Iann Barron

Interviewed by

Simon Quicke

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.....before I went to university as an integral part of it. Slightly complicated.

Oh, well we, we start with… We'll start where you want to start. I just have to say, this is Simon Quicke, it's the 22nd of November 2016, and I'm interviewing Iann Barron.

So… Well let's start where you'd like to start. How did you, how did you start to get into the world of computing then?

Well, it was when I was sixteen or seventeen, and I, I read an article on computers, which was something new and unusual at the time. And, I knew that was the future. And has been ever since.

Mm.

At that time there was virtually nothing published about computers. There was a book by Douglas Hartree, who had been at Cambridge, on computing machines, which told you how to design a computer, so I designed one. I couldn't make it of course, but… And I had little… It was not obvious how to do things in computing, because there wasn't much happening. But, being a precocious, nerdish type, I read the *Times*, and they had little advertisements in the personal section for NRDC, National Research Development Corporation, which was the thing that was promoting computers, because it had been set up by Churchill after the Second World War because of his knowledge about Bletchley Park, and he thought computers were going to be extremely important. But he didn't want to do anything very overt about it, so there was this company set up to finance the development of computing, basically. It had a wider brief than that, but, computing was the essential thing. And so I wrote to the head of the company, it was Lord Haldane [Halsbury], and said, I'm interested in computing, what do I do? And, apparently he had never had a schoolboy write to him [laughs] like that before. So he was intrigued, and I was invited up to London.

Oh right.

And I met him and Chris Strachey, who was the technical guru that they had at the time, and a Canadian called Donald Swann[sp?], different Donald Swann[sp?]. And, they were thoughtful about it, and they said, 'Well you ought to go to Elliott's,' which was a company, an electronics company, in Borehamwood, which was actually developing computers.

Right.

And that's what I did.

[03:07]
So how… You were still at school, were you?

I went between the time that I, I left school, before I went to university, so I had a few months, learning about programming. And I did just that. And, the first day I went there, as an employee that is, everybody was assembled from the computing group that they had, and, they said, 'Here's this young man, and he's going to write programs.' And there was a, a little man sort of, on one side, he looked extremely unhappy, and he sort of started jumping up and down. And so the leader of the group, who was called Ed Hurson[sp?], said to him, 'What's the matter?' And, this man got himself up to full height and he said, 'I am Herr Doctor Sheiler[?]. I program computer. I have a PhD in mathematics. He doesn't know mathematics. He cannot program a computer.'

Wow.

It was an interesting attitude at the time.

Yes.

So that was my, literally, first experience of being a programmer. And I, I was rather upset about this. So I decided I was going to write a better program than this man, and, I actually succeeded in doing that. Shall I tell you the details?

Yes. Yes.

[04:47]
Oh, well, computers obviously were very basic at the time. The computer I was working on was a thing called Nicholas, which was probably the only computer ever made out of wood. And it had been created to do calculations for radar. And it was very basic but it worked, and, it had very limited input and output. Computers at that time had a teleprinter, or, paper tape actually as the output, and paper tape as the input. But it was worse than that, because, there was actually, you couldn't just output information to the paper tape. It was all done in real time, you had to move each of the pins in the paper tape punch at the right moment, advance it at the right moment, and of course, convert from binary to decimal. And, this man had written the program to do this, which was regarded as a, you know, pretty complicated thing. And, before I left I wrote a program which did exactly the same thing, except it interleaved the conversion of the numbers from binary to decimal in whatever format, with the printing. So it went twice as fast. So, that, I felt that was good.

So did you get his respect in the end, did he, did he warm to you, or…? [laughs]

I've no idea. [laughs] He had disappeared by the time I returned. [laughs]

[06:28]
Right. So you were there, you were there in between…

In between… I went in during my vacation.

Yes.

Yes.

And did that, it sounds like that really reinforced your initial thinking, which is, this is what you wanted to do.

Well, yah, it was what I wanted to do. Everybody at university, because I was doing mathematics at the time, thought I was mad, because, the future at that time was seen as being nuclear physics. Everybody wanted to do nuclear physics. And people weren't interested in computing, so… Yes, I, I went back, and, in successive years I, I designed parts of the computer. And then in my last vacation I actually, really did design a computer. I arrived, and the person who was supposed to be designing it, Lawrence Clarke, said, 'I haven't got any time to design this computer. Can you design it?' So, I worked for them for six weeks, and I designed a complete computer, and, it was eventually implemented and became, firstly the Elliott 802 and then the Elliott 803. It was, really quite successful.

Yes.

So that was a, quite a, a good introduction if you like.

Yes. Yes. And you were what, you were about twenty-one?

I was, less than twenty-one, yes.

Right. Wow.

And, I was paid the princely sum of £8 a week. I did it in six weeks, so it cost them £50. [laughter]

What an amazing experience though. Was it…

No, I was lucky, I was in the right place, right time.

Yes.

And that's what happens with people.

[08:30]

Yes. And in terms of that environment, were you, were you the youngest by far? I mean was it…

No.

You didn't… Or was there a, were there peers like you, other people who had also…?

[hesitates] Yes, there were, but they were scattered around. I mean there were people I met when I was at Cambridge, because, Maurice Wilkes was, had crested the EDSAC 1, and there was the computing group now at Cambridge, and, there were some young people attached to that. My particular friend was Roger Needham, and, so happens, last night I met David Hartley, who was also there at the same time, and he became responsible for the Computing Service at Cambridge, and Roger became the professor there eventually.

Right.

But, we were all regarded as a bit weird. [laughter]

[09:31]
Well just talk me through, because, if I get the dates. So you, you had finished your degree.

In 1958.

Yes. And then, I guess it was just, it was a natural thing to go back to Elliott.

Well I didn't do it immediately, because, there was National Service at the time.

Right.

Again, something quite odd happened. I was having to go off for my National Service, and I was due to go into the Army, I was due to go up to Catterick, and, the day before I was due to go I was called, and I answered the phone, and a man said,

'Oh, Gatsby[sp?] here. I want to see you, tomorrow morning, ten o'clock.' And I said, 'Terribly sorry.' [laughter] I had no idea who Gadsby[sp?] was anyway, but… 'I can't possibly come.' And he got extremely irate about this. And eventually he said, 'Well why can't you come?' And I said, 'Because I'm going to be called up, I'm going to Catterick tomorrow.' And the man exploded. He said, 'I am Gadsby[sp?]. I am from the War Office. You will come here at ten o'clock tomorrow morning. That's my instruction.' And, so I did that, and, as a result of that, rather than doing my, whatever it was in the Army, I actually did science things for the Army and for the Air Force for two or three years, which was much more interesting.

