenon.

Yes, that was before. Yeah, no, but when you say Cambridge…

Cambridge phenomenon.

Of course Cambridge were pioneers in setting up the Cambridge Science Park, and, and other, other, other ventures. But, if you think about it, it's, it's a poor substitute for what, what you've got almost hanging off, half a dozen universities in California. I mean it's, it's laughable by comparison. Having said that of course, dear Chris Curry and, gosh, I've just forgotten his name, I had lunch with him recently.

Hermann Hauser?

Hermann. Did manage to get this Acorn thing going. And then…

ARM.

AMD. Sorry… NoARM, yes. Which actually is probably, probably the UK's most successful little piece of technology ever. I mean it's in every mobile phone, two or three of them sometimes. And, and I know Hermann, I had lunch with him not too long ago, was kind of sad that he, that the shareholders were happy that they had sold out eventually. Because he would quite have liked to have kept it going and made it bigger and bigger. But, it's, it's so, it's so enormous and so important that it, that it just, it just kind of shines a spotlight on, on the paucity of what else there is.

It is making losses though.

It probably is. But does that matter? [laughs]

It may do.

Yeah.

[38:24]

Touche Ross.

Yes.

Management Consultant.

So, I went from BACo to RHP, which was another branch of the basic engineering, which was Ransome Hoffmann Pollard in Chelmsford. Which again was one of the last things that the Wilson government, the Industrial Reorganisation Corporation it was called, did to try and save the rolling bearing industry of the UK. They put together Ransome's Bearing, which were, I think high-speed aero-bearings, with Hoffmann's in Chelmsford, which were, which were road and, big, big ones, and then Pollard's which were marine bearings. Put them together into this new group called RHP Plc, and put money in to form a new bearing research centre at Chelmsford. And I actually saw an advert for a senior mathematician, which looked like a fabulous new salary. I think I moved for £500 a year, which, which seemed pretty good at the time. And it was going to be reporting to the director of research and doing fundamental new, going from process engineering to tribology and, and fluid mechanics, much more my thing, but in lubrication and noise and so on. Which, so it was good, from, from a professional interest as well as being in a company that was looking like it was trying to go there. [laughs] Again, so many ironies again. It was put together by the UK government to confront the Japanese who were taking over the world's bearing industry, saying, no, we will, we must compete with the Japanese, that's why we need research, da-da-da.
[40:00]
And we did some quite interesting research about, noise reduction, about vibration, about lubrication. And, there is still, I just, there is still a mathematical problem that comes out of that, which I, I have never solved, and I've never seen anyone else solve it, which is to do with, one of the ways you can reduce noise in a bearing, which is usually the ball race, which is usually evenly machined, to be even numbers of angular apart. So if there are ten, if there are ten balls in the ball bearing, they'll each be exactly 36 degrees apart in the whole 360 degrees. Sorry. Yes, 360. One of the, one of the tricks we tried was to machine a race that was not even. So, you, you disrupted the even nature. So, as a bearing spun, you'd still got, it's almost the same

load bearing characteristic. It wouldn't be quite the same, but it didn't make a lot of difference. But that way you destroy the building up, because, particularly for submarines and aircraft, you can get, a standing wave builds up, because of the very repetitive nature, which can create noise, and also, give you a decrease in performance of the bearing, weirdly. Because sometimes the bearing itself resonates to it. And we did try this, and we machined a couple of them, and it did kind of… It created a whole lot of new noise signatures, which was interesting.

[41:24]

But, one of the things, in terms of the practical, here's the practical coming in, when you machine a bearing, you put it on a particular piece of engineering equipment in a, in a factory, which can only do exact degrees. You can't say, I want it 32.5 degrees. It's not built to do that. So, you can put… You can specify these bearings, because, depending on their size as well, to be any set of integers, integers, you remember, that add up to 360, because you've only got 360 degrees, that you like. But, what you then may get is that the, from the triangular forces, you may find that the centripetal force does not balance out, because you don't close the triangle of forces. And when you do that mathematically, you usually end up, to satisfy the triangular forces, so you don't get a net force on the bearings, you don't, they're supposed to be spinning evenly round and round, you find you have to do half degrees, or, or… It becomes not an integer problem, but a real number problem. So here's the unsolved problem in mathematics. Prove or disprove that you can always close… Are there, are there always a set of n integers, where n is the number of balls in the bearing, such that 360 over n, such that it always closes the triangular force, the parallel grab, as a way of expressing that mathematically. But, all n are integers. Prove or disprove. And I never, I never, I still haven't done that.

[42:58]

Anyway. So, yeah, so we did work there. It didn't go very well. The whole thing was quite sick. RHP was quite sick. It wasn't competing very well with the Japanese. There was huge internal labour problems as well in all the factories. It was at a time, as you probably remember, when labour bargaining and strikes and so on were becoming such a feature of our national pastime as it were. So this would have been in the early Seventies.

Yes.

[43:29]
And, eventually I decided, do you know what, mathematics and scientific applied research in industry, I don't see much of a future for that for me, really. So I started looking around, and I must have looked at all kinds of things. I looked at all the consultancies. And the one that most attracted me and, I got offers from many others, Arthur Andersen, Sykes. What were the big ones in the computer world then? Philip Hughes and Logica.

Logica.

He had just spun off from the other one. Scientifica? What was it called? Science something.

Computer Sciences? .

Well there was Computer Sciences. No, but this was another one. CAP of course, there was CAP. I got offers from most of them to go into… Because it was booming, commercial computer consultancy.

Yes.

But the one that most attracted me was, was Touche Ross, who were just starting their management consultancy.

[44:21]
Why did they, why the most attractive?

It was smaller. It was cosier. It was… I just liked the people I met there.

Right.

And they were just starting out again. I often like new things that are starting up.

You do.

