



Professor John Tucker

Interviewed by

Elisabetta Mori

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Via Zoom

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[00:00:12]

Okay, I'm going to start right now. Welcome to the Archives of Information Technology, it's the 8th of April 2021 and we are recording this interview on Zoom. I am Elisabetta Mori, an interviewer with Archives of IT. Today, I will be talking to Professor John Tucker. Professor John Vivian Tucker is a British computer scientist. He is an expert in mathematical modelling of computational systems and in theoretical computer science. He is also a scholar of the history of computing and of the history of science and technology, with a particular focus on Wales. He is a Professor of Computer Science at Swansea University, he is a Fellow of the British Computer Society, a chartered engineer, a founding fellow of the Learned Society of Wales, and a member of Academia Europea.

Welcome, John.

[00:01:11]

Delighted to be here.

[00:01:13]

Erm, we can start with erm, where and when were you born?

[00:01:19]

Oh, I was born on the 4th of February in 1952, in Cardiff, which is the largest city in Wales and, er, its capital.

[00:01:35]

Can you describe your parents, what were their occupations?

[00:01:39]

Okay. Well, my father, at the time of my birth, was a young police detective, with a rank of sergeant, and my mother was a housewife. And er, we lived together, er, in er, a small, er, sort of ... I don't know, suburb, of, a Valley town, called Aberdare, which is, er, er, a very nice, and er, rather forgotten about sort of place, er, north of Cardiff, in the Valleys above, er, well, around the Taff River.

[00:02:19]

And what about your grandparents?

[00:02:23]

Well, my grandparents, er, come from, erm, well, ultimately, all my ancestors come from, er, an area near Swansea called ... called Gower, which is a peninsula, er, to the west of the city of Swansea, which is Wales' second town. And in particular, erm, they were all farming people, but gradually, they, they started to, er, to move and, er, many of them ended up in Cardiff, some moved into other places in South Wales. And so, they were, by profession, my immediate grandparents were in business, and er, er, lived all over South Wales, in fact, I would say the whole family has been rooted in the county of Glamorgan, which is essentially, the-the region of South Wales between Cardiff and Swansea.

[00:03:20]

So, have you got any early memory of your life, or like, what was your family life like?

[00:03:29]

Well, it was very, er, very pleasant and enjoyable and calm. Erm, my father worked all hours and has always been a very hard-working man and er, that comes with the nature of the job where you ... where you respond to things and er, he, er, he was someone who was very gentle and quiet and yet, at the same time, er, out in work, I think was rather a little bit more larger than life. Er, my mother was very er, active and busy and knew everybody and er, I was just er, just her... her best friend I think.

[00:04:14]

Do you have any siblings?

[00:04:16]

No, no, no, no. My mother lost a baby, er, before me, but er, there, there, there were no other children. My er, my mother had me rather late in life and when I did er, a little investigation of the dates of my grandparents, for example, they were all born well into the 19th century. So, I find it very strange sitting here in 2021, thinking

about my grandfather being born in 1877, what an amazing amount of time. So, we, we, we all get married late, and we have children late; I did this, of course, myself.

[00:05:05]

Erm, who were the important influences on you in your early life?

[00:05:12]

Oh, I think my mother and my father, without any question, they er, they were, er, they were the world really, weren't they, you know, in the early life? And it was only much later perhaps where one, er, started to, er respond to school teachers.

[00:05:30]

Yeah, so, which schools did you attend?

[00:05:34]

Oh, I, I went to many schools because if you were a police officer, in those days, you moved around a lot, it was part of a kind of, erm, er, due diligence. Officers were moved and were billeted in special houses and so, er, it was not ... wasn't common for a police officer to remain in the same area, er, for long periods. So, I moved from Abernants in Aberdare, I moved to different districts around the area of Pontypridd, then we moved to Bridgend. And these, we basically followed a, a, a stream of promotions for my father, who ended up being, erm, one of the chiefs of the regional crime squad for Wales, er, in his later life. But that idea of moving around, moving to different schools, became very common. In fact, things stabilised when I ended up in a town called Bridgend, which was the-the town in which the headquarters of the police in South Wales was, was based. And we never moved from there then, and my father worked essentially in Cardiff when he was running the regional crime squad. But er, we stayed in Bridgend.

[00:06:52]

And what were your favourite subjects at school?

[00:06:55]

Oh, I think science, definitely science. If you talk about, er, my time, erm, in jun... junior school, before going to the secondary school, erm, I think, I had no favourite subjects, I just did whatever was served up and if I had a favourite subject, it was an, an abiding interest in architecture. And this was driven, by the fact that I was given an enormously large Lego building set, er, sometime in the '60s. And so, through this Lego business, because in those days, the ... all the guides for Lego sets weren't about Star Wars or things like that, they were just an endless collection of buildings. You had Lego in order to build buildings, or towns even. And so, I had, a Lego set that allowed me to build a town, which was quite big, and so on. But once I got to secondary school, then science become ... became a very interesting, er, intro ... you know, er, thing for me. Especially ... especially, first of all, chemistry, but then soon physics, physics started to be the thing that I liked most.

And I was not very good at mathematics, and the reason I think was very interesting and it was purely, erm, ha-having a poor teacher. Now, everyone can blame teachers, and, and I am absolutely convinced because the moment the teacher ch-changed, I started to become extremely good at it, so, [laughs] there is some truth in this at least in teaching mathematics.

[00:08:39]

Have you got any special memory about those years?

[00:08:43]

Oh, well, lots of memories but, er, I suppose, er, in the days when I was in the grammar school in Bridgend, my memories were very much of, er, enjoying all... most forms of school work, er, having quite an independent interest in the world and in-in-in different subjects. And I remember coming home one day, and I sat down, er, in front of the television and I was pressing some buttons, and I discovered that, er, a new channel had appeared on-on my television at home, and it was called BBC2. And in those years, and for many, many years, BBC2 was an enormous repository of cultural programmes, scientific programmes, advanced documentaries. And that really was very int-interesting and-and quite influential. So, for example, er, for many years, BBC2, would erm, have regular series of films from foreign countries, so, by simply watching television, you could work your way through, er, all the films of

Bergman, and er, Michelangelo Antonioni and-and, erm, the Polish School, Andrzej Wajda, and people like that. And so, suddenly, this became a very interesting, er, thing, which I and my friends in the school cottoned onto. Er, so, there was a kind of a-a nice cultural life, intellectual life if you like, and then there was the sensible solid business of learning science, especially physics; that was school.

[00:10:40]

And what about ...?

[00:10:40]

And no-and no girls, of course, because it was a boy's school. [laughs]

[00:10:43]

Okay. And what about university?