Right. How did they, how…

A friend of mine had, somehow… I don't know how. He had mentioned my name, and said, 'This man knows about computers,' and they were looking for people who knew about computers. So, saved in the nick of time.

Yes. So where were you, was that in London, you…?

It was, I went first to the Army Operational Research Group, which, at West Byfleet. Then I went to the Air Ministry, which was in Whitehall. Then I went to Fighter Command in Stanmore. And then I ended up in Bomber Command in, whatever it was, West Wickham.

Wow. Yes,

And when I was at Bomber Command I, I was given someone as an assistant to work for me, and I found out, actually, afterwards that he had been Alan Turing's batman.

Oh really?

I didn't know it at the time.

Yes. And what was that world like, going from your exposure to the commercial world of Elliott to the military?

Oh, well… [pause]

I mean, did you enjoy it?

Well it was, it was interesting, and things to do. There was really not much understanding of what computers were, or what they could do and their potential.

Right.

They were all experimenting with things.

Yes.

I was actually, the original reason I was asked to do this was because they wanted to develop computer war games, but that was a challenge which was beyond the computers of the time.

[13:20]
Right, OK. So you were there for a while, looking at the dates of, '58 to '61.

'61, yes.

Yes. And then, what drew you back to Elliott's, did you, did they contact you, or did you…?

No, I actually contacted them. [laughs] It's quite interesting, again. I said I'd like to come back, and I had this idea that… They were doing research, like computer companies did at the time, in terms of the hardware, and I said, 'I think it would be a jolly good idea to set up a group to do research into the software of computers.'

Mm.

They said, 'Oh, what a good idea.' And so I went off to Elliott's, and, the moment I got there they said, 'Well, we've got a problem. We've got this computer we're supposed to be delivering. The man who is responsible for it has gone to take up a position at Cambridge, so can you take over?' So I never actually did the thing that I wanted to go there for. But the amusing thing about it is that, I was sitting in the research laboratory at Elliott's; in the commercial department there was a young man called Tony Hoare.

Right.

So… He was the person they should have been employing to do the software research. But they never realised that.

[15:02]
Yes. So you went in, and, it says here, you developed a high-performance computer. It was secret, was it?

Yes, it was… It's sad really, because it was, it was almost identical, as it turns out, to an Atlas in in almost every respect, I mean performance, technology, but nobody knows much about it because it was developed for the, to test out the radar systems in the UK, so it was being developed for the Royal Radar Establishment as it was at the time. And it was, it was quite a technological challenge. It took some time to do unfortunately. But it was a, sort of successful technology. And it took me, unfortunately, a couple of years to get over that, and then to get back to being able to do something more interesting.

Yes. Yes, I mean was it, in the end was it, it was deployed was it, people…?

Yes, well it was intended… Oddly enough, beforehand I had worked on the planning of where the radar, the advanced radar systems were going to be, like the one at Fylingdales. And this was to take the data from those and process it so that you could see what was happening. And there was actually, a computer was being made by another company, Telecommunications, TRE, which was basically an old telecoms

company, and they tried to make a computer, well they made telecommunications systems. It didn't work.

Yes.

And that was a system that was supposed to actually run this. And then, the computer that I developed was supposed to test the whole thing. But because, as these things go, the testing's more complicated, it had a much more powerful system which was actually processing the radar. But, when we actually eventually installed it, the system that was processing the radar didn't work, and so my computer was switched in to actually run the radar as well.

[17:55]
OK. So you did, you did that. Then, what… What was in your mind? Because you had obviously gone there with, you wanted to do the software, you had ended up doing another big hardware project. So what were you thinking then, were you thinking, I want a new challenge, or I want to…?

When I finished doing that, again, back again, yes, now I'm going to do what I want. And they said, 'Ah, well…' Unfortunately, this man that went off to Cambridge, he was developing this project of a very high performance computer using tunnel diodes, which is a marvellous technology. 'So can you sort that out now?' [laughter] So I had another couple of years dealing with a marvellous, the tunnel diode is marvellous technology, they were incredibly fast. They were just totally unreliable.

Right.

But we built, I mean I was building devices with switches and bits of computer that worked in 40 picoseconds at that time. We had challenges, because there was no technology to look at it. And, the time for one element to switch to go to the next was such that the signal could only propagate about, five inches. Printed circuit boards were only just being invented. So, it was a nightmare sort of trying to build a computer which, out of these components, because they were relatively big, which

could work. Because the delay due to the physical structure was so big in relationship to the performance of the devices themselves.

Mm.

Well the sad thing about tunnel diode was that, if you switched it about a million times, it died. So, it was jolly fast but didn't work.

[20:05]
Yes. Yah. So were you aware… You mentioned there about circuit boards on their way sort of thing. Were you aware of what was going on in the world around you, did you try and bring that in?

Well, this company, Elliott Automation, had been set up with the idea that automation was going to be the future, computers were going to be embedded in everything, that's what you'd say now. And this was the first steps towards that. [pause] Sorry, I've lost the thread of…

Well no, it was just that, that, were you aware of all the… You know, at the very beginning you were saying how you read, you read everything you could about computing. Were you still soaking up the information that…?

Oh. Yes, sorry. Yes, they acquired, or, they set up a company to make semiconductors, which was run by a man called Ian McIntosh[sp?]. And so, the first semiconductor devices they made, I was able to use, we were able to use that technology. And, yes, then we moved to, integrated circuits actually just became available, and… Oh, what happened was that, I was doing all this stuff which was to build incredibly fast computers, and I thought, what's the relevant technology to this company which wanted to do automation. And, in America, Digital Equipment Corporation announced a thing called the PDP-8, which was the first small computer. And so I went off to the management of Elliott's and I said, 'Look, why don't you just stop making computers, why don't you license this machine, because it's going to do exactly the things you want, and it's going to revolutionise the world.' And they weren't impressed by that.

No.

They had lucrative government contracts, and that was more interesting than the other things. So, generally speaking we fell out with one another, and I was ejected from the company with half an hour's notice given.

Oh. Wow.

Well, they weren't interested in developing this computer.

No.

I was being asked to design this super-fast computer, which I didn't think was a sensible thing for them to do. And I got so frustrated, because, my manager, who was the same person I had been involved with when I went to Elliott's, Lawrence Clarke, said, 'Well, you ought to think these ideas in your bath, not in the, my company.' And so I, I was so irritated by these things that I went and approached six other people straight out of the meeting and said, 'Why don't we go and set up our own computer company?' And no more thought about it than that, that's what we did. But when I went and told Elliott's, they, they gave me half an hour to get out of the company. [laughs]

Escorted off the premises.

I was escorted off, yes. Just like that. And my associates kept with the idea of trying to convert them back to staying with the company, and they, actually all left and joined, and we set up this computer company.