And a couple of guys I met there, there was Mike Braithwaite, and Joseph Johansson, who have been lifelong friends every since. I mean it was a, it was a wonderful ethos there, in a way that Arthur Andersen wasn't, which was already quite big already in London at the time. And, the fact that it was part of one of the top five accountancy firms, as it was then, meant that there was all sorts of opportunity to learn all about the commercial side of the accountancy. And they were the leaders in computer audit for example at the time. And, Touche Ross also had the auditing of the Post Office at the time, and I got involved in one of the annual jollies that everybody did, and they invited various people in. How do you value, for the books of the Post Office, the, the debit, the liability, that is represented by all the stamps that people have bought, but are sitting in their wallets, in their pockets, in their drawers? You've got to make an analysis, an estimate. Because it's like a prepayment, it's like an insurance policy. They've paid for it, you've got the cash in; they haven't yet had the service. OK, how do you value the service? Well, whether they post a letter or not, you still have the same costs. Would you or wouldn't you? So, we used to sit round there and come up with these amazing models about how to, [laughs] how to try and value the, the multimillions of postage stamps that were sitting out there not yet stuck on the letter and, licked and stuck on a letter. And in the end I think, being accountants, they're used to taking almost the simplest, and just, [laughs] do that.
[46:06]
Yes, so I got involved with Touche Ross, and then got immediately plunged into many, as you did, many different commercial… The first thing I did was, I went on an intensive IBM COBOL course, of course. Became quite expert in COBOL. I had a reputation for being able to spot COBOL bugs even before you put them through the compiler.

[46:27]
That is, compared with ALGOL 68, it's a dog's dinner, COBOL, isn't it?

[hesitates] Well, it… I think there are pros and cons for both. I mean, they're different application domains really.

True.

You wouldn't want to do business records processing with ALGOL.

No.

And you wouldn't want to try, try and solve funky equations in COBOL. I mean you probably could do both, but, it would be a bit of a tortuous way of programming.

There is a compute verb isn't here in COBOL.

A compute verb? [laughs]

There is.

Yeah, there probably is. Yeah.

Yes. Yes.

It would probably add two numbers up and divide by a third or something.

[46:57]
You worked on a online system in the London banking services sector.

Yes.

For an international merchant bank.

Yes. It was Bramar, b-r-e-m-a-r. Bramar Holdings Limited was one of the clients of, a new client of, of Touche Ross management consultancy. And I was thrown into managing a project to put in what was then quite an unusual thing, which was an online system, through dial-up modems, using… But we chose the latest advanced terminal at the, at the user end, which was a Hazeltine screen dumper board. It was… You could actually fill in a form on the screen, and hit a button, and it would take all

the, it would wipe, scrape all the, scrape all the data and send that all down as a record, rather than having to do each one at a time and get a response back. Which was quite revolutionary then. And Hazeltine were well ahead of the field. They were very expensive. So I did that, and it was online to Brian Tytherleigh's TSL, Time Sharing Limited, in Great Portland Street.

Right.

Dectem, Decten Equipment.

Decten?.

Yup.

Digital Equipment Corporation.

Yes.

[48:05]
And the word here, in your CV, is that you are leading a team.

Yes.

So now you're management skills are being tested.

Yes, I was basically plunged in to learning how to be a project manager at the team…

How are you as a manager?

Absolutely amazing. [both laugh] I mean what do you expect me to say? [pause] I think I am. I've done a lot of, as you know, the last 35 years, major expert witness jobs, and sometimes I have a team of experts, who are all prima donnas in their own field. And, I do, I do… My management principle is that, he manages best who manages himself. And I really don't have time for people who can't manage

themselves. But those that I can, I will weld into a very powerful team. So I never, to be fair, I never had to manage a large department in a company which, where you could have a whole range of, standards of skill, and, motivations and training. It's, it's usually been at the fairly rarefied end of people who are top consultants in the IT world; those, those are actually the teams I am good at managing. But mainly because they're pretty good at managing themselves. But nevertheless, need to be kept on target, and need to be… I mean, the CASTELL motto, my consultancy motto, is, the, the sharpest sword is forged in the fiercest flame. And I always say, every team, every, you know, genius, every leader, needs a team round him, if only to be devil's advocate on everything. We always sit around and say, 'OK, today *you* are going to tell us why we're all wrong. Tomorrow it can be you. And I want you to make sure you can poke holes in everything we say, and tell us it's rubbish. Because that way we will, we will find the truth and the right way to do it.' And it's a very good team technique, I think, which is probably underutilised.

[49:58]
Are you a good butcher?

I'm not, never been a butcher. I'm not really a meat man. Having said that, one of my holiday jobs was at Mattessons meat in, [laughs] in Stratford.

No, but you know what I mean. A management butcher.

Oh a management butcher. Well, yes. [laughs] The mantra, the point about project management, as I say, is, you're not there to be loved. You've got to take difficult decisions. And difficult decisions, by definition, are going to satisfy one set of people and piss off the other people. And you've got to be able to take them and stick by them. You must be sensitive to people's emotions and, and motivations. The trick is to try and, to try and prepare the way you do things, so that by the time you take the decision and a chop comes, to use your butcher analogy, the person that is being chopped, or is having his wonderful idea chopped, or maybe you saying, 'Sorry, you have to go,' kind of sees the logic for it, and has almost bought into it if you're lucky. So he is almost saying, 'Well do you know what, if I was you, I would do the same.' That's what, that's the reaction you should try and get from somebody… So they, so

it becomes a, it still becomes a colle- The idea of collegiate decision-making is really fascinating, and really powerful. So even when I am telling you, 'I'm sorry, I've got to tell take you out and shoot you,' you say, 'Do you k now what? That's… Yeah, as a collegiate decision, I see the rationale for that, and I think you're making the best decision. Bye. Where is the blindfold?' I mean, you, you hopefully, if, if you can get it right, it's a good thing to try and aim for, that even the people whose decisions you are taking, against their interests as it were, can still see the value, and buy into the, the emotion, both emotionally and intellectually, that it is the best, in the best of all possible worlds. You may have an argument, they may try and convince you for personal reasons why not, that some other, some other route should be taken. But yeah, so, to that extent… I mean I have studied the process of management, I'm a member of the Institute of Management, a member of the Institute of Directors, I've read books on management. When I was at the BBC, I almost decided to write a book on management, because, when I did my five-year consultancy with BBC Enterprises, getting BBC Datacast off the ground, which was this peculiar combination of IT, telecoms and broadcasting, precursor to the Internet, being able to transmit commercial data instantly, in one-fiftieth of a second, nationwide, one way only but still very powerful, [laughs] I remember writing a, a review, after I had been there a little while, about where to go with BBC Datacast. And I did my usual consultant's thorough job, and then come out with recommendations. And a nice guy there, what was his name? He ran BBC Enterprises. The admin side, not, not the chief executive. We had a lovely little coffee together afterwards. He said, 'Well all the board's read it, and I've read it, and, it's absolutely wonderful Stephen, thank you so much for doing the work. But do you know what? I don't think the BBC is up to putting all these things in place.' I said, 'But, you know, if you're going to do it properly, this is the way you've got to go. I mean not necessarily all of it. As you see, I've given you various options of the way to go.' 'Well, Stephen,' he said, and he kind of, closed the thing up and chucked it on his desk. He said, 'I expect we'll muddle through somehow. We always have.' And I thought, and I've heard other people say this about the style of, of Britain, we'll muddle through, as… You know, Britain's always… And OK, all these world wars, it's created the biggest empire, for all sorts of reasons, but it's always done on a muddle through basis. [laughs] And I thought, that's it, I'm going to write my wonderful, world-winning, millionaire making management, management training book, which is called *The Muddle Through*