[00:10:49]

Well, er, after-after really getting involved in-in mathematics, 'cause one of the things that happened in my school, which I think might be relevant, is that erm, er, er, when you come to the last 2 years of school, the sixth form, you have to choose things called A-Levels. And so, I chose, erm, physics and erm, pure mathematics and applied mathematics; these were completely different subjects. So, that constituted 3 subjects. And what was interesting about that was that I was determined to do this physics, and er, I-I felt I had to do this mathematics in order to get anywhere with the physics, which of course, is true. Erm, but my teacher at Bridgend of applied mathematics, together with a teacher at another school in South Wales had applied to the examination board to create a new syllabus, and only 2 schools were doing it. And what he had done, is he had taken out quite a lot of statics from his ... er, the classic A-Level syllabus and inserted computing. So, from '68 to 1970, in my applied mathematics, erm, A-Level, instead of very advanced work on-on-on-on er, er, static mechanics, we were learning about Boolean Algebra, we were learning about circuit design, we were learning about algorithms, flow charts, and erm, mechanical calculators of the classic wind the handle variety and marvelling that numbers could have, you know 8 decimal points [laughs] 8 decimal places. And so, that was school and that had quite an effect because in that package, if you think about it, the Boolean

Algebra and the circuitry was very, very abstract and it was taught axiomatically. So, in other words, there were these postulants, these laws and you did calculations with them, very abstract. And on the other hand, there was this numerical work where you learned quite a lot about, erm, you know, the complexities of a numerical algorithm and also error management and this sort of thing. And that had quite an-an interesting effect.

So, when I left school, I'd had a taste of this, then I showed up at-at Warwick University. Now, if I remember correctly, Warwick University was 5 years old when I arrived at Warwick, because I arrived there in October 1970, and erm, by that time, er, it was beginning to show real energy and one of the most important departments in Warwick was the mathematics department. For some reason, probably it was because of the senior professor, a man called Christopher Zeeman. Erm, the Vice-Chancellor and council of the university had decided to invest in a big way, in er, in mathematics. And they created a big institute that was so rich that it had beautiful, er, 6 beautiful houses created for it, where people could come to visit and live. So, you're talking about very serious investments. Obviously, money drawn in from charitable foundations and other things.

But Chris Zeeman was not only a very gifted mathematician, he was a-a wonderful person actually, really, extraordinary man. Erm, and er, anyway, so, er, he developed a mathematical curriculum and Warwick that is worth mentioning to you. It was this; erm, first of all, there was a formula which didn't prescribe how many, er, lecture courses you had to do. The-the least you could do was 8 and the most you could do was 15, and you could choose how many you did, but the formula would weight your performance so that obviously, if you did more, your final marks would be, er, more highly valued even if you didn't do so well in them. So, it was a very complicated thing, it was named after a physicist called Seymour—Seymour Percentage Formula, it was, a very cryptic formula, I can tell you.

Anyway, Chris Zeeman said, the way we're going to play it is this, the mathematics department is only going to have pure mathematicians, only those. And in the first year, we're going to provide 6 courses, and they're going to be super-modern-style courses and they were. Er, so, the students have got to go off and find other courses

to fill up the 8 or 10 or 12. The normal load was 10 if I remember correctly, so, you had to go outside the maths department to learn something else and I went and learned, erm, er, the, erm, philosophy of science and mathematics, which was a course sitting in the, erm, philosophy department, taught by a well-known, er-er, philosopher called David Miller, who was closely associated with Karl Popper and I went to the computing department to learn computer programming. Because, of course, I-I had done a lot of algorithms and computation in my A-Level, and so, I was initiated into algor on an Elliot machine, complete with punched cards and all the dreariness of producing a programme and waiting for the results to come back, er, only to find that it wasn't quite right and so on. So, that was my initiation into, er, into-into programming at Warwick.

But erm, that point was quite interesting because I did another course on mechanics as well, and-and-and... so, by the time we got to the second year, this principle was continuing. There were never enough maths modules to fill the quota, so, in the second year, I was going off to the computer science department again where I took a course on the theory of computable functions, which was taught, erm, by a man called David Park who was quite well-known in Britain, er, as an-an early theoretical computer scientist and with some supporting classes, from, er, a man called Mike Pattison. And these are quite, er, well-known individuals. David died many years ago, but Mike is still around, and probably, he's been interviewed by the Archive.

So, then comes the third year, and then there is more of the same, but by that time, I was doing mathematical logic in the second year and that involves you in all kinds of questions to do with, er, er, theoretical limits of knowledge that can be formalised. So, by the time I'd finished my Warwick education I had done a lot of pure mathematics, which was very, very abstract in Warwick, it's extremely abstract, everything was abstract. At least that-that- I think that was true, the bulk of it was done in an abstract style. And then, er, I had done courses on logic and the philosophy of logic and the history of science, the philosophy of science and computing. So, that was the kind of portfolio and-and I enjoyed it, I simply did things that pleased me and er, and it was great, absolutely great. And er, Warwick was terrific from that point of view.

[No speech 00:19:30 to 00:19:38]

Okay. Well, at the end of Warwick, er, I definitely had a huge appetite to learn more. But the thing that I wanted to learn was, um, basically, er, logic, mathematical logic, which had been, as I've mentioned, taught in the philosophy department at Warwick. The mathematic department did not, er, did not involve itself in the subject at all. It had a very... the mathematics department at Warwick, did algebra, did, topology, and er, er, essentially that was... those were some of the dominant subjects. Anyway, so, the question then was, if I wanted to learn more where might I go, er, to do logic?

[00:20:26]

So, what was your next step?

[00:20:29]

Well, er, in that final year of studies at Warwick, I was applying to various places and one of the places I applied to was Bristol University, which at the time had a-a-a large logic group, erm, and er, a very well-known professor of mathematical logic called John Shepherdson. But there were a whole bunch of people there, er, doing logic and er, it-it-it appealed to me very much. Erm, I knew Bristol anyway, because Bristol is, er, essentially close to South Wales. I had been to Bristol on a number of occasions, and I'd even considered going to Bristol rather than Warwick, er, in the, er, in days of being in school. So, Bristol, I applied to, I applied to, um, one or two other places, erm, the place that was perhaps most, er, interesting, was erm, Oxford, where they had, er, a, um, definitely some logic, and I applied there, and eh, that was it.

Now, by the time... by the time, erm, Christmas of my last year at Warwick, er, was over, the Christmas holidays, and so, I was looking now towards finishing at Warwick in the summer. Erm, I got an acceptance from Bristol straight away and this was quite interesting, erm, so, er, it just cheered me up a lot, I have to say, erm, because, um, I really was getting more and more keen on-on-on working, er, and learning more about logic. So, that period passed, and it happened that in the summer of-of that year, 1973, the um, the Association for Symbolic Logic's er, annual European meeting, which was European in the sense that it was in Europe but is essentially... was the big meeting of the Association of Symbolic Logic, was in Bristol. And so, erm, that

summer, I went to erm, I went to that conference, so, I probably was the only undergraduate in the conference, and it was an extraordinary and brilliant, er, experience because it had many very distinguished figures from all over the, er, logical universe. Even Paul Bernays, the great set theorist, was there, as a very old man, Abraham Robinson, and so on. But it also had a number of, er, people who were, if you like, I-logically trained, or logically interested who had already started to work in computer science. So, Dana Scott, Robin Millner, and people of that ilk were at this meeting and this was because of John Shepherdson.