[23:57]
So this is, we're talking now about 1960…

1964 I should think.

Yes. And how did you… I mean, were you a bit frightened about going it alone?

I was completely naïve about it. I had no idea. I had no money. So I had to find a way of getting money. And it seemed to me to take an incredibly long time to raise the finance for this company, Computer Technology. Actually took six weeks, and it was, it was really one of the first private financed science companies in the country, just, there was no sort of tradition to do that. And I was just fortunate and I was able to find two people, two private individuals, who funded me. The first of them was Robert Maxwell, which was not a good experience. But he was, Maxwell was an absolutely ruthless, frightening man, but, he was very clever, and he saw, or thought he saw, that computers were going to actually revolutionise publishing and printing and the spoken word – the written word. And he wanted to be involved with it. And so he actually put his own money in, not company money in. And the other person who put money in was someone called Arno Gavitri[sp?]. Now Arno[sp?] was a very wealthy scion of a French family. And he had been in America with a man called General Doriot, who set up the Harvard Business School, and Arno[sp?] was his prize pupil, and the two of them then set up a thing called American Research and Development, ARD. And that had been the company which invested, and was the first significant venture capital investment in the world, in Digital Equipment Corporation, to go back a nice loop.

Mm.

And Arno[sp?] had invested his own money, I mean he was very rich anyway and he made an enormous amount of money because he owned a large proportion of Digital Equipment Corporation. But the man who created Digital Equipment Corporation, Ken Olsen, was the most conservative, rigid thinker, and he didn't believe in integrated circuits, and they'd just sort of become available. And, he wouldn't use this technology. And Arno[sp?] thought it was a good idea, and here was me proposing to build a computer using integrated circuits. Because that was, that was the step you see.

Yes.

It had been very difficult to develop and design computers using discreet components, just hard work. Integrated circuits were dead easy. That was the idea behind the company really. Suddenly you could actually make a computer in much shorter order with much less investment.

Yes.

So he actually wanted to use me as a testbed to convince Ken Olsen that he ought to be using integrated circuits. I mean, he was open about it, I knew all the… So, that was how, how he got my money. I got it in six weeks, which I thought was dreadful at the time but, I realise was absolutely miraculous. [laughs]

[28:02]
Pretty good. Yes. So, your vision was, sort of, bring it all together, use the latest technology and go places that other people just hadn't yet gone.

Yes. I was inspired by what had happened with Digital Equipment Corporation, and I just thought we could do much better than they had done, because of the change in the technology, and because there was an opportunity to do it in this country.

Yes. And so, you got your backing, and then, off, I guess you, how quickly did it take to…?

I think I said it was going to take two years to actually do… I mean, it took sort of, that kind of time. Yes, it was still hard work. And nothing like it would have been a few years previously.

Yes.

And it was, it was difficult because, although I had this support, one of my backers, Mr Maxwell, was remarkably reluctant to actually produce real money, instead of talking about it. I had great problems financing and running the company.

How long did your association with him last then? Did you…

Maxwell? Oh, I don't know. [pause] Seven or eight years.

Right.

He was, obviously an interesting guy, and, and it's not appropriate to your current context, but…

No, no.

It seems to me that Mr Trump and Mr Maxwell have a lot of characteristics in common, except that, Maxwell was, as I said earlier, he was really clever, and I don't think Trump is, and both I think probably behave in very much the same sort of way.

Yes.

Maxwell was completely immoral. He would screw you, with great delight. But he was actually quite good, because if you screwed him, you know, that was, that was good. He didn't resent it. That was… In fact he respected you for it. And that was a good thing about him.

Yes.

And, you had to play by his rules.

Yes.

His rules or no rules. But if you did, yes, he'd get on with it.

Yes. Well he was right actually, wasn't he, about the impact on publishing, computers just…

Oh yes, absolutely right.

Yes. Yes.

Yeah, I mean…

[30:42]
So you… Obviously now doing your own thing, you could bring on people that you, you respected and liked. So did you build quite a good team of people around you? You mentioned that some had come from Elliott's. Did you bring in other…?

Yah, well I had a sort of small group of seven. I did the same thing three, four times actually, which, which was that, at Elliott's, to build the group which was developing this high-speed computing tunnel diode system, I had gone to the universities which were just sort of getting into computing. And I had recruited new graduates, and I got extremely good mileage out of them. And I did the same thing with Computer Technology, and then again at Inmos, and, strangely I met one of them last night, and again with Divisions. Well less with Divisions, but, yah. So, all the people that I employed was invariably new graduates. Didn't know a thing about the world. They probably knew something about computing. And, that's a very powerful and effective way of doing things. And a lot of them went on to do great things afterwards.

[32:18]
Yes. Yes. So, Computer Technology, ten years doing that. And you developed the Modular One and… And so, how did that period end, what…?

[pause] Well, it was all fairly difficult. And the Modular One was sort of, a great technological concept, it worked extremely well. But, we were eventually sort of, rolled over by Digital Equipment Corporation. [laughs] Because we just didn't have a large enough market, and the market in the UK wasn't big enough. And I had taken the decision, for reasons which were valid, but maybe in retrospect I shouldn't have done it, that we wouldn't expand into America. Because I just didn't think we could support the equipment effectively, and supporting equipment was a sort of, major part of computers at that time, because, they went wrong fairly frequently.

Yes.

And we just didn't have the financial resources, and I thought it would just be too difficult, because, America being a large place, it wasn't just one place in America, you have to, you have to do it in the lot. So, I didn't go into the American market. But that's where computers were being sold, and we just didn't have the volume to compete against American companies when we came over here.

Yup. So, did it sort of, it just sort of petered out?

Well, I had a board of directors who didn't understand much about computers basically and they, they kept on saying, 'Well, why aren't you designing the next generation of computer?' And I kept saying… Well, because, at that time, the next computer was completely different to the previous one. You didn't sort of just change the technology, you changed the architecture, the software, everything. And I kept saying, 'You're not going to do that.' You just stay with the same system, you update it. And, they got more and more unhappy about this, and insisted that I design another computer. I didn't want to. But actually the technology had changed a lot. And so eventually I did that. But there was a big drawing out, because, the person who was actually… And so I had moved across from being Managing Director to actually doing, at the same time we had another managing director, and, he fiddled the books. He did that thing which quite often happens in companies, he declared sales that were not sales, because they were going to happen in the next financial year, and they got worse and worse. And I went to the directors and said, this can't go on. And much to my surprise I was the person that got chopped.

Oh.

Which was rather sad, but, that's what happened.

Yes.

So.