Manager. Because actually, [laughs] that's probably more practical than anything else.

[53:55]
You eventually, by being Manager, Group Management Services at Bramar Holdings, did a number of applications for them, and so and so forth. But in '78, was the breakout year when you formed CASTELL Consulting. And, interestingly, it is, you point out, the same year that Butler Cox from PActel were launched.

Yes.

And those also used the term information technology.

That's right. That's what sticks in my mind. Butler, George Butler and, and – George Cox and David Butler, who became great chums, broke out of Diebold and formed the Butler Cox company, and I did a lot of work with them as one of their consultants when they were first doing their multi-client studies on things like video techs and telecoms and so on. And then, from PA Consultants, who were one of the big consultancies, they formed this PActel. Both of them… I mean I call… My strapline was management and financial consultants 'in information technology'. They came out with whatever their strapline was, 'in information technology', PActel. But it was a relatively unusual term to use, to say, we're in the ind- 'Oh, what's that?' at the time. And that's why I remember it, because it was like, three companies formed in the first year. They grew, both of them have grown. I mean, I don't know whether PActel's still there, but, well PA's still there. Butler Cox of course eventually sold out to Hoskins I think, and they both retired. Well David Butler's still around, he's doing stuff on, on government grants for research and so on, I've come cross him quite recently. But yeah, that, that was quite interesting from that, from that light, and that direction, perspective, alone.

An interesting year, because, I characterise it as the year that IT became conscious of itself, and indeed it does with that title.

Mm.

Because, it was also the year that James Martin published The Wired Society.

Exactly. Yup.

And it was also the year I think that one of the more famous books about the microelectronics revolution came out. So, the year in which the industry was getting, getting aware of itself.

Well, let me…

What were your first…

Just dwell on that a bit more.

Sure. Do.

[56:13]
Because… These are very interesting years, not just '78. '75, '76, again, being in a merchant bank, I think they may have come to the merchant bank for finals, and we couldn't help them. I came across one Paul O'Grady and Brian Reynolds, who then had this amazing thing called a microprocessor. 'A what?' I said. 'A what?' 'Have you not heard about them?' 'No.' 'Not many people have. We've got one of the first development kits for the Intel 4040 microprocessor.' 'Really?' 'Yeah. And we, we're going to start off just, training engineers on how to program it.' 'Oh, OK. I'd like to get in on that.' So I went to one. And then they said, eventually, 'Well why don't you…' Again, it exploded. 'Why don't you take some of their…' And as a sideline to what I was doing, I helped them with some of their training courses on the Intel microprocessor. I thought, now this is interesting, I thought. And indeed, then, we did, we did various other things. We would go and do… We formed a company called Microcomputer Land, the idea being – a micro shop as well, the idea being, we see the day when computers will be sold in shops. Wow, what? No. They then went on and formed Micro Focus, with their CIS COBOL, which was unusual, and it's still there today. And, they got too busy to worry about having a shop as well.

[57:35]
Interestingly, I came across a guy called Geoff Planer, Geoffrey Planer, his name should come in here, who is the brother of Nigel Planer, and Roger Planer, they're three brothers of a father who founded a physics, physics instrument company. Geoff still runs that company. Nigel of course is the actor that's in *The Young Ones*. And Roger is an accountant with other companies I think. And for some reason I came across him. Because he had actually opened, probably *the* first computer shop in London, just off Victoria Street, called, strange name, Beyts Logic, b-e-y-t-s, Logic. And one day I found myself wandering into the shop, and there were, computers on sale. There was a Commodore PET I think, and something else. And I got to know Geoff very well. He was for a while married to Jane Seymour, very, very, for about a year. And he has become a lifelong friend as well, Geoff. And, we got discussing, discussing. And we decided, in, this is a bit later, that what the, what was needed was an introductory book for computers. And we, I wrote *Computer Bluff*, which he illus- He's very well-known in women's magazines for being a cartoonist. Jeep. I think he's had cartoons running in *Woman* magazine for, like, 50 years or something. So he did all the cartoons for it. And, he published it with his publishing house. Became a bestseller. We sold about 20,000 copies, which is quite a lot for a little technical book. And do you know what, I read that from time to time. It's still just as good as it ever was.

1983.

That was '83. I started it I think a little bit before that. But it was all in that period.

Right.

Yes.

[59:12]
Who were your first customers at CASTELL?

Well, that's interesting. The very first client I had, and I only had the one, was one that we had been discussing when I was in Bramar, this whole idea of venture capital.