Shepherdson was a very gifted logician, a very, very quiet man, but essentially, he spent his whole life in and around the University of Bristol and er, had been appointed as a lecturer at the age of 19, a very gifted man. But his interests had always been, in-in down-to-earth theories of computation and he had done a lot of very important work throughout his career. But by the time I got there, he was already spending summers at IBM Yorktown Heights. And that had a great influence over what kind of vision of mathematical logic was going on at Bristol.

Anyway, just to finish off the other story, this wonderful conference, the Bristol Logic Colloquium, er, of '73. It was during that, I finally got a letter out of Oxford accepting me for Oxford University and offering me something at, er, Jesus College Oxford. Now, Jesus College Oxford is, er, notorious, or famous, I should say because it has got strong associations with Wales. And so, if-if you're ... if you're atypically, a traditionalist and come from Wales and you are going to go and get your education in Oxford, Jesus is the places to go because then you are surrounded by your compatriots and you can create your own, er, comfort zone, so to say. But I thought, well, that's too late for me, I'm not bothering with this, so [laughs] I-I think this Bristol is fantastic, I'm staying there.

And so, I stayed at Bristol, and that proved to be a very important decision and a very good decision for me. Erm, so, erm, I then studied at Bristol and my supervisor was a man called John Cleave. Now John is a very interesting figure. John was a tremendously active socialist, and a powerful, er, er, a power mathematician, who, er, loved mathematics and logic. But by the time I came there, he was moving away from logic. What was interesting about it was that because I'd been at Warwick and

had been taught an enormous amount of contemporary mathematics through their somewhat ambitious programme, er, we could talk at many levels, not just at logic, but also of some of the things he was getting himself interested in, which was something called singularity theory.

Erm, but the other side of John was that he had got into logic because, as a young man, he had educated himself and got a PhD from, erm, from Andrew Booth, the Booths at Birkbeck College. And he did his PhD on machine translation and natural language processing for Booth. And he was very interested in that and he programmed for [unclear 00:27:00] he programmed this and as he had got more and more deeply involved in some of these questions for Booth, he'd become more restless about the foundations of this new thing called computing. And he had stumbled across this thing called logic through his interest in natural languages and suddenly, started to move rapidly in the direction of being a professional mathematical logician.

So, by the time he was at Bristol, he was a reader with this long experience of early computing through Birkbeck, because remember, he was self-taught, so, Birkbeck, this is typically, a place where all kinds of magic happens to people, er, whose lives are not made into straightforward railroad into university from school. And er, he found logic and developed it and had a career in it, he was quite active. But by the time I met him, his restlessness had moved now in the direction of this differential topology, differential equations, in the modern style, and so on. And he became my PhD supervisor, and I wanted to do something that was particularly, erm, connected to computability and computation in this logic department. And so, er, he proposed that given that I knew an awful lot about algebra from the Warwick experience, I might want to look at a subject, er, where you look at what can be computed in classical algebraic systems.

Now, this is where it all gets, to some extent, depending on who's listening, somewhat technical. But abstract algebra, erm, is wonderfully, er, wonderfully rich and complicated set of theories about the things you learn in school but done in a very abstract way. And there were theories about this kind of numerical system, this kind of, er, geometrical system and so on, all done axiomatically and symbolically. So, it

is a world in which the application of rules to symbols is a standard practice. Now, at that level, you can again feel that resonance with what goes on in computing, of course, a very symbolic subject.

So, I then worked on algorithms and computability theory, to look at the scope and limits and of-of er, what can and cannot be computed, er, in the algebraic systems that, er, the-the basic algebraic systems, erm, groups, rings, and fields. But I did it after immersing myself in something called universal algebra. Now, universal algebra is just a completely even more general account of the all the other algebraic systems. Where, er, to use modern terminology, you essentially assume that you have a set of data and a set of operations on the data, and you formalise that mathematically and you start finding out what you can do.

Now, most abstract algebra has very firm views over what this data might be, it could be numbers, or it could be o-o-o other objects that people use in the world. But uh, this er, universal algebra was a world in which you didn't know what the data was, you just knew that it satisfied certain laws and these laws were about the operations you could do on it and that was my PhD thesis. It was looking at computability theories, what could you compute with this thing? And then, to test drive some of the-the ideas, I applied them to more conventional other abstract theories. So, this was a great big dollop of mathematical logic, computability applied to abstract algebra in-in-in the case of algebra's that are quite universal as a general framework. That was the thesis and er, I-I learned a lot during that period of all sorts of subjects just to get this thesis written. So, I acquired a rather general appetite for absorbing things, sometimes very superficially I have to say, but it-it-it worked for me.

[00:31:56]

Then, in 1977, erm, you got a Royal Society European Fellowship.

[00:32:07]

Yes, that's right, yes, yes.

[00:32:09]

So, did anything happen in between your, er, PhD and when you moved to Oslo?

[00:32:18]

Er [coughs] that's a good question. So, again, er, I decided at the end of the... at the end of the... er, towards the end of the PhD, I was advised that the idea of ever getting a job in academia is-is the sort of thing that you-you'd be well-advised, not to-not t-t-to pin your hopes on anything like that. Er, it was a period of retrenchment in the university system because, by the time '77, '76 was around, the legacy of the gigantic expansion of the universities of the early '60s was now seen as, er, er, partially, if you like, er, er, a mistake because it was too rapid. And there was a mood that anybody who was anybody could get a job in a university, no problem, because of the '60s expansion. I kind of referred to the '60s expansion when I mentioned that Warwick was 5 years old when I arrived there, if you see what I mean, so, there were lots of jobs. And so, there was definitely a gloomy mood about the-the future of academic life, er, around the late '70s. And er, John Cleave, recommended that I-I-if I wanted to go forward and have post-doctoral positions I should cast my net wide.

Now, in my second year of my PhD, John packed me off to a meeting in Leeds, and so, this was quite an adventure for me, going up to the north of-of England, to Yorkshire and Leeds, where there was a big logic group. And some Norwegian er, logicians, a very famous one called Jens Eric Fenstad and one of his, erm, younger colleagues, a man called Dag Norman and others, er, had been in Britain for a year and they were up in Leeds for a while, and they were doing a special meeting on-on computability and its general faults. So, John Cleeve packed me off to this.