[35:56]

So is that… That brings us on to sort of, 1975. And, you, you did a few years as a, as a sort of consultant…

Yes, I, first of all I thought, well, I don't have to do anything. I will retire. And then after a few weeks I decided that retiring wasn't really very interesting, so… But the thing that was obviously going to happen at that moment was, the next step, which was microprocessors, which, the Intel 4004, and probably the 8008, had been produced, and I could see that that was, as far as I was concerned, was the future and was going to obsolete computers the way we had them.

Yes.

And particularly the sort of things that we had been doing, which could all go on to a single chip now.

Mm.

So I decided I, I really ought to become the world expert in microprocessors, which was what I tried to do. That, that was reasonably successful, and sold them to Motorola, to Texas Instruments, to Fairchild, to Intel, telling them what was wrong with their microprocessors. And there was a lot wrong with them. [laughter] I did that for a bit. Yah, I had actually three things I wanted to do. I wanted to become the world's expert in microprocessors, which I think I did. I wanted to get rid of the people who were running the Department of Trade and Industry computing. They were so dreadful. And I did that too. And the other thing I decided was that there ought to be a minister for information technology, and so I went round promoting that, and we got one of those too. So, that, I thought that, I actually achieved my objectives.

[37:56]
Yes. Yes. Well, just unpacking that a bit. What made you feel that was, did you just feel there was a lack of understanding and support?

What, with the DTI?

At government level and…

Fairly dire.

Mm.

They just, again, didn't really understand what was happening with the technology and where it was going. And that was rather a pity, obviously, because they were responsible for promoting it.

Mm. Yes. I mean, it sounds like you embraced the new, but presumably there were people around you who were a bit resistant and a bit frightened at that… I mean, did you find that you had to, you get people, I see as well, where people almost, this is a full stop, this is, I'm only prepared to go this far and I can't deal with the next big thing. It sounds like you embraced it, went with it.

[hesitates] Yes, I probably did actually.

You kept that interest.

Yes, I was, yes, interested in the future. Still, I was much more interested in the present.

[39:14]
Yes. So you did, you did that. Then, that must have brought you into contact with people that will have influenced your thinking and opened different horizons to you, particularly dealing with people like Intel or TI. Did that, did you find that was a, a good way of gaining more insights?

[pause] Well, again, entering the semiconductor industry at the time, all of these companies, Intel for a start, with the others, they were memory companies, they were interested in making memory parts. And the microprocessor really, totally different and alien. And within each of the companies there was a big conflict between the

microprocessor people, who were a small part of the revenues and a nuisance, and the people who made the money who were the memory people, and, they all had this same conflict going inside them. And that's a conflict that we had in Inmos as well. Because, we tried to set ourselves up as a mainstream semiconductor company with memory and microprocessors.

[40:37]
Was that… That brings me on to Inmos, because, so, October '78… This, did this come direct then, it came out of your idea of, rather than just consulting and helping other people, let's do it ourselves?

No, not a tall. Everything I've done has been accidental.

Right.

I think. It doesn't sound good, does it? But, the central view of life, to be successful, you've got to actually be pretty clever one way or another, you've got to work bloody hard, and you've got to be extremely lucky. And you need all those things. And the other thing I found about entrepreneurs in particular is, they're the most conservative people you ever met. They don't take risks. That's why they're successful. You know, you think of an entrepreneur as being some someone, he backs an idea, one idea, and he goes for it. But he's probably incredibly safe and conservative, like Ken Olsen was. I mean he did, he eventually destroyed Digital Equipment Corporation by not making the right decisions at the end, because he, again he wouldn't go for what was happening in the world outside, which was rather sad.

Yes.

So, in the case of Inmos, it was pure accident, and, Computer Technology was really a pure accident, it wasn't something I had in any way planned. But, the event happened. I was asked to provide a keynote paper for a computer conference, it was an international computer conference every three years, and this one was at Ottawa. And I had this idea of trying to show how each aspect of the technology of computers was going to develop in the future. So I had a man to talk about semiconductors, a

man to talk about architecture, and a man to talk about software. And… This is a long story, I'm sorry, but it's…

No no no, it's…

The man… I had a problem, so, I couldn't really identify someone to talk about the future of semiconductors, other than the people I could think of, who weren't interested, interested in talking.

Yes.

And, I eventually met a man called Dick Petritz, who was writing about semiconductors and what was going to happen. And I invited him to, I didn't know him at all, give this talk. He didn't know anything about computers, I mean he was a real semiconductor man. And, he never replied to all my invitations, and I did this for some months. And eventually I went back to this organising committee and I said, 'Look, terribly sorry, I've been totally unable to contact this guy.' And they sort of said, 'Tough. It's all published. You'd better get him to come.' And I, I failed. And, I had no contact with him whatsoever. And then… So, I went off to this meeting, and I was going to have to give this extra paper myself, because, he wasn't around. And, the day I was flying to Canada the air traffic controllers in Toronto went on strike, and so planes couldn't get into the airport. Now it so happened that I was going on an Air Canada flight, and they said, 'OK, we'll go anyway, and, we'll fly… We can't get to Toronto. We'll fly to Buffalo, and we'll take you on a coach to…' And that's what happened. And, three o'clock in the morning, we were driven onto the tarmac of Toronto airport, because we had to go in through Customs to be official in Canada. But, as a result of that, it was complete chaos as far as this conference was concerned, and there was the sort of, opening event, and then, my bit was the next one. It was a full plenum meeting, about 7.000 people; it was the biggest meeting I've ever controlled.

[45:43]

And, just before it actually started, Mr Petritz arrived, and gave his talk. And, as I say, I had never met the guy. But he gave a perfectly confident talk, and… But, this, this was a sort of nerve-racking 36 hours, I had had no sleep, I was absolutely

shattered afterwards. Because, in the meeting itself there had been a huge controversy, because, the software person I had had to talk about microprocessors was [inaud], who was the guru of software at the time. And, everybody wanted to ask questions, and there were fights in the aisles of people trying to get to the phone. So, afterwards I was in a complete collapsed state. I sort of said to everybody, 'Well let's go and have a drink.' So we went into the bar, which was completely dark, and I sat down. Petritz sat down beside me. And, he leant over to me and he said, 'How would you like to start a new semiconductor company?' And I ignored him. I, I was so out of it. And he asked me about three times. And I, I just never said anything to him.

Mm.

And then the next day I thought, oh, you know, what was all that about? But he had gone. He wasn't there anymore.

Oh.