I wrote a whole analysis of something called… The Anglo-German Foundation had produced a report in 1976, '77, entitled the financing of new technology…' NTBF, 'New Technology-Based Firms: a comparative study between Germany and the UK.' And I wrote a very, almost passion, impassioned article, which they then put with a big picture of me on a big page of *Computer Weekly* saying, 'Castell says we must start backing venture capital,' and, 'there are new technologies,' de-da de-da de-da de-da. Actually I had completely forgotten about that. And it caused quite a stir, from all sorts of places. I got phone calls from all sorts of people, including one Tom Wilmot of Harvard Securities, who had just started, under a new change in the law of the then quite new Companies Act, which allowed for so-called licensed dealers in securities, to basically act as traders for stocks and shares without being members of the Stock Exchange. The Stock Exchange did not like that very much, because they had a cosy club called the Stock Exchange, which at that time was very nicely carved up between stock jobbers and stock brokers, as you can well remember, till, till the Big Bang later on, and, they always look with deep suspicion about these licensed dealers, of which there was quite a flowering of 20 or 30 of them at the time. But Harvard were far and away the, in a class of their own. They quickly achieved multimillion turnover, and they managed to find, to quite hard pressure, it has to be said, what you might call boiler house techniques these days, lots of private investors. They told me at the time, 'Look, we've got dentists, doctors, lawyers, who have got lots of good income, and they don't want to go and put it on big traditional stocks from the Stock Exchange. They want something that's a bit more younger and that they can make big… You know, OK, it's more risky, but they want something they can have fun with, and, you know, that's what we're here to do.' So he had made a big name, and you may remember it, he had, he had started… They suspended, was it Burma Oil shares? Or was it BP's? Burma Oil I think. For some reason, they were suspended on the Stock Exchange. And he said, 'Well, if they're suspended on the Stock Exchange, they're still public company shares. I can trade in them.' And he started his own market in these Burma company shares, and allowed people, got liquidity for the shares. And it caused a furore with the Stock Exchange. He said, 'No, we're legally fine. It's… These are public company shares, they're freely tradable, and that's what we're doing. We have a licence to do so. If you've suspended them on your private exchange, that, you know, that's your lookout, not ours.' And, I don't know whether they actually took him to court, but anyway, they

lost, and it established the point that licensed dealers in securities were effectively able to launch their own over-the-counter market.

[1:02:15]

So I became… My only client when I started was, for £100 per month retainer, was to work with Harvard, and eventually got on their letterhead as their, as their advising consultants, to go out and find new start-up, new technology companies. Which I did. And for the next five years I must have looked at 400 to 500 new, new companies. And out of those we floated about, six.

[1:02:41]

What was the quality?

Well, it's the usual problem with venture capital. You know, I came across lots of people, one of them started using microprocessors, that may have had a good idea, a good product, but you could see, they just didn't have the management to turn that into a business. And, the two, the two that, that stick in my mind that we did float, that were wholly in the IT… Because there were other technologies I came across. There was something called Grease Eaters, which was amazing, which was a big bath for, for cleaning car parts in garages. Very low tech. But nobody had thought of it until then. And we floated Grease Easters. Lovely name as well. [laughs] And there was a, just a television, a video and television company that was trying to expand its retail arm that we had disposed of. It wasn't really IT, but it was in a new technology area. But two that we did float were Micromite Plc, which was actually, one of the first in the world, but certainly the first in Europe, to have written a disk handling system, a microprocessor-based disk handling system, for a hard disk. And that sounds like, er? what's so, what's so good about that? But it was actually quite difficult at the time for a microprocessor to be able to do that. So they had something called Micromite, which was their, their server, we'd call it today, but it was a, a hard disk unit, which was all just microprocessors, not, not fixed, not stuck on the side of some digit-, on, you know, mainframe or mini, which up to that time they all were. So that was an interesting one. Didn't survive in the end I don't think.

[1:04:13]

The other one, which did survive, probably still survives, is Bleasdale, Eddie Bleasdale's computers, which was one of the first Unix computers in the country.

Eddie is a bluff northerner. We floated him. He stayed floated. And then eventually he sold out to BT. And I haven't checked recently, but I know relatively recently, Bleasdale computers was still the Unix system that BT then took over, only for within BT. They were still running within BT. That's probably the one that's had the longevity.

[1:04:43]

But yeah, it's, variable quality, but were quite exciting at the time, to at least get a few launched on an over-the-counter market. Which went very, which went very successfully, not just for the IT and technology ones I was doing; they were doing other ones as well. To the extent that eventually the, and I had many letters to the *FT* and interviews, and eventually it got through to the Stock Exchange, that they should really have something, to do the same thing, for the small cap, risk capital. And you may remember there was, in the *FT*, a, a kind of, a competition in, what's that little diary one that does it? I can't remember his name, 'Observer' wasn't it, they used to call it, to, to think of a new name for the new London's high risk stock exchange. I said, 'Well not High Risk Stock Exchange, High Rise?' [both laugh] So they, they thought that was good. But they didn't… In the end they, they, they allowed something called the Unlisted Securities Market, USM, which then became the Third Market. Then, eventually, the rump of that is now still AIM. We still have that. But it's a poor shadow of what we thought it was going to be at the start.

[1:05:58]

I then actually became, while I was running my own consultancy, I actually was the first technical director of a company called International Communications Technology Holdings SA, which was listed in Luxembourg, but, we raised capital through Tring Hall, who were a big brokers on the USM at the time, to fund, amazing, the Triemco multi-function telephone, which had video text built into it. And we did produce prototypes. We never got further than that, because we could never get second-stage funding. But, because Luxembourg and London had a reciprocal arrangement, it was also listed in London. So I did end up being a director of a London listed company, for about three years till the money ran out, and then we found we couldn't get secondary funding. As usual, to go round the City and start talking for, raising money for finance… One of the brokers' meetings we had for when we were trying to get ICTH funded, we were having a discussion about the technology that's in it, and the, the subject of gate arrays came up.

Right.

Gate arrays. Gate arrays, OK? You know what a gate array is?

Yes.

Was. Is or was. And, we were sitting there, and one of the, one of the accountants or lawyers, one of the techie guys, we, we were using one of the big technical consultancies to do the design work for, he was talking generally more and more. And this guy said, 'But, here's Stephen.' He said, 'I've, I've heard of X-rays and gamma rays, but I've never heard of gate arrays. [both laugh] Anyway.
[1:07:36]
That brings us to '78. '79, were you about to go on to that, is when Maggie Thatcher came in.

She did indeed.