I mean, at those times, conferences w-w-w-were grand occasions in some ... s-special occasions. If someone was organising a conference, you took note of it, and er, you know the er, er, the number and the range of options were much smaller, but it had quite an effect. So, off I went, and I-I gave a talk on what I'd managed to do, and I-I think it was reasonably received because no one else was working on these questions of what computable structures and-and so on at that time. So, it was something a little bit off the wall, even though John Shepherdson himself had done perhaps one of the most interesting exercises in that area, in the '50s.

So, erm, so, there I met this Jens Erik Fenstad. Now why that is relevant, of course, is that amongst the different places I tried to apply for a job, I noticed that the er, European programme at the Royal Society was announced which would offer a year's fellowship at a European university, and with a possible extension for a second year. And er, so, that was one of the things I applied for having first contacted Professor Fenstad to ask would he mind if I er, er, er, applied for this at his logic group in Oslo. And he was very pleased and very enthusiastic and so, I did.

Then, in the summer, that summer of '76, er, which meant that essentially, it was the end of my period as a student, er, I'd already had the letter confirming that I was awarded this opportunity to work in the University of Oslo under Fenstad, or in Fenstad's group. Erm, but they reminded me that I had to have my thesis submitted before I go.

[00:36:49]

[laughs]

[00:36:54]

So, I, you-you can imagine the effect of this [laughs] so, then I spent 6 months writing the thesis and on a very wintery day, a very, very wintery day, even for Norwegian standards, I arrived in the first, er, I think the first ... the second week of January 1977 at Oslo airport. And er, Dag Norman, who was er, this young colleague that I had met at Leeds, er, met me, despite the plane being hours late and that began a very, very wonderful period living in Norway and in this very, very intense atmosphere at the University of Oslo because the University of Oslo, mathematics department was very strong and-and-and quite aggressive in-in many ways. Bristol is very complacent; if you live in Bristol, y-you feel that this is... the-the-the life can offer you very little more than being comfortably off in Bristol. And that is its strength and its weakness. Warwick had to prove itself, and it did and it has, Bristol didn't have to prove itself and er, and-and Oslo had to prove itself because it was the number 1 university for the country and there is this big bad world and you don't get this British complacency that was much more visible in the period, that yes, indeed, there is a big, bad world out there, and of course, some of it is very, very important, but in general, we do the way things... we like to do things the way we do them, which was the world of the '70s, I

can tell you, very much so. That is why the European Union, er, business was so interesting, this was really a big break.

[00:38:49]

And then you moved to Amsterdam.

[00:38:51]

Yes. Well, yes, eh, logic was great then. Of course, Ole-John Dahl, a very famous computer scientist at Oslo, had a seminar and various things going on and, er, I-I'd move already then into computer science, essentially while... at the end of the time in Oslo for 2 years, I was ready to er, move to computer science. And again, I had the same problem, how do you get a job in this world? [sighs] So, on... this is true [coughs] in those great days, there were things called notice boards everywhere, thousands of bits of paper on these notice boards. And I noticed that something called the mathematical centre in Amsterdam, er, was, erm having a summer school. And that a man called Jacob Dubakka was organising it and I had vaguely been aware of the mathematical centre as a place for er, working on logical aspects of theoretical computer science. So, I wrote him a letter, and send him some papers that I'd been working on, and er, I got a letter back offering me a job.

[00:40:06]

And this was over here?

[00:40:09]

This was in Amsterdam, in, er, this was er, well, this would have been in er, let's see... so, I arrived in Amsterdam in January '79, so, this arrived in erm, I think it arrived in the, er, end of the summer in 19... well the year before, 1978. So, er, it was very nice to have this job offer and er, we'd not met, he'd never seen me, he just offered me this job for a year, so, I took it. So, then, of course, in a very... another miserable January, I arrived in Amsterdam, and er, that really was then... that-at that moment then, I was formally, and I think completely psychologically now, a theoretical computer scientist. No longer a logician or a mathematician or any other kind of tribe, I was-I was in computer science and I loved it there too. I loved

Amsterdam and I loved the work in the mathematical centre and then... the mathematical centre, while I was there, was renovated and given brand-new buildings and has now become the CWI, which it retains that name and is a very big centre for computer science in Europe and, Jacob Dubakka was one of the early pioneers of looking at series that a relevant for programming languages and then behaviours, the semantics of programming languages. And he, er, he had quite a group around that.

And so, that was a very important move but one odd point that might be relevant is that my time in Oslo was very productive. I-I-I learned a lot, I learned that a-all sorts of things my colleagues were doing there, I didn't like. They were far too arcane and er, erm, conceptionally, er, exhausting and so, er, that moved me in the direction of computing if you see what I mean. There was a certain direction of travel in computing and logic at that time that, er, that meant that I was finding myself reading computer science papers more perhaps than papers in logic, so, that was important. And I befriended someone who used to come... because the Oslo people used to have weeks where they would invite someone for a week, and erm, er, it would be great, there would be seminars every day and meals and parties and it was terrific. And one of the persons that erm, they invited was a Dutchman who was called Jan Bergstra. And we hit it off immediately, and we kind of, sort of became friends, even in Oslo. And so, when I arrived in the CWI, or rather the Mathematical Centre at the time, er, I-I phoned him up and said, erm, well, perhaps we should meet? And that-that started a-another relationship, which er, er, which has lasted in the sense that er, we're on Zoom twice a week; still writing papers. So, er, and another friend of mine, at-at Oslo, a man called Vigo Stoltenberg-Hansen, we also wrote papers for many, many, many years.

So, these things sort of, er, had er, for me, quite a profound er, er, impact. When you meet people that you can work with and you enjoy hanging out with, it's-it's er, it's wonderful, it's a great privilege.

[00:44:14]

And you were back in Bristol in 1981?

[00:44:20]

Yes, but after 2 years at-at er, at Amsterdam, Jacob asked me would I like a permanent job there. And, for personal reasons to do with my mother, I felt that was a bit difficult and so, I thought, I really... I've now had 4 years of post-doc and it's gone very well and very much the thing... I wanted to return to Britain, and I wanted to work in computer science departments so, it was all very clear from point of view. And so, I contacted my old supervisor, John Cleave, who said that he would apply for a-a grant to work on various things, and he did, and the grant was awarded, and I was the named researcher on it, which enabled me to-to return to Britain.

And it was a tricky decision because I really did enjoy living and working in-in-in Amsterdam, but I just thought, I must do this. And so, I did it and er, er, it was quite interesting because my friends all visited me in Bristol, so, all these relationships were kept alive, my friends visited me in Amsterdam to write papers and we carried on in Bristol. But I felt an incredible sense of boredom returning to Bristol and erm, er, I thought well, I really must start applying for lectureships, erm, fairly promptly, and so, that year, in Bristol, was er, sort of productive but m-m-mainly productive because I had a massive legacy of work that I brought with me on returning from the Netherlands. And I did get stuck into the new subject that I was going to work on, but my real focus, I think, was-was trying to get a proper... to put, if you like, this scientific life on a... some sort of permanent basis. And th-th-that's what happened in that year.