Come the Saturday… So, there had been a week of conference, and I was, I was actually flying off to go to Austin in Texas to Motorola. In Canada, to go, flying into America, they had the American Customs in the airport, in Toronto. And you went through the Customs there. And then you, so you could go to any internal location in America. And so I went up to this. And, I was dressed somewhat informally, and the guy who was on Customs said, didn't believe I, I should be going to Austin for some reason or other. And I, we had an argument. And he demanded… I, I showed my papers and things. And they were, of course, already in my bag, my bag was in the hold by that time. And so I was arguing, trying to get… And along came Dick Petritz. And he said, 'Oh I know him, let him on the plane.' And so, I got on the plane. I was sitting at the back of the plane; he was sitting in the front of the plane. And he came along and he said, 'How about setting up a semiconductor company?' So we met four days later, and, he said, 'Would you be interested? Because you know all about microprocessors, and we want to set up this full range company.' And I said, 'No.' [laughter] Because I didn't want to work in America. And so we had some discussion. And he said, 'Well, if you could raise some money in the UK, you could have your bit of the company in England.' I said to him, 'Well, you know,

maybe I could.' And so, I… And, that's actually what happened. And I came back to this country. I had been consulting for the organisation National Enterprise Board, which had been set up to sort out various bits of British industry by the Labour government. And I had been consultant on a number of things. They wanted me to, they first of all asked me to look at a small computer industry, and I told them it was waste of time, because, it was going to be obsoleted by microprocessors. And then they wanted me to look at, did three things. Telecommunications. And, that wasn't any good either. And it was a bit frustrating because I knew that if I, I made a recommendation, I'd have probably got the job of doing it, but, they obviously were, really not goers.

[50:23]

And so I went, I asked my wife when I got back to the country, 'Oh, do you mind if I set up a new company?' And she said, 'Well you'll do what you want.' So, the week after I, I went and I saw the, he was called the chairman of the National Enterprise Board, Sir Leslie Murphy, and said, 'Look…' I had been asked about this, yes, the third thing I had been asked about was the semiconductor industry. Again, I said, 'You can't do it. The technology in this country isn't good enough.' And, I said, 'Well maybe I have got an idea of the way we can do it, which is to use American technology, and import it into this country.'

Yes.

And he said, 'Great. Produce a proposal, and I'll back it.' Just like that. And then we got back to the Petritz problem. [laughs] So, I, I sort of wrote to him and said, 'Look, yes, maybe I can produce some money in this country.' He told me many years afterwards that, he hadn't believed a word of it when I said I could produce some money. [laughter] The reason why he hadn't communicated with me the first time was because he was being employed by IBM at the time to advise them on setting up a semiconductor company, and then, this second time he didn't reply to me for months and months, because he was advising the South Korean government on setting up a semiconductor company. And, but eventually he, he sort of, sent me a bit of paper, and it was a proposal for the South Korean semiconductor, saying, 'Why don't you edit that and give it to the National Enterprise Board.' Which, roughly speaking I did. But because, Petritz… Sorry, back off explaining about Petritz. He was

technical director of Texas Instruments, and he, it was in his laboratory that Jack Kilby developed the first integrated circuit. And he had gone on, and he had left, he being Petritz, he had left Texas Instruments, set up a venture capital company. And he had invested in various, miscellaneous companies, and one of them was Mostek. which was a major player in semiconductors. But another one was a word processing company, which was a completely new idea at the time.

Mhm.

And he had this word processing company, which had very limited technical capabilities, you could sort of just about edit a document. But, he could only edit the document he had got by changing letters, and the South Korean company, I think called E-MOS[sp?], which I think, E[?], it means good or something in, in Korea. And he said, well he can't do much about it. And so we turned it from E-MOS[sp?] to K-MOS[sp?], and, that was the original proposal that, sort of went to the National Enterprise Board. Except I wasn't very happy about it, because, it didn't seem to me to ask for nearly enough money; it asked for, twelve and a half million dollars investment. I didn't believe that. So first of all I changed the dollars to pounds, and then I sort of, didn't think that was very good, so I changed it, I doubled it up, so we asked for £25 million. And that was a proposal which was put forward, and Leslie Murphy looked at it and said, 'We never have enough money for companies. We'll double that figure.' And so we asked for £50 million. [laughter] And that was the way it happened. But then I had a big problem, because, there was this proposal, and they obviously wanted a better proposal. I had asked for all this money, and there was, I had to justify, what was I going to spend it on?

Yes.

And I was really in a bit of a fix about that. And, I didn't know much about the physical process of making semiconductors. Petritz wasn't available because he was still trying to do this thing in Korea. And so he sent me over some technical documents, and, and there was an announcement of a new product, a thing called a wafer stepper At that time, the images for a wafer were just a photographic image which was projected onto the wafer. And, the resolution was good enough, but not

really as good as the processor, you don't… So a wafer stepper was being developed which printed multiple images onto a wafer, so you could get a resolution 100 times as good. And to me, in America these things, each one costs a million dollars. So, I put those into the proposal, and that was what went through. And then, they obviously were the right technology, which was brilliant. And, when we actually set up the company we went off, and we ordered, I don't know, 25, 50 of these wafers, 25 I think it was, wafer steppers. There was only one company that made them in America. It hadn't really had any orders. We actually bought the whole of that technology, and all the other semiconductor companies couldn't access it, because, we had it in Inmos, which was a great plus to us.

Yes,

Serendipity.

[57:00]
So, I've got to ask you…

Sorry, that was a complicated way of answering that.

Well no, I've got to ask you about the transputer, because…

Oh well that was what I was impressed with.

Yes.

Obviously. Yes. I had had this idea that, first of all you could make microprocessors, but also they were cheap and easy and, it would be really nice to be able to make a computer which was made up of a lot of microprocessors all connected together. So, I had this idea of a component which you could actually build into largescale arrays. And, I mean, it's obviously, it's built around the idea of neurons and things like that. And, it is actually possible to formalise the properties of this component, and sort of, so you could actually mathematically design an array to do a particular thing. And that was my, my sort of concept. Yup. Took several years to realise.

Yes. And you said in your opening statements that, it still isn't fully understood.

Yah. The transputer was, the whole… It's very frustrating. Inmos was an incredibly successful company. There was only one thing wrong with it, which was Mrs Thatcher. She hated Inmos, because, she thought that it had been created by the Labour Party, and specifically by Tony Benn, and therefore, it was not acceptable at all. And she really made our life impossible by, all sorts of things, publicity in Parliament and things like that. It was all adverse, saying how bad the company was. The company they owned, or were investing in, and they were actively bad-mouthing it. And that made it, made it pretty hard for us. Inmos was a remarkable success. We started off making memory products, because it's easy to design memory relatively speaking; microprocessors are much more complicated to make and to design. And, again, the press, *Computer Weekly* and co, couldn't understand what we were doing. It was a time when the largest memory that was available was a 16 kilobyte dynamic RAM. And the next step we knew was going to be 64 kilobytes dynamic RAM. And, the press in this country assumed that we were going to make this next generation, except, we didn't say anything about it. And they all said, you know, that's rubbish, you're not going to succeed, you'll be too late to the market, and things like that. Well actually, our strategy was quite different, except we didn't tell anybody, we couldn't really. The memory products, dynamic RAM and static RAM, and, the static RAMs were the profitable ones. Intel made all of its money out of its static RAMs. And they were, they were a size down, so they were 16k, the next step… They were 4k at the time, and they were going to go to 16k. And so we made, designed 16k static RAM. And then the press got… and they couldn't understand why we were making a 16k device, you know, that's bad. But, the device was, a) incredibly successful, it was the highest performance device, and it had, we introduced a new interface which became the industry standard. And we took 60 per cent of the world market for that product.