And she, quite uniquely, and it's never been done since, started a whole, a whole strand of, of new technology backing. And she… A guy called Jonathan Soloman, who a lot of people in the IT industry will remember, and I, worked quite closely on the so-called Electronic Entrepreneurs' Forum. And we arranged various meetings in various large conference rooms in, in Whitehall, between, you would have at one end the DTI as it was then, and at the other end we kind of, enthusiasts, and then you'd have, I'd get a range of companies that were trying to raise funds, and somehow or another, Philip Hughes often used to attend it for example. And, and then, potential bankers, the sort of people we were trying to say, you know, 'Please, there are these new companies. There's going to be a whole new technology future. We should, you should find, we should be finding some way, let's come up with some ideas.' And out of that actually came the Loan Guarantee Scheme, which did… And a couple of other schemes as well. The Telecoms Products Scheme, which I took advantage of, and produced the world's, not the world's first, but certainly UK and Europe's first, software control modem, which I can come on to later, which, again, I could never get

secondary financing for, so it folded. I should have gone over to California much earlier in my career [laughs], I often think.

[1:09:03]

But, again, a little, a little funny story, one of those. We were having our kind of, sherry and canapés after one of these meetings, and, always put on, DTI always put on a good spread [laughs], and, Philip Hughes and I were standing here together, and, there was a civil servant, a top civil servant from the DTI who had been drafted in to give it, give it, you know, profundity. And he was sipping his sherry. And he said, 'Oh, Philip,' he said… He probably was Sir Philip. 'Philip,' he said, 'you talked a lot about business risk,' he said, 'business risk.' He said, 'I'm not quite sure what that means. You know, I've been in the Civil Service all my life, and it's not a, not a word we use really.' He said, 'Can you, can you give me an example of what you mean by business risk Philip?' So Philip said, 'Well look, here we are, it's Monday lunchtime this week.' He said, 'It's the end of the month on Thursday, and I know that by Wednesday I have to make sure we have enough money in our bank account to meet…' And this was before the days when you didn't pay salaries the week before, it was literally at the end of the month. 'We have enough money in the bank, company's bank account, to pay the salaries of all our,' several thousand I think he had, 'people. Which is a figure of roughly,' and he gave the figure in millions. 'Now I know as I sit today, because I've just been on the phone to my accountant, we only have about two-thirds of that amount as cash in our account. We have a credit line with the banks, but we're already up to the stops on that. Now, that's what I call business risk. I've got two days somehow to find that money, otherwise, I could go bust, or I could get into deep problems with my own staff. That's, that's really business risk.' He said, 'I… We have got an order book, and invoices out, for five times that amount, but we just… So I, what I've got to do tomorrow, first thing, is get on the phone and beat up some of our customers, and send round couriers to go and get cheques. They will do it. I have to do it every month. But, I will do it, but it's a risk. I might not. That's what I call business risk.' 'Oh, [intake of breath],' said the, the top civil servant. 'Ah, I understand.' And he thought for a minute. He said, 'Oh yes, we don't have that problem in government. All our salaries get paid by computer.' [both laugh] And that was so ironic on so many levels. We didn't… We both just looked at each other, and thought, well yes, they do, don't they, yes. [laughter]

But it's got to be there in the first place.

Yes.

[1:11:38]
Let's move quite rapidly, because, I really want to spend some time talking about your work in the last, well, what is it, two decades or something…

Yup.

…as an expert witness.

Probably three decades, getting on for now.

Yes.

Yes. Yes, of course. Yeah, yup.

This is, two sides have got a contract, and that was the delivery of some type of IT system or IT service. And it so fundamentally breaks down that they get into a contract dispute in court. And you are one of the handful of people who are able to go in and say, 'Well, yes this happened, but actually the cause was this,' and so on and so forth. Do you see a pattern there in how these people get to court? Is there a pattern in why these systems fail?

Well, the, the issues… What's so good about the expert witness work is that, every case is, is, every case is, novel, because it's the same in a different way each time.

Right.

But there are some very common signatures about why projects fail, and actually, much literature is already out there.

Right. In your estimation, what are the common signatures?

The common signatures of, if you take the classical bespoke, let's call it a bespoke system, even with, with ERP systems, even package systems, you still get the same… Because you usually end up tailoring them, or customising them.

Yes.

So you end up with this tension between the definition of the requirement, and the code written to satisfy that requirement. And then there may be issues about testing and configuring and performing that code, and the project management of the construct- Because it's a construction project. But… And often, some of the cases make allegations more about the way the project was managed, rather than necessarily the quality of the code, to meet the requirement. Quality legally being defined as fitness for purpose, that's the key. That is the key concept legally, under Consumer Act, under, under all sorts of Acts. Fitness for purpose.
[1:13:50]
So what does that mean? Well it has two, two very interesting concepts in there. It's got fitness. So how do you define whether it's fit for anything? What does it, what does it actually do? And then purpose. Well what is its purpose? Well that was in the defined statement of requirements. So you get this tension. Well how well were the requirements defined in the first place? And indeed, supposing they were as well-defined as anybody can make them, and is comprehensively defined, and as clearly and as un-, what's the word? You know, un- You know, you can't have more than one meaning, it's…

Unambiguous.

Unambiguous, thank you. Unambiguously defined. Then, how, how do you check on its fit-, on the fitness of the code? What does checking, what does checking the fitness of code mean? It means, what do we know? Testing. That's the way we design software, and it's still the way we design. We code it a bit, we test it a bit. We check whether it's got bugs, whatever a bug means. And then, fix it a bit and test it a bit. And we keep doing that, till we think we've tested it and we can't test it any

more. Then it's fit. Well, yes. And, we have lots of cases where people have stopped halfway through the project because they get alarmed about the number of bugs that are emerging in systems testing. And we say, 'Hang on, no, that's the point of systems testing. If you're not finding bugs, you're not doing it properly.' It's a question of whether they're expanding and the thing is not going to converge, which is, we had to develop some models for one particular case to be able to decide whether we thought it was really expanding, because there was such a huge database of bugs, it was a big piece of software, or whether we thought that they would have converged to their own solution. Whether that would still have met the requirements is another matter. But of course you test. What do you tests against? You test… You draw your test from the statement of requirements. That is classical, computer science, computer project management. So many people don't even know that. Well… So if you haven't got a well-defined set of requirements, how can you even write the tests? And yet people go ahead without that. So those are the, the common tensions between statement of requirements and quality of code. And so many of the cases reveal that tension in many different ways.
[1:16:09]
There's another big area where, and it's, it's probably become more common in, in later developments in the industry, where we've had much more package code customising wholesale replacement of legacy systems by so-called new techniques. And, I think IBM did… I remember going to lunches and dinners 35 years ago, and there was a great guy, he had one leg. What was his name? Who ran IBM UK at the time. I can't remember his name. He's…

Is it Nixon?