So, in the March, in the March of that year, I er, I applied for er, some jobs, and er, in particular, I applied for a job at Leeds... Leeds University. Now, I had been to Leeds, of course, because in '85, I had... not '85, sorry, in '75, I had been at this conference which led me to Norway, so, I applied for that. And er, I-I went up for an interview to the d-d-... it was called the Department of Computer Studies and it was run by an ex-physicist called Professor Ken Smith, who was er, a larger-than-life powerful sort of figure, erm, er, who spent a lot of time in California er, and then as a sort of side-line, was head of department at the D-D-Department of Computer Studies, at er, at Leeds. And er, I was offered a job.

It was a very interesting experience, by the way. Er, in the interview, erm, I attended, and it was chaired by a Pro-Vice-Chancellor, a biologist and it had 2 people from the

Department of Computer Studies on it, someone else from another department, I don't remember who that was. And then, a quiet man sitting gently there, listening to everything, not saying very much and this turned out to be the Vice-Chancellor, who had a habit of popping in to see what people were up to when hiring new staff. And this man was Ed... was-was Edmund Boyle, a former minister of education er, in the Conservative government, o-of a decade earlier and a close friend of Edward Heath. Erm, and er, Lord Boyle, as he was, sat quietly in this interview while we were all prattling on about our academic business and teaching and research and so on. And at the end of this interview, erm, er, well, I felt well, you know... I-I-I wasn't used to interviews so; I didn't know whether it had gone very well. Er, the chair said, "Are there any other questions?" and suddenly, Lord Boyle woke up, and he had some questions for me. And his first question was... imagine this now, imagine this, right, so, here is this humble computer scientist sitting there being interviewed and Lord Boyle asked him, "When you were in Oslo, did you ever visit the National Gallery of Stockholm?"

[00:49:40]

I'll stop...

[00:49:40]

Yes, stop... Now because I had a friend Viggo Stoltenberg-Hansen Vigo... we were writing papers, who came from Stockholm, God was on my side because I had and in particular, Viggo had made sure that I had seen their marvellous collection of Rembrandts, and in particular, a wonderful painting called "The Oath of the Batavians" And I said, "Yes, I-I-I have been to the National Gallery of Stockholm and admired "The Oath of the Batavians" [laughs]. So, he obviously thought I was taking the piss 'cause his next question was, "When-when you were in Amsterdam, did you go, er, to the Frans Hals Museum in Holland?" Well, it turned out I'd been there many times and it turned out to be one of his favourite museums. And so, I've always felt that whatever the others wanted, the sheer fact that I-I-I-I... I-I not only talked the talk but could walk the walk, it helped with... helped with this thing. And I love this story because it reminds me of how universities were years ago. I got a job in Amsterdam, no interview, no... Jacob had never seen me.

[00:51:11]

Why do you think he invited you?

[00:51:15]

Because er... oh, I had obviously had lots of very interesting papers that he could relate to. He might have got a reference from Jens Erik Fenstad, but it was enough. And now, of course, er, if you try to hire someone in a modern university, er, the process is erm, almost a caricature, it's almost... it's all-it's almost-it's almost comic material, the-the essential properties, the desired properties, configuration of committees, you know. If someone takes-takes a trip to visit the university, there are some universities, where they don't allow anyone to take you out to dinner because it would be unfair for all the people who are going to do it by Skype, or now, Zoom. So, all of it, is bullshit, of course, complete, and utter bullshit. On the other hand, erm, those days, er that I refer to, erm, they were more in touch with fundamentals rather than processes and management, even if they were a bit sloppy.

So, sorry about this long digression but er, I found this, er, quite interesting. So, suddenly, I was in the north of England, from 1981, I left Bristol in the same year. John was completely content with this, although actually, he missed me a bit because we got on very well. But er, then I started teaching computer science and working in Leeds University.

[00:52:48]

And then, you also established the University Centre for Theoretical Computer Science there.

[00:52:55]

Yes, that's right. Er, this was an interesting exercise because I was very friendly with a man called Stan Weiner, Doctor Stan Weiner who was a reader in mathematical logic at Leeds and I'd met Stan in the '85... in the '75 Leeds Conference. And I'd met him again because he was one of these visitors to Oslo and I'd met him again at various conferences, so, Stan and I knew one another quite well and we were very friendly. And in the course of, I think, '83/84, erm, a man called Duncan Dowson, who was a great mechanical engineer, very well-known in Britain, and also a historian

of engineering as well as a great, er, tribologist. He had come up with the idea that Leeds needed to have inter-disciplinary centres so, he created a programme, using Leeds money to form 5 or 6 inter-disciplinary centres and he invited applications to colleagues in the university, “Would you like to create a centre that is multi-disciplinary?”

And, already at that time, Stan and I were meeting all the time, we were going to one another’s seminars, there was also a whole pack of people doing logic in the philosophy department at Leeds because Leeds had a very strong logical tradition in both the maths department and in the philosophy department. And also, now, there was logic in computer science, you see. And so, we put in for the idea of having a centre, an interdisciplinary centre for er, er, theorising about computing and it was awarded at Leeds University. And er, suddenly, this centre was created, and it functioned rather well for some years, at a time when, erm, theoretical work and the whole of the er, i-i-investment in computer science in the UK was growing. That is a story in itself, of course, and is a national story.

But the ‘80s was a very, very important period for the development of computer science in the UK and the university system. And much of it can be attributed to a man called Kenneth Baker, who was a Conservative minister and who, in ’79 had written a great manifesto for erm, IT, er, which he had sent to Margaret Thatcher, and item 1 on this manifesto was that there should be a minister for IT. And Thatcher then agreed with this manifesto and invited Ken Baker to be that minister and he had many years in the Department of Trade and Industry, in which he was looking after the up-and-coming new industries that we think of to do with computing software and hardware. Well, his-his... the senior minister there had to deal with Stephen Cole, which was... er, you might call sunset... in a period of sunset. And so, it was a very interesting period and Baker had a huge influence... a huge influence on computing throughout the 1980s. And one thing that came up was, erm, the Alvi Programme and things of this kind, which I’m sure the archive a testimony about.

And so, this creation of this Centre for Theoretical Computer Science at Leeds, staffed by mathematicians, computer scientists, and some philosophers proved to be, er, erm, timely. And we also then started and had a meeting, not unlike the 1975 meeting, where we invited people who do theoretical work to come to Leeds for a conference,

and er, that was very successful. I wrote letters to lots of people and er, quite a lot of people came. And so, that began something called The British Colloquium on Theoretical Computer Science and that was a decade after Stan Weiner had organised this meeting in Leeds, for, er, er, people interested in computability theory, which I had attended as a second-year PhD student.