Ah that's good.

This was, as I say, it was the most profitable semiconductor product there was. And we then actually did produce a 64k dynamic RAM, which was, again, restructure that,

because, again we, we designed a different interface for dynamic RAM which is, the static RAM interface now are on Inmos designs, they have Inmos patents. Made a large amount of money out of those patents. So, the company was actually being very successful. We had this microprocessor which was absolutely revolutionary.
[1:02:08]
We had no money. The business plan that I produced to start the company, which ironically I did with my children over Christmas while I was playing Monopoly [laughs], said that, we were going to make losses for, until 1984, and then the company was going to become profitable. And then, we would have a refinancing. And, we duly made our losses until 1984, and we were really profitable in 1984, and I think I forecast that we'd have revenues of, £150, £125 million, profit of £10 million or so. And it was, we made revenues of 150 million, and we made a profit which was slightly less. But, incredibly my, my actual forecast for that year was spot on. Previous years hadn't been, but that one was. And that was the year we intended to go out and get refinancing, because, we knew that we needed the extra money to expand our, our manufacturing, and to develop the next great products. And what happened was, after a series of painful episodes we were sold to EMI. The Government wanted, Mrs Thatcher wanted to get rid of us. And she, she… But EMI had no money. They couldn't refinance us. We had no funding. Couldn't develop the next generation of transputer. We had no money to expand our manufacturing capacity. And so we, we just fell into a funding gap. That was what happened. The biggest tragedy you could imagine.

[1:04:12]
Mm. No, it sounds, it sounds… So, in terms of the transputer, what happened to that vision?

I don't know, it was a great idea, we developed… We, again we were strapped for funding, and one of the limitations that I had was, I wasn't able to develop the programming languages that I really wanted for it, so it wasn't… We had a marvellous system for actually programming multiple transputers, but it was a non-standard, and I wanted to put other programming languages on, because they had to, not just be a simple program, because they had to work with multiple processors. And

that was a, a technical challenge. And I didn't have the funding to do it basically. So, the software was, was better than the other microprocessors, but it wasn't [inaud].

Yes.

So that was sort of a, a limitation on us.

Yes.

People didn't understand it, and so…

No.

As I said, people still don't understand it, what the potential is. And it had one limitation, which was… A transputer, this great component, and it can run multiple programs and parallel programs, in a very elegant way, and it can be exchanged with other transputers. And, the way the fundamental software worked, you could, it was the same program, and it could run on one transputer or multiple transputers. But the, the links between transputers, there were just four of them, which is OK, but, they were not, they were limited in performance. I had originally intended they were going to be, like the Internet basically, and you can just pump information out to any transputer you like. But, the real estate situation was such, we just didn't have the semiconductor real estate to be able to make the interface that we wanted. And so they were just sort of limited, fairly simple links. And they were actually a bandwidth limitation on the, an array of transputers, which made the performance of an array of them less than, certainly less than we wanted. And, it wasn't until 1990 or thereabouts we actually developed a transputer which had this capability, and by that time it was just too late.

[1:07:10]
Mm. Well that brings me on to, the sort of 1990 era is, is Division, which, virtual reality. Is…

Another bit of serendipity really. Inmos, it had this unhappy relationship with Thorn EMI, which was run by a man called Colin Southgate, who is probably being interviewed. I had known Colin for many years, because of knowing all the software companies in this country. So he was… And they were basically sympathetic to us. They just didn't have any money.

Yes.

And, so eventually, Inmos got sold to the French-Italian semiconductor company that was set up, again which, they were trying to get rid of it. I left, and I, I didn't have anything much to do. But, one of the people who had been working for Inmos said, 'Well, I'm setting up a new company, would you like to come and be involved with it?' So, I said, yes. And their idea was that, they thought that the software, the concepts that we had for the transputer were absolutely great, and they wanted to sort of, apply this to microprocessors generally. I told them I didn't think there'd be a market for it, [laughs] which was wrong. And, I said, you know, it isn't going to work, you're not going to… But they were absolutely hot on this idea of using the Inmos software technology. And there was an exhibition in California, and so I said, 'Go off and look at this exhibition and see what's interesting and come back and tell me.' I didn't go myself. And they came back and, I sort of quizzed them about what was interesting. And they didn't have much to say. And then, one of them, Steve Ghee, who, employees, said, well there was this guy, weird guy, he'd got this thing called an EyePhone, which was an e-y-e phone, and it was a pair of virtual reality goggles.

Ah.

And he said, he was sort of dancing around with it, and saying, 'Look, this is going to be the future.' And, I said, 'That's it, that's what you're going to do.' And so, we got into virtual reality, because, there was this man, whose name was Jaron Lanier, and we bought up all his goggles, and used parallel processing to make virtual reality systems. And, it was great. So, again, right technology, really interesting. Just too early. I've always been too early. And then, that's how Division happened, it was just as serendipitous as all the others.

[1:10:44]
Yes. Well, the interesting thing as well, is, is, what's also emerging as a theme is Bristol at this point, which is…

Yah, well…

How did…

How do we get to Bristol?

Yes.

Painfully. When we set up Inmos, we knew we were going to have this operation in the UK and one in America. And then obviously there had to be a lot of communication between them. So I said, well, in the UK we've got to locate in a place where it's easy to get to America. And I told the American people, 'I don't care where you go in America, provided it's one stop from Heathrow.'

Yes.