Was it Nixon? I can't remember. No, he didn't have one leg did he?

No?

Anyway. He's a very powerful speaker. And he used to give us this thing once a year of IBM's latest analysis of the quality of data.

OK.

Do you remember that? And, IBM, from the early days of when they were tracking the quality of data, which almost goes back to their punch cards, they discovered that most corporate systems that they surveyed, and they had a methodology for doing it, had up to 20 to 25 per cent of corrupt data in the system. And yet the system still worked. Because little fixes had been done, or the operators had been, by, by practice, for speed, had found little workarounds, 'Oh yeah, when we ask for that product, with that code, it always comes up with this silly little number. But we just ignore it. All we have to do is just change it ourselves to that, and it works after that.' 'Well isn't somebody going to go and clean up…?' 'Oh well, yeah, but try and get that on the IT department's list.' And, interestingly, that sort of thing gets discovered when you do a migration from an old system to a new system. And everyone's defined very carefully the database and the, the data model, and the, all, all the fields and all the, all the data entities for the new model, programmed it beautifully, often they're all built into the new package anyway. Ah. Now let's try, let's migrate the data. Well we recall this data's in this format, flat files or something. OK, we may have to write a, a transfer program. Often that, that is forgotten in a contract by the way. Who's responsible for the bit in the, you know, bridging the bit in the middle, from the old system to the new, is often not very well spelt out in contracts, I have found in my experience, or the ones that I found that have gone wrong.
[1:18:30]
So, they write something. And then you find, 'Well we've written the transfer program.' 'But it keeps crashing, because you've got, you've got duff data in your data.' 'Well I'm sorry, that's, our data has been working perfectly well for the last 25 years.' 'Sort it, fix it.' You know, 'Stop complaining and move on.' [laughs] you'd get that. 'Well we can't, because it won't work in the new system.' So we, we find a bigger project comes up called the data cleansing and data migration project, which was never budgeted, [laughs] and never thought of. And, two or three of quite large litigations I've been involved in, that hasn't been the only problem with it, but it did emerge as a big problem, and each side is saying, quite properly, 'Well we never agreed to do that,' and they're also saying, we… And the lawyers are saying, 'Ooh, nobody thought of that.' So who's at fault? Nobody did agree to do it. So, you know, you should have sorted it out somehow. So that's, that's become an interesting feature of later projects.

[1:19:30]
And, right up to date, a lot, there's a lot more today about, the whole, the whole area of what you might call forensic data analysis, to do with security, and to do with authentication of documents. So it's not so much… There's a much bigger mixture of types of case, not just the classic contract for, I want a system, and it goes wrong because it's a construction project. And some of the techniques and some of the lawyer-y, lawyer-y techniques, do come from the construction industry. You often have something called a Scott Schedule in, in the claim, which is something called a, a judge called Scott years ago said, you know, if you're going to bring a claim to court, and it's going to be alleging a whole series of defects, you have to have them set out in a schedule, which actually shows, itemises each defect, you need to say why it was a defect. So you have to have some evidence to say it's not as it was originally specified. You have to show the data, what revealed is the defect. But also, and a lot of people forget this, you have to show, well what were the consequences?

Right.

[1:20:37]
And, the great mantra is, you don't go to court for law specifically; you go to court for money. And, unless you can show that there is consequence, then what are you doing in court? You may have 1,000 defects, you know, things that don't work as they were supposed to when they were specified, but, OK, what's… If none of them work, what would actually be the damage to your business? Well, now that you say that, you're absolutely right. 950 of them, probably very little, but hang on a minute, there are these 50. And you get this idea of a material defect, which is both… And we, we evolved, I evolved with my team, a new model for software defects which had never been done before, which is that it's, there's two orthogonal measures. One is the difficulty to fix it. Because the thing about constructing software, unlike buildings, is, you can rebuild the building every night, chuck the old one way and start again the next day. You don't… You know, you can dismantle it all. The software brick as we call it is virtual, and it's infinitely reproducible. So, the time to fix is just a matter of rebuilding the building, as often as you like. But there could be, different levels of difficulty, from pretty, pretty easy to impossible, because it may be that it's a design fault, nothing to do with the actual code.

Right.

Well I can't fix that, because the thing was never designed that way in the first place. And you've got a, there's a whole area of, how do you identify the defect and the cause of it, which can often be tricky to fix. So on that axis, there's difficulty to fix. On this axis there's consequential effect.

Right.

So, we said, we eventually said, that, you can only really talk about a material defect in both the technical and the legal sense if it scores high on both.

Right.

If it is both difficult, or nearly impossible to fix, and that's, that's a matter of judgement as to what that actually means for any particular code and any particular project, and is also of, of major consequential effect, then you can talk about material defect. And in fact that maps into the, the code of a contract and a, how you terminate a contract. You can terminate for material defect. It's one of the codes that you can… Which means that, after you have given somebody 30 days to, to, and they still haven't done it, you're entitled to say, 'I am alleging that there are material defects that go to the heart of the contract.' And you never did, and you never will. And often some of what we do is to give an estimate, well what would it have taken to fix it?
[1:23:08]
And one of the very big cases I had in, in Australia, at an early point – not that early I suppose, '98, they had… It was a big university system for nineteen universities, and it was a seven-module system from a UK company. And they had actually delivered five of the modules, and there was a sixth one which was to do with consultancy research which they decided anyway wasn't that urgent, and the last one, which was a really key one, was the financial module, which was all the finances of the university. And that one caused a lot of problems. And, they got down to a final user acceptance test where just seven bugs emerged, logged in the test. The association of vice-