So, these things in your life, s-sort of have an incredible, erm, continuity... is that the right word? It's of course, the continuity you impose in hindsight, but you can, if you want, have difficult things, a difficult job to use hindsight to get this continuity, or you can have an easy job. And at least, I think a lot of my subsequent life it is kind of easy for me to see this continuity rather than it being hard or difficult.

[00:58:22]

And between 1982 and 1985, you were also a visiting professor at the University of-of Uppsala.

[00:58:29]

Yes, and this was a-an easy job, it was about a-a month or two months a year and it-it came through my friend Viggo Stoltenberg-Hansen. Er, he had got a permanent job in the mathematics department at Uppsala, and at that time, Uppsala had some miscellaneous small department of computing. One devoted to numerical work, which was very strong, an extremely strong department. One department with a slight hardware digital technology of the electronics variety. And another one that was a little bit more like what you might call a computing department. But they were small, and er, they had er, er, er, an important role in teaching but their research programmes were, at the time, er, very weak, extremely weak. And so, there was an initiative at Uppsala to create a new degree.

Now, doing this in Sweden is much more complicated than doing it in Britain, which was called the Datavetenskap and erm, various people were working on this, and Viggo organised for me to come and give a course on er, current trends in theoretical computer science, which I did. And it was a-a lecture about different topics so, I went through lots, and lots, and lots of topics in order to-to showcase, what theoretical computer science might be, in order to feed the development of this new degree programme, which is a big deal in Uppsala in those times. And through that, Viggo and a man called Hans Flack who was running one of the departments, came up with the idea well, why don't I go and visit there, and I could do some miscellaneous teaching and I could do some miscellaneous, er, encouragement of PhDs, and this sort of thing.

And so, er, for 7 years, I-I went for Uppsala, and-and-and performed those duties and also wrote papers with Viggo and generally hung out with whoever was around and enjoyed what is a remarkable town and a remarkable university; very interesting place, indeed, I have to say, a marvellous place. And er, so, that allowed me a lot of interesting experiences. But also, it put me in a situation not to become too narrow because when I was there, I was supposed to be, er, er, er, a sort of one-eyed man in the land of the blind really and advocating the value of theoretical work which erm, which took root for a while. And now, Uppsala has a very strong organisation. Many people have come there, many people were brought up through the system and er, I wasn't the only person active in that area, but it-it-it was something that was special in those... in the-in the 1980s.

One of the things that is interesting is how small everything is in the 1980s in computer science, in the UK, and in other countries. And the older and the grander the university, with one or two exceptions, the more neglected and small was computing; so, that is a point. Places like Middlesex were thriving, thriving. They-they simply saw the value and importance of the subject and taught it. And places like Leeds had the same attitude, there's plenty of things that have got to be taught to people, let's teach it. So, they would set up departments and grow them and sometimes w-w-with little attention to research programmes, research really started to take off as a kind of obsession in the British academic system, er, through the research assessment programmes and that changed everything, which is again, the 1980s.

[01:03:15]

So, at the end of the '80s you moved to Swansea University, so, what led you to move there?

[01:03:23]

Yeah, well, of course, it's going home... simple as that, it's going home. And erm, er, so, in Swansea, erm, there was a quite interesting configuration of-of events which would... which are quite long, and which I've written a little bit about because this year is the centenary... or last year was the centenary of the university. And I wrote a historical essay on how computing came to Swansea University and er, er, it ends

with my arrival. So, I wanted to write about what happened before I came, I didn't want to write anything about what happened since I came. So-so, that was very interesting, so, that is why all those '80s and the '70s are all... er, quite, er, quite useful to know about.

But er, they-they decided to wake up and do something about their computing department. And they were forced into this really by events surrounding a university grants committee, mathematical sciences committee visit, who wanted to know why this computing department was so small. And er, it had a good reason for wanting to know this because as part of the great building up of computing in the 1980s in the United Kingdom, in addition to things like the Alvi Programme, the university grants committee that funded the universities had written to universities inviting them er, to submit er, cases for special ring-fenced funding to build up computer science. And Swansea had returned their documentation and the amount of money they got, was a function of how many students were being taught computing. And Swansea had returned, not just the computer science department, but a wider selection of students most notably, a lot of students in business. So, the amount of money that was being sent to Swansea through this special programme was large, but when the mathematical science committee came they found a small computer science department. And although it is all completely acceptable and legal within the rules, they put pressure to say, "Well, go and do something about this."

So, they decided to do something about it, and they advertised a position. Now, at this stage, one of my friends from Oslo, erm, who was a reader at Warwick had been offered a chair in pure mathematics, and at that time, computer science had been declared so small that it had to join with mathematics to become a mathematics and computer science department. So, suddenly, the authorities running computing in Swansea was the head of mathematics. Now, I mentioned my friend from er, Oslo, let me just say, that the very first night when I arrived in Oslo, Doug Norman took me to see the mathematics department. So, this is the culture of it, right. First stop, let's see the mathematics department, then, later on, we'll find somewhere for you to sleep.
[laughs]

So, I'm taken to the mathematics department and I'm wandering down this corridor with all these names on it, because the place is in the night, it's dark, right. And in amongst all these wonderful Norwegian and general Scandinavian names, with their special alphabets and so on, there was one door, with the name David E Evans on it. Now, you may or may not know that there are certain surnames in Wales that are common, Evans, Williams, and Thomas being very much frontrunners, Lloyd being also another one. So, the moment I saw David E Evans, I thought, hmm, I wonder if he comes from Wales, and of course, he came from Swansea. So, he was returning from Warwick to Swansea, and he told the university and told the head of the maths department about me. And he would visit me and my mother and er, erm, got me interested in the [unclear sound loss 01:08:40].

And so, er, that [unclear sound loss 01:08:54] I was offered without an interview. So, this was quite interesting, there was a chair committee, and it did do all the formalities, but it didn't seem to see the need to meet me. And so, there I was, back in Swansea, or rather, back in Swansea for the first time. And er, it's interesting because again, trying to mention this idea that some people have an easy time of finding continuity in life, erm, I was suddenly here, where all my ancestors come from and now, in fact, I live in a-a place, and er, attend a church where all my ancestors are buried. So, I have absolutely got nowhere [laughs]. It's so strange, but there we are.

[01:09:54]

Let's go a bit personal. When and where did you meet your future wife?

[01:10:01]

In Leeds.

[01:10:01]

Oh.