And the original idea was, I thought we could go to Reading or Newbury. But the property was too expensive. Didn't really want to go to Swindon. So the next place down the road was Bristol. And, so I proposed to the National Enterprise Board that we should locate Inmos in Bristol. And they said, 'Oof, that's going to be difficult. It's not a development area, and, the Government isn't going to like this. You've got to produce a really good case.' And so, I did this study, which was interesting to me at the time, about where people wanted to work. There had been, there was a famous geographer who had done this, a study about people's preferences in the UK. And it turned out that, where people wanted to work, and this is graduates basically, was actually where their university had been or another one. So, the most attractive places were, Cambridge and Edinburgh and Bristol. Well, Cambridge wasn't very good, from the point of view of transport; Edinburgh wasn't. Bristol was, OK, just down the motorway. It was further than I wanted to be. So I proposed that we went to

Bristol. This had really difficult implications at the time. Inmos was financed, there was a Labour government, and, so they weren't happy about it. By the time we were actually going there, the Labour government had fallen and Mrs Thatcher had come in, and they were even more unhappy about it. So we had the situation where it had been agreed that we should set up in Bristol, but we couldn't tell anybody. So I had three people employed in Bristol. I never went there, because, I was being tracked by newspaper people all the time. And, eventually, we did go to Bristol, and we sort of set up in this office, but it still wasn't public in any particular way. And I said, I've got to be able to recruit, I need to put ads in the paper, I've got to say where the company's going to be located. And there was a, a big pressure group saying, you must go to the north-east. A man called Greville Janner actually. And they were demanding that Inmos be located in Newcastle, or thereabouts. And that just didn't work, for logistic reasons. Nothing worse than… But, so, I was told, yes, you can… Eventually the NEB got approval we could go to Bristol. And so… And I'd got all these ads ready to go the moment I was given the all-clear, and I was given the all-clear about ten o'clock in the morning. So, I told the newspapers, put the ad in, it was a half-page ad, which was a pretty unusual thing at that time. And, then at six o'clock in the evening I was phoned by Sir Leslie Murphy, saying, 'You can't go there.' And I said, I've let… All the ads are out tonight.' And he said, 'Christ!' And, they went, they talked to the *Guardian*, and they pulled the newspapers. All the initial editions were pulped, and the ads were taken out. Yeah? So, that, that was that. Except, the dear old *Graudian* had this marvellous system they had just introduced where they, they actually did remote printing in, Manchester I think it was, and, they had cocked it up, and they had pulled it from all of their nationals, but the edition that got published in, would you believe, in Newcastle, had this ad in it. [laughter] You can't imagine the row that ensued. But, by that time, that as it. So, we went ahead and, the ad went out in all the other papers as well. Yeah.

[1:16:21]
It's interesting too, because now, things like HP Labs are in Bristol, and it has a reputation. But was that… You were one of the main players

We were the, actually… Well, I think, the two things that made Bristol, one was BBC. The fact that they'd got the BBC channel there, and, and whenever you see the

BBC news now, it will have a bit in it about, from Bristol, well not about Bristol, but… And, and that has had a dramatic effect. And yeah, we were the technology bit, and we attracted a large amount of technology companies to Bristol. And also we spun out, off of technology. Because when Inmos sort of, run out of money, lots of people left and they went and set up, all set up their own companies. And that was sort of, a very powerful effect.

[1:17:20]
Well that leads… Talk to me a little bit about the Bristol Millennium Project. Because this is obviously…

Oh.

…'96 to just beyond… What was the aim of that?

[pause] Well it, to go back slightly further than that. When I was at Cambridge studying, I had actually wanted to do research – well, I wanted to do a PhD. And the thing I wanted to do a PhD on was consciousness, how the brain worked. And I, I had total failure, because, no one at the time was interested in that subject, which is, you know, slightly ironic. But one of the people I met was a man called Richard Gregory, who was then at the Cavendish Laboratory in Cambridge, Professor of Psychology at Bristol University, very influential. And, he had this idea that he wanted to interest children in science, hands-on science, by just recreating experiments that people had done in the past, and… So the children could actually feel what science as like. It was a great idea. Originally, he couldn't get it happening in this country but he got it happening in America, in a place called the Exploratorium. And eventually he raised the money to set up something called the Exploratory in Bristol. And, again, it's marvellous, it's a lovely place. And, the only trouble was, it wasn't financially viable. And he had got himself into a state, and he, in some desperation, asked myself and Clive Sinclair and a man called Alex Moulton, who was the person that designed the springs for the Mini car, to help him. And the other two wouldn't have anything to do with it, because they could see it was a, I mean the company was trading illicitly and things like that. And I said I'd sort it out. So, I got involved with this Exploratory, it was a good idea. And then, there was the Millennium Project, which was happening

in Bristol. And, the Exploratory managed to get itself integrated into that, and set up as an enlarged centre called At-Bristol, which wasn't nearly as good as the original Exploratory. And yes, I was involved in doing that for several years. Which was an interesting experience.

[1:20:26]
Yes. And that's where the, the sort of CV stops. Was that your last…?

My last hurrah? Yes.

Was it? [laughter]

Pretty much, yes.

Yes, OK. OK, well that's covered your work life. Well I wouldn't mind, if it's OK with you, is just going back to your childhood and before, before that. So, just talk to me a little bit, if you could, about your really early years. Was it a good childhood, happy time?

Oh yah. No, just sort of, fairly ordinary. For some reason or other, when I was about eight, I decided I was going to be a mathematician and I was going to get to Cambridge. Now, I have no idea, in retrospect, how I could possibly have decided that or wanted to do that. And that became my goal.

Right.

And I, that's what I did.

Yah. Yes.

Now, I lived through the Second World War, and all the experiences of London when it was being bombed and things like that, which was, pretty horrific actually in many ways.

Yes.

I was saying to someone yesterday that, because they were talking about the Post Office, the sorting office, I actually saw that the next day as it was being burnt down after the bombs had fallen all the way around St Paul's. A number of fairly nasty experiences.

Mm. Was it though, were you one of those people who sort of, made your own transistor radios and type of thing?

No, not…

No?

No. I… Not quite true. [pause] No, I wasn't, I didn't really… I… Yah, I loved making things. Still do. But not like, electronics. But I did make a differential calculator out of Meccano, inspired by Douglas Hartree, when I was…

[1:22:53]
So you were, in terms of your parents, had they gone to university, or…?

No. No. My father was in the book industry, and he, he was responsible for…, but, I had quite a good childhood, because I met all sorts of authors and publishers and things like that, but, he wasn't particularly rich or anything. But, no.

No.

I had loving and good parents.

Yes.

Yes.

[1:23:23]

So, how did, what did you do in terms of getting to Cambridge? So, you said, this is what I'd like to do.

I just… Just…

Did you just go to a normal sort of comprehensive school, or was it a grammar, or…?

No. I went to a public day school in Hampstead, at University College School. And, for some reason or, other the year that I was in was the best year they had ever had or have ever had subsequently, and, virtually everybody went to Oxford or Cambridge. I mean, 30-odd people. And, most of them had scholarships or exhibition, and I got an exhibition to Cambridge, I got one in natural sciences actually, but… So I, no, I had a, I had a fortunate childhood. I've had a fortunate life.

Yes.

I think you have to say that.

Yes. And was Cambridge everything you hoped it would be when you…?