chancellors of the university, which was basically the project manager, or the procurer, decided that, on the grounds of that, they were going to reject the whole system, just of these seven bugs in one of the seven modules. In the meantime… They were… It was over the Christmas period. In the meantime, the software house had gone ahead and fixed all, they said, fixed all those bugs, and were ready to issue a new version with those bugs cleaned up. And I got called in at that precise point, actually by a guy called Ross Graham, who was from Misys, you might recall, Misys Plc? Did quite a lot of projects with them. And Ross said, 'Stephen, come quickly, I need you in London. Just, just tell… What… You know, I'll get on the blower. Choose a time.' It was either very early in the morning or late at night, because they're in Australia. Nick, a UK guy, was running the company in Australia. 'We want to know what to do. I mean, it may come to litigation, it may not, but what do we do? They, they're threatening to terminate, or they've written us a letter before termination, but we're ready to… We've… I, my guys tell me they've just cleaned up the bugs, so why are they doing that?' So I said, 'Well, you chat with your lawyers, but what I would definitely do is, if you believe strongly that that does fix the bugs, put it on a CD,' as it was then, 'take it by hand, and give to them, and say, "We hereby deliver you version eight which fixes all the bugs."' Now if they don't… That could be quite good tactically, not that I'm supposed to give advice on tactics, that could be quite good, because if they decide, 'No, we're terminating, we're not even going to look at it,' that actually puts them in a weak position, because if I come along as a, as an expert later, and run the version eight and find in my opinion that it has fixed all the bugs, then, they are going to look pretty, silly, frankly. And legally they wouldn't be in a very strong position. So that's what they did. They did that. And then eventually it did go to court, and, I was then in Australia for about a year and a half, off and on. And we tested and tested and tested. And that's actually when we had to sit down and really, challenge ourselves, what do we mean by a material defect, for software?

[1:25:58]

Mm. Do you find, given this fascinating work, that there is, as there is a common perception, that there are more failures in the public sector than in the private sector?

[pause] I don't know whether numerically there are, but in terms of size of projects, in other words, the amount that's risked on them, all or nothing, before they get… Usually in the public sector, it's not so much that they fail, as that they just get, terminate. They just get cancelled. Because they're running on too long, and they're spending far too much money. Because they're running on too long, and they're spending far too much money. That has been a common feature, that the public sector procurement of IT has not been of the best to say the least.

Why?

Part of the problem I think is that, the IT industry has always been an industry that's been controlled by the suppliers, the writers of the code, the builders of the hardware. When you are dealing with a commercial company, they're already in business, and they know probably in their own business how people control their own value chains, and it may be that they are themselves in a business where they know they control the value chain, because they're producing, they're a big supplier in that business. So when they go and procure anything in that business, you know, this is, this is added in, in, in business generally, that the best salesmen are the ones that can also buy well. I mean, making profits in business is about, probably as much is more than buying well than selling well. So, when they go and buy an IT system, what are they going to do? They're not just going to go and sit there and listen to the, the starry-eyed salesman and say, 'Oh how wonderful. Yes, I'll just sign here for ten million.' They're going to get their own advisers, and they'll get consultants who are probably as clever, they've also been in the industry. So there's much more equality of, of might on either side, when you are analysing and negotiating the contract in the first place.

In the private sector?

In the private sector.

Right.

[1:28:06]

In the, in the public sector… Now there's another interesting thing. We used to have something called the CCTA, which was the Central Computer and Telecommunications Agency, directly funded by and answerable to the HM Treasury. Where else would you go? Who's going to pay for all this? And I did a couple of projects with them, which we haven't really talked about, which is the whole issue of, of reliability and security of IT systems, which I wrote 'Definitively Poor' back in, part of which was published, some of it was, you know, sensitive, and it got edited out, because it was, it was the Ministry of Defence, the Home Office, Foreign Office, Department of Business, and, I can't remember the fifth one, who funded it. And some of it was in the Defence sector. So they edited it out. We got, published the appeal report. It was, I think you were trying to find a copy of it, weren't you? I don't know whether you did find one.

I did, for £86. [laughs]

Ah, so you haven't read it? [laughs] I thought you were going to tell me what I had written in it, because I haven't, I haven't looked at it for years. I'm sorry, I, I didn't… I probably could have found a copy, but I didn't hear any more from you, so I thought…

No no. But…

Anyway.

But tell us.

But anyway…

So you were looking, therefore, at the public sector.

Yes. So, that was interesting, because that was run by the CCTA, and there was a guy called Tony Staten-Davis there, sadly died from motor neurone disease quite soon after that, bless him, who was really, on the ball with this whole idea. And they, they would do, CCTA would do best practice guidelines about procuring IT systems, and

this whole issue of looking at the interface between the law and I- That's really where I got into, and created a reputation for IT and the law, one of the founders of the whole subject of IT and the law in this country.

Yes.

[1:29:45]
As well as founding Infolex, my own company, which uses Prestel to, to use the technology for an updating service for lawyers. So using the technology *in* the law as well as the legal issues to do with the law. And then the expert witness work came. It all, it all happened kind of at the same time. But then what do they do? The Government shut down the CCTA, saying, 'Oh we're going to even outsource our own advisory service to an outsource.' Oh yeah? And how are they going to… They're going to charge you an arm and a leg. You've got nobody internally any more that could say whether they're, you know, BS-ing you. And I think this is the problem, there's never been a centre of excellence within government. There's now, what do they call it? The, the outfit up in Norwich. We still try to do that. I'm sorry, I should know them.

Office of Government Procurement?

Yes, Office of Government Procurement. Yes. And, the outgoing… They did a study, just in the last days of the Labour government, before the 2010 et cetera, looking at procurement of both hardware and software, and still saying that Government is the largest single entity procurer of IT, both software, hardware and services, increasingly services rather than… And there must be ways of improving that procurement. Not… They weren't particularly focusing on the failures; they were just saying, there's that amount of money going; are we getting the right bang of the buck? And I wrote a letter about that time, 2010, it was published in *Computing*, 2010. Because I had just done a, a project as an expert for a large data centre, a dark data centre, so it was a standby data centre, of, again, I can't say any more because I've just sign the Official Secrets, but it's a large, part of what we call the National Critical Infrastructure, which had been destroyed in a fire, and that particular body that ran that centre decided they'd put in a claim to insurers, and basically said, 'Oh,

here's a nice way of getting all brand new mainframe kit.' And so they put in that, basically we want all the latest new kit. And it ran to, I think 420 items. The two, the two biggest ones of which was a big new, what's… Not Hitachi. You know, the… Nixdorf, Siemens Nixdorf, the three of them came together. The old ICL's in there as well somewhere. Mainframe. They were still, they were still up there with the best mainframes in the world. I think they still are. That, and then, several other servers, and, and telecoms equipment. So those, those three categories of items probably accounted for 80 per cent of about a ten million claim, something like that. It wasn't a massive massive claim, but it was significant. And the insurers said, 'This doesn't seem right, does it?' I mean, but they haven't actually got a new for old policy, you don't have for that sort of thing. But, actually, what… Could they have got old to, to, to do what the old one… We don't know about, this is technology. And what would have been its price anyway?