[01:10:02]

In Leeds. I met her in Leeds, and she was writing a PhD thesis, erm, on, in ancient history, ancient Greek history and we got on very well, we were friends for many years. And er, the friendship, er, ultimately transformed itself into married life. And

it was very nice, and she had a post-doc in Leeds and then we, erm, we moved down here. She was looking for a career as well, so, you've got the classic problem of partners who have met in, you know, academic life and, er, but then she was fortunate, because she, er, got a job in the Classics and Ancient History Department at a-at a place called Lampeter. Now, Lampeter, at that time, was a university, in fact, it's the oldest degree-awarding er, body in Wales, from I think the 1820s or something like that. Er, er, it started as a theological college and it only taught the humanities. It was a very unusual place, and er, like many things in Wales, if it isn't in Swansea or Cardiff, or Newport, it's in a very small place because the rest of Wales is small in terms of its urban development. And er, Lampeter was a charming town and she for 5 or 6 years worked there and then out of the blue, erm, one of the professors o-o-of ancient history at Swansea, erm, decided that the bureaucracy and all this sort of thing was getting on his nerves, heaven only knows what it would think of it as now, I can't tell, you. But certainly, at that time and asked her, would she consider, erm, coming to Swansea to do a job share, which, she thought about and erm, agreed to do, because at that time, erm, she was having our daughter. And so, for some years, she was part-time and then became full-time.

[01:12:34]

So, you have a daughter, that was born in...?

[01:12:42]

Oh, I hate questions like that, thank you...

[01:12:45]

1994?

[01:12:46]

I always have to... s... it's so embarrassing.

[01:12:52]

And also, a son?

[01:12:55]

In '99, yes.

[01:12:56]

And in 1994, you also became a scholar of the history of computing.

[01:13:02]

Yes, I did, yes, well.

[01:13:05]

So, what happened?

[01:13:09]

Oh, well, erm, now, this is where trade secrets start coming out, right. I've always been interested in historical things, both local history, and technical history, all those things. And er, so, what happened was that the computer science department at Swansea went through a major renovation when I arrived. And that was the point of it, and-and I became close friends with someone called Peter Townsend, who was the er, the person who kept the whole show on the road and had been promoted, professor. So, suddenly, computer science has 2 professors and wanted to become an independent department again. Now, Peter was talent-spotted by a new Vice-Chancellor and invited to become a-a senior Pro-Vice-Chancellor, on a relatively permanent basis, which meant that I had to become head of department, of the Computer Science Department, which I didn't mind, it was not a problem, it wasn't my plan or anything.

And so, I had done a huge amount of work with Peter on the new curriculum and so, on and I-and I-I suddenly thought erm, I want to do something about the history of computing in this university and so, I want to make sure I know a lot about this, it's time for me to really study it. And of course, the best way to study something is to give a course on it. And so, I consulted the then head of department, that's me, who thought it was a fantastic idea. And so, following his strong enthusiasm, I started to teach it in '94. And I hit upon the following method, er, which may interest you, that is er, the prospect of making a large number of lectures on the history of computing

and being head of department and writing lots of papers about theory struck me as, erm, what we now call challenge, but which in those days would be called a problem.

And so, I thought, well, looking at our students, what-what-what don't I like about our curriculum. And what I dis... found I disliked, was that one of the most important aims of our curriculum design was at the end of the day, for students in their final years to be able to learn new subjects on their own and to write about them. And although we had final year projects, most of the final year projects were really proof of technical competence projects. And so, I thought, I will do something that I had seen at Warwick; Warwick had a final year module where students could take a whole module which was basically, learning something on their own and writing about it. So, this is way back now, in the 70s, 72/73. But I took that, and I thought, right, I'm going to get our students to do a history of computing course, which was called History of Computation and it would take 2 terms, I would lecture on topics of my interest in the first term, one a week. And in the second term, they have to give talks on topics they have chosen to investigate, and they have to write a dissertation. And so, this proved to be very interesting because educationally, it was about them learning how to be scholars, learning how to investigate, learning how to write about things, give talks.

And in those times, people hated giving talks, it was all on acetates, of course, you didn't have data projectors and things of that kind. And so, er, that's what they did; and so, I would lecture about Babbage or I would lecture about er, something in logic, or I would lecture about the development of the British computer industry or all sorts of topics that just appealed. So, I started to have a stockpile of lectures and they were very much, at that time, I lectured on subjects that were erm, computing before computers. So, it was about computation and this allowed me the luxury that the students then had a completely free hand to work on topics that are really more modern, you know, i.e., post-electronic computers; and then they would give their talks and write their dissertations.

And it was very, very successful in terms of a small number of students, well, our department was small, so, there weren't that many students to go around and-and they did it. And then, that has continued and now, er, I do it again. I changed the name of

the course, erm, about 4 years ago and now I don't... in-instead of History of Computation, it's now called Invention and Innovation in Computing, which is much cooler. But it also reflects the fact that now, I lecture about post-war commercial development. So, you know, it's-it's about, well, Silicon Valley, and other things and-and-and then they pick topics that they want to talk on and it's very, very nice and they do it rather well. In fact, it's quite striking to see the quality of the work that students... Sometimes, students who are trying to escape a fly... you know a treadmill of very technical work. Some students want to-to escape, others have really got a topic they want to study. They do very well, and the standard is very, very high and it is because they have real ownership of the topic.

[01:19:53]

Did any of them decide to pursue a career in the history of computing after leaving?

[01:19:58]

[01:19:59]

Not as far as I know, not as far as I know. I think it is fair to say that many of them will take with them a comfort feeling; a feeling of comfort in terms of historical matters because these things make a big impression on them because it's their own investigations and their own work. But of course, it has changed because already, as '94 went through to, say, '98, the emergence of web material started to take its effect and now it's very dominant, of course, but erm, I-I think it's very good. But er, it has certain qualities, and er, today, for example, I have about [unclear sound loss 01:20:52] which means a lot of commitment to listening to their talks, 'cause their talks are 30 minutes. They have to give a talk to the class for 30 minutes, really a non-trivial thing with lots of questions.

But I tell them, well, you know, you've learned a lot with us, we're just rounding off your education because what you're going to get from this course is more than a perspective in history, you're going to get certain skills; and what are these skills? These skills are the following, they are what the veterinarians call Day 1 competencies. Now, a Day 1 competence, is a list that the-the-the veterinarians have got of what a student who has graduated as a vet can do on Day 1 of entering

professional practice. In other words, when you walk in through the door for your job, what have you got that is instantly u-useful and r-relevant? And I point out that erm, people who have done well on this course, will have absolute confidence in investigating a subject on their own, have written a complex scholarly document, and have given an industrial-strength talk, not some 5-minute, this is my project thing. And so, given that we are educating technical people, this small addition to the learning experience I think has a sort of extra value because, of course, our programmes are completely technical, you know, that's what goes on.

[01:22:48]

And in 2007, you also founded the History of Computing Collection at the University of Swansea.

[01:22:53]

Yeah.

[01:22:54]

Can you tell us more about these, where did they come from, what is the current state of the collection?