No. [laughter] It was… Yah, it was wonderful, because, I went there and, I had all these ambitions, so I went to lectures in Classics and things I… I didn't do mathematics basically. I wasn't interested in a maths degree. I was interested in advanced maths and logic, but I didn't like the whole practical aspect. And so, I rather messed myself around at Cambridge. But it was good.

[1:24:54]
Yes. Yes, OK. Well it's… I mean, it's hard for somebody like me, I guess, to get a picture, but we're talking about, you were there, '55, so ten years after the war had ended. What was it like as a…? Did it feel like this was a, a world of opportunity for your generation, it was…?

[pause] Mm. It was a sort of, split world at the time, because, I went to university before National Service, but a lot of people were going after. So there was, the

undergraduates were split with sort of, three-year difference between. All these mature ones, and then there were us, sort of just out of university that didn't – school, that didn't know anything.

Yes.

And so there was quite a division in people at the time.

Mm

Mm. It was a time when DNA, the structure had just been worked out, and things like that, and it was all very exciting.

Yes. Yes.

Sorry, to go back. When I went to Cambridge, I had… I had this experience, I knew how to programme and things like that. And, I had Lord Haldane[Halsbury] and Chris Strachey as mentors. I mean very lucky. They maintained an interest in my career subsequently. And as a result of that, one, Chris Strachey had told me, when you go to Cambridge, the thing you must do is to go to the Colloquia, the mathematical laboratory as it was then. And so, I, as a sort of, raw undergraduate, I turned up at this big green door that you went through to get into the mathematical laboratory, and I attended, oh it was marvellous, all the great people in computing around the world at that time used to come and give lectures every Thursday afternoon. And I listened to all of them. Much to the disgust of Maurice Wilkes, who I had problems with for 40 years, so, who didn't think I ought to have been there. [laughs] grotty undergraduate, it wasn't meant for people like me. But… So, it was actually very exciting from the point of view of computing.

Yes.

You just met everybody who was anything in computing. They all went there, that was the place to go.

[1:27:48]
Mm. And in terms of other, when you look back, other interests, did you have, outside of computing, were there other things that excited you?

Nn… No. No, I was a nerd. [laughs] [pause] Most other people couldn't understand why I would be interested in computers. You know, it wasn't a big deal, they were, sort of, you know, they were there, and they were doing some useful stuff, but they weren't regarded as being very interesting. I mean, to just give an example. As I said, I went, I went to the mathematical laboratory, and, they actually had a brass apparatus in there which was an original bit of the demonstration of Babbage's Analytical Engine, which he had made for some purpose. And I had it. They gave it to me. It wasn't very interesting to them. And so as an undergraduate I had this bit of Babbage equipment in my rooms. Made me very interested in him, nobody knew about Babbage.

Mm. What an experience though, to have that sort of exposure, like you say, to the history of it, and the object.

Yah, I… Yeah, I was, I was just lucky.

Yes. Yes.

Sorry, I keep on about this luck, but, it's important.

[1:29:26]
Yes. Yes. The final area I just want to talk to you about is, what you think about the development and importance of the IT industry over, over the years you've been involved in it. Because it's gone, it's gone from almost like, a dark back room, hasn't it, to, it's now ubiquitous, but, what's your feeling about, as you've seen it grow and expand?

[pause] Well, a) it's wonderful, and b) it's tragic. Because, most of the computing that people are exposed to is, 1960s or 1950s technology. What we as computer people have delivered to the world is pretty pathetic in comparison with what it could

have been, and should have been. It's pretty unreliable, the software doesn't work. You can blast bugs through it all the time. That's all our fault. And, I feel, I suppose embarrassed about it on one level. Most computing is about failure. But, the technology is wonderful. We're not using it as well as we should or could. And, and we have these sort of, continuing problems about software that has been developed, and, either doesn't work or costs too much money or is insecure. But, that's bad. And avoidable. It should have been avoided.

Mm. What do you think about the…?

Well we were revolutionising the world obviously.

Yes.

Just could have done it so much better.

[1:31:32]
Yes. I mean what do you think about the state of the UK? I mean you talk, it's very interesting, one of the things that came out particularly of the latter part of your career was problems with funding and things like that. And, the things that did happen in the UK no longer seem to happen here, they happen elsewhere. Does that upset you a bit when you look at, you were doing things here, you were making things here, developing things here?

Well, so far as I can see, the UK has had the same problem throughout my career, and I don't think it's addressed now, which is that actually, yeah, you can get funding, there's money available, people, yeah, put money into a new idea, and there's lots of ideas that are created. It's the secondary funding. You've got the idea, you make it work. You've demonstrated a market. And at that moment you need really large sums of money, firstly to be able to manufacture and support, and to be able to market. And it's that second stage that all my companies went wrong on, and, to my observation, has been generally true with other companies as well.

Mm.

So, yeah, we're, we're great at technology. We're not great at exploiting it, because when, this big gutsy bit where you have to put in really large sums of money, because it's worked, and now you want to go for the world market, it's just not there when they're needed.

Mm.

And, I mean, the one company that has been, arguably, it's a wonderful success in my area, is ARM, which is sort of, rather sad as far as I'm concerned. Because they were started a bit after Inmos, five years or so, and the situation changed. When we started, if you wanted to be in semiconductors, you had to set up a manufacturing facility, which is big bucks and, a pretty complicated thing to do. By the time, when they got there, you could actually go, and there were wafer fabs around the world and they would make your product. And so they had a much easier situation that, they didn't have to have this really large sum of money, or the pain and difficulty of, of getting the manufacturing bit done. And they've been wonderfully successful, and, they should deserve every credit for it. And now what have we done? We've sold it off to SofTech[Softbank]. The one really good bit of technology we've got, and now lost. Tragedy.

[1:34:47]
Mm. Would you still… I mean if somebody came to you and reminded you of yourself back in the days when you were first getting excited about computers, would you, say, go into IT, would you recommend it as a career?

Well it's the future of the world.

Mm.

Yes. I mean… [laughs] The thing that I was always interested in was called embedded products. And, in the 1980s I used to go around saying to people, how important microprocessors were going to be, and, the example I gave is, the motorcar. I said, 'Look at a motorcar. How many electric motors do you think it's got in it?'

And people have no idea. And there were lots. I mean maybe 30, 40 hidden away. The winders and things like that. And I said, that's what's going to happen with microprocessors, they're going to be inside these products, and you won't know anything about it.

Mm.

Because they'll just be doing things. And that's the way it is, all new products are coming out, microprocessors. Even light bulbs now have them.

Yes.

So, the ability to actually programme, create systems, is fundamental to every manufacturing and service industry that we have. And so it's much, much more important than it was when I was young. We have the potential to be able to benefit from that.

Mm. Mm. Well, thank you very much for talking to me.

Right.

Really appreciate that. Thank you, that was really interesting.

[End of Interview]