[1:32:48]

Interestingly, I had done a very similar project, I can say the name of this one, because it was, it was in the press. Sainsbury's had outsourced its data centre to, was it Accenture then, or was it still Andersen, to run for them, out in Hertfordshire somewhere. And one Saturday night… And it was a, again a fairly humming, needed hardly any people to run it, it was humming away, with low lights. And the, the security guard got a buzz on his entry phone, somebody said, 'Oh, I don't know if you can help me, but my car's broken down outside. Could I just come in and use your phone?' This is before mobile phones were… And so this, this very helpful security guard, and there was some discussion about whether he was in the team, let these guys in. And he was overpowered, tied up. And this very slick team came in, went into the data centre, and knew exactly what they were doing. They took all the motherboards out of all the brand new servers, and all the high, all the high value stuff, they took it out. And they also took a whole range of new stuff that had just arrived that day, which was still in pallets in, in the storage warehouse. About, again, four or five million pounds' worth of kit, and away they went. And again, Sainsbury's and Accenture… Well Sainsbury's claimed against Accenture. Now they claimed on the insurer, to say, 'We want new replacements.' And at that point I was brought in by the insurers, and it was for insurers the second time round as well, to say… Actually no it wasn't, it was the… Sorry, that's a separate issue. To say, 'Well, if they, if they had actually gone out and, to the second-hand industry, is there one? to get back what

they had had, not the brand new stuff, OK, some of it was brand new, what… could they have done? Would it have performed the way, and what price would it have been?' And I had to go and do my own research. I, I was kind of conscious of a second-hand… It's a massive industry. It's one of the largest public companies in the United States, it just does nothing but sell second-hand computer kit. And typically, prices for kit that's still within the bath curve of five years, you know, the bath curve you get, massive likelihood of failure in the first year.

Yes.

Once you've got past that, electronically, it goes along flat for three to five, up to five years, but three years certainly. And then you might start getting increased likelihood of it failing. Most, most technical change-out diaries for, for kit, try to do it within two and three years.

Yes.

But it's still really only in the, only in its middle age of usage. Because, new ones come. People want the newest and best. People do that. So, they then sell their old kit into the second-hand industry. You pick it up for next to nothing, actually next to nothing. Sometimes they get paid to take it away. They, they do it all up. They put it through a, a rigorous manufacturing and both data cleansing, which is sometimes better than the ones they had originally in the manufacture. I discovered all of this. And then they sell it back onto the market, and, and for, for something like, as low as five per cent, no, usually no higher than 20 per cent of the current price of that equivalent, you know, equivalent performing piece of kit. So you could actually get, pick up second-hand kit, covered by, better than the manufacturer's warranty, because they often give their own…

What's the company called?

Well, I can't remember that company, the American one, but there are several others in the UK.

OK.

Names you know, but I've just forgotten.

[1:36:14]
If we come back to the, to the big problems.

Yes.

OK? And the big failures. Here's a big question.

Yeah.

Is that fixable, or is it inherent?

The fact you get failures in IT?

Yes.

No, it's not fixable. [laughs] We have an on… My, CASTELL's first dictum, which came out of the peer report, is that, you cannot… This was more about reliability and security of the technology, but it's the same point. You cannot secure an ontologically unreliable technology by use of an ontologically unreliable technology. And I said at the right, at the start of the whole cyber security industry… And funnily enough, I was having a wine with somebody else in a block chain conference, who said, 'Oh Stephen, you and me both. I stand up on, I get invited to these security... I say, "You guys are all shunning and selling a scam,"' which they are. There's no such thing as computer security. You're building… You've building houses out of straw, and then putting walls of straw around them. It might keep people out for a while, but it's still all straw. And that's the trouble, the, the technology to protect computers is exactly the same technology as the thing you are protecting. So it ain't going to protect it, because, why? Because, computers are… The only thing you can say about, with certainty about software, is that it's uncertain. In fact it's the only definite thing you can say about it. Girdle… It's a girdle zero problem, software.

When you go beyond about six lines of code, you're into infinite, infinite possibilities about what the, what the software can do in a way you cannot even predict. That's inherent in the way that some languages are designed, and the way our thinking goes to try and, to try and map a problem in our brain to computer code. So, so the problem is inherent in the, in the practice of writing software.

So programming languages like Ada don't fix this?

No. Why would Ada fix it? Other than any other language.

And formal methods don't fix it?

Well, formal methods, and things like, what's… Kit Grindley's systematics. You remember that? Where we could go straight from the word definition to generate the code. Which is a nice idea, but that then only takes you back to, well how well have I defined the word? It's, it's about epistemology. It's about the meaning of meaning. And no language can get round that. Because what do we *mean* when we say we want the software to do the, x, y, z? What does x, y, z actually mean? You have a different idea in your brain of x, y, z than me, the one that's supposed to be specifying it. There is no, there is no objective way of agreeing on the meaning of anything. That's the trouble. And all the software does is, trying to encapsulate meaning in a formal way. So formal methods, which can, which can assist in… and… but they're very complex and very expensive to use, and they have been used in things like safety critical systems, but even there they have failed, even… There's still no way of proving mathematically the thing you are setting out to say you are intending to do with your formal method. I don't think, unless there's been new, new developments in it, I've not, I've not necessarily kept up with formal methods. I've never, I've never been involved in using formal methods, and they're not really a commercial, a commercial thing, I don't think.

[1:39:29]
So, as an expert witness and the work you do, you have an infinite future.

Well I'd like to think so.

I think that's a very good note to end on.

OK.

Thank you very much Dr Stephen Castell.

[End of Interview]