[01:23:04]

Right, n-now you're getting, now you're getting onto my-my most er, my most enthusiastic er, subject at the moment because erm, I'd been teaching this subject for a long time and we had stored lots of bits and pieces. And there was a certain again, continuity of some of the things we had stored. For example, our department had been an Apple-based department from early on and-and there were other things there, all sorts of miscellaneous things. And the engineers had lots of stuff as well, our engineering department had been heavily into computing from the early 1960s so-so, it was quite a kind of computing-oriented thing. And so, er, with a friend of mine from the university library, a man called Steve Williams, we were talking about the development of the subject and the fact that it is transformed in our own eyes almost on an annual basis, or certainly on a basis by decade... the world around us that because Swansea University has very significant holdings in industrial history, er, particularly for the South Wales industrial past, mainly coal and iron and steel erm, this whole question of computing and its effect on society is also interesting. But of

course, what is also interesting is that a reasonable number of er, things have gone on in South Wales in and around the computing industry, particularly manufacturing. So, lots of computers had been built in South Wales because it has always been a big manufacturing centre. You might design something here, but you build it there.

And also, erm, because I'd been teaching this course and I could see the relevance of some of the things we had, erm, Steve and I decided that we would simply declare whatever we could find as the beginnings of this collection. And we started to put things together and because Steve erm, er, is, er, is sort of high up in the university library, with research collections, he acquired a space and we started to transfer materials and put it in a central place. And so, this collection, this computing collection, er, went in two directions. First of all, there is the natural equipment and software manuals, which are lying around. Then there is an archival operation because erm, I have quite a lot of archives, but also, various [unclear sound loss 01:26:18] colleagues who were in Holland, for example, erm, heard that I was collecting this stuff and er, offered donations, their filing cabinets. So, I started to collect, er, the papers of various computer scientists who had retired and wanted to dispose of them in a way that was sound.

And of course, the sort of people who want to dispose of these things are people who have lovingly cared about them, if you see what I mean. It's not really disposing of them; they want to find a home for them. So, suddenly, the archive started to grow, and the space started to grow. And then as a third wing, where we actually do local history er, for the computing and its technical and its social and economic roles in er, in the region. Now, originally, we started off thinking about Wales in general but in practice, we've tended to focus on the South of Wales. So, a lot of things of happened in the South of Wales, we've been collecting various er, testimonies and er, erm, investigating.

Some of the things we investigate are completely general, for example, erm, er, we have a research student working on how er, computer educating entered the Welsh educational system, which has been, to some large extent, erm, er, semi-autonomous, erm, in Wales. And so, we've been talking to teachers, tracking how they got into the subject, what facilities they had, etc., etc., etc., and then various people who had

created advisory centres, again, the '80s pops up here because that is a period where a lot of new initiatives took place. And er, other things are, of course, to do with the steel industry, and other industries. Lots of electronics has gone on here, there have been some very significant factories manufacturing electronic products, both s-special ones for military work but also, erm, commercial things. Erm, we even have erm, an iMac that was built in Newport, so, Newport has always been very busy in the computing area. There were machines built in the 1950s and '60s er, in that er, in that town. So, there is a local scene as well.

And then, occasionally, other things come along like the-the Comrie collection of course. So, we have er, a collection of materials from the er, from the company, the Scientific Computing Service that he had. And-and er, what has happened recently, is that the space that Steve arranged, er, which is library space, erm, has been converted into a much better, bigger space, where there is a study area. Before, it was essentially a storing facility, but now, we have a very nice location with, er, easy access to the files, to the books, to the machines, and plenty of desk space and bench space for people to use it. And gradually, students are doing projects er, in and around this computing collection. And by students, I don't only mean students of computer science, but we have students doing history and heritage from the history department and we have classes from the media studies department. Erm, you know, occasionally, erm, we have just what they want to see, just what they need because- because of this broad reach, and er, I'm very pleased with that. Er, the big question now is to erm, get it better-known, I suppose, attract more, er, researchers and to attract, er, some sort of er, critical mass.

But it is officially a university collection and therefore, erm, one of the shocks to my system, of course, was that, as it became a university collection, it started to follow professional practices of museums and collections and archives [unclear sound loss 01:31:15] life has changed as all the accreditation processes kick in on how you keep stuff.

[01:31:29]

So...

[01:31:31]

The-the days of me taking a hankie, spitting on it, and wiping a bit of dirt off an old Apple 2, are-are gone [laughs] none of that [laughs].

[01:31:46]

So, if you look back at your career, what is the proudest achievement of your career?

[01:31:55]

Oh, I don't know, that's tough... that's very tough. I think you can ask that question as a question about scientific work because, of course, the-the work that I did er, early on continued, and it was very technical. So, scientifically, I've done an awful lot of work generalising computability to er, these algebras. But w-w-what was missing from our conversation was that in Amsterdam, when I was working with Jan Bergstra, everything that I had learned up to then, proved to be directly relevant to the development of abstract data types and the theories-theories about what is data and how does it work. And also relevant for programme verification, which then really took off in the '80s, so, there is a big body of work there, and then there is a lot of work also, on erm, er, you know, on-on digging up historical matters too, which drifts in all sorts of directions towards a general history of science as well. So, I would be very cautious about picking on a single achievement. I'd have to have a break and have a think about that, write you a letter.

[01:33:20]

Okay. [laughs] And, er, what advice would you give to someone willing to pursue your career today?

[01:33:36]

Erm, well, the... never underestimate the power of an individual with an interest. And if that interest has got elements of passion about it, and also ability, never underestimate how important that is. And the focus on the subject, for example, er, is the key thing. So, the first thing, is to try to understand where you are in relation to those qualities and that is all about this sense of inner confidence or belief, which needn't be explicit but it's simply in you and you trust it, even though you can't rationally explain it, you trust it. Then be optimistic and hopeful that if you can

satisfy yourself that you have these properties, things will work out for you through patience and persistence. And the energy levels... the battery for the persistence are those things I've just mentioned. And my third point is never underestimate how many people around you don't have these things and are yet doing very well but are not doing particularly good things. So, keep an eye on them, make sure they don't get in your way, and keep the faith and er, be very cautious about er, the modern world's mechanistic transactional bureaucratic tendencies. If you keep all of those plates spinning, as long as the energy level... the-the real interest is there and the patience and persistence, it will all work out. That's my-my-my-my observation. And try to keep your mouth shut sometimes [laughs] when you don't like something; that's something I have not done. I've done it in this interview, I've been very well behaved in this interview [laughs].

[01:36:32]

Is there anything you would like to discuss that we haven't?

[01:36:40]

Well, I would be very interested to discuss the history of computing in general, but that is something for another time and-and not of part of me particularly. I think that's... So, I hope this was of some interest.

[01:36:55]

Yes. So, thank you, John, it's been a real pleasure talking to you today.

[01:37:01]

Thank you, I've enjoyed it very much and I'm very pleased to have met you, okay.

[01:37:09]

Thank you.

End of Interview.