



# **Ron Weeden**

Interviewed by

**Tom Abram**

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Woodley, Near Reading, Berkshire

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**Archives of IT**

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*Hello. Welcome to the Archives of IT. I'm Tom Abram, Director of the Archive. It's 22<sup>nd</sup> May 2022. Today I'm in Woodley, near Reading, at the home of Ron Weeden. Ron is a notable pioneer of technology with roles in desktop calculators and personal computers and can trace the development of those devices from across a thirty-year career and another thirty years beyond that. Ron is also able to offer illuminating recollections of life in pre-war and post-war Britain which are in themselves a fascinating insight into the development of a society in the UK. Ron has been a member of the BCS and the ACM since 1968.*

*Ron, welcome.*

Thank you.

*Can we start by talking a bit about your early years? You were born in 1932 in Kent, which means that later this year you'll be ninety years old.*

Yes, that's right.

*Congratulations. Can you tell us what it was like, and particularly your experiences of life in Kent before the Second World War?*

I think the impressions that I feel the most about are the way that there were no... there was no traffic. I lived in a long road, about three-quarters of a mile long, I suppose, roughly, and it was uphill or downhill all the way, however you want to look at it, and in the whole of that road there were only two vehicles. One was a signwriter who had an Austin van and the other was the coal merchant with a lorry. [laughs] All week the only vehicle I can recollect seeing other than those two was a lorry, a steam engine lorry, from the Gas Light and Coke Company, coming up the road, which delivered coke. Even the doctor used to come on a bicycle. He charged two and sixpence a visit.

*So a very different environment from what we're used to now.*

Very. I go back to that road now, it's a one-way street, cars are parked on both sides of the road and there's just about room for a car to get between them so it can drive up the road. But when I was a child we used to play out there in the road, totally different. I also remember the car park that they built after the war in 1946 in the middle of the town, right next to the town centre. Now, because I had to cross that car park quite frequently and walk across it, because it was just open air, just no floors to it, it was just an open space, and I remember the whole of the first week there were no more than six cars parked there. Quite different.

*So what about your home life? Tell us a bit about your parents.*

My mother didn't go to work, it wasn't done in those days. My father had volunteered to go and join the army in 19... well, I'm not quite sure exactly when, probably 1915, but I can't be sure, he never spoke about it, frankly. But he suffered severe head wounds and shellshock from an exploding shell, I assume, when he was in the trenches, and that was virtually at the end of the war, so far as I can gather, and he was not capable of doing any normal work. He acted as a casual labourer doing golf caddying, emptying great big colanders in laundries, he acted as a hospital porter taking bodies to the mortuary in the local hospital, that kind of thing. We were extremely poor.

[00:05:30]

*So what sort of house did you live in?*

We lived in a tall house, detached, which had been a greengrocer's shop. It had a very large basement, below ground level, mostly below ground level, where they used to wash the vegetables for the greengrocer's shop. It had a very large, long garden. We lived in the two floors above the ground floor and for quite a long time whilst we lived there, the ground floor was unoccupied. I never saw it in use as a greengrocer's shop.

*So you rented part of this house, did you?*

Correct, yes, yes.

*So with your father not being able to work in any substantive sense, how did you get by?*

Well... it was wartime so there was very little food, whether you had the money to pay for it or not, so that didn't make an awful lot of difference, to be quite frank. And everyone was growing vegetables in their front gardens as well as their back gardens and allotments and so one ate an awful lot of vegetables. And as for meat, we lived mainly on rabbits.

*In spite of that, in the notes that you gave me, you said that your childhood was very happy.*

Absolutely, utterly, yes.

*It's a bit of a contradiction there, isn't there?*

Yes, indeed. I was exceedingly free. From about the age of nine I could be out at a weekend all day long, from 7 o'clock in the morning till seven at night. We had an enormous common land – two of them, actually – which was gorse covered and fern covered and tree covered, but there were asphalted footpaths all across it because it was maintained by the local council, but nevertheless it was wild, vast, yes? I used to play on there for hours and hours. Also I used to cycle an awful lot. It was amongst my kin, well, amongst the ones I used to play with, we would go up to the rubbish tip and recover stuff, and so that's how I came to have a bicycle. A couple of wheels in the rubbish dump and a bicycle frame and put it together, and so on.

*So you had brothers and sisters, but I gather that because, presumably, because of the poverty, they were taken into care.*

They were taken into care, indeed five years before I was born. So I only knew the one who at that time was over sixteen and who went to live at, with a couple that we called my aunt and uncle. They weren't in fact, they were peculiarly related to my

mother, inasmuch as the one we called aunt had married a brother of my mother. I couldn't tell you whether she had any other siblings at all, but apparently that's what happened, and he was killed in the First World War. And then she married a chap called Harry Punshon who was a tailor by trade and they lived in Shepherd's Bush and we frequently used to catch the Green Line coach from the middle of Tunbridge Wells on its way to Windsor, via Victoria Coach Station, because it stopped right at the top of Becklow Road in Shepherd's Bush, which is where my so-called aunt and uncle lived. And that's where my eldest sister lived, who was Kathleen.

[00:11:00]

*So you knew her a little bit?*

I knew her quite well, yes. I got taken out by her and the daughter of- she and the daughter of this so-called aunt and uncle were very much mates together and they also used to take me out when I was up there, to museums and the zoo and all that kind of thing.

*You described yourself somewhere in the notes as a loner.*

Yes, yes. I'm very much a loner.

*Was that true as a youngster in that environment?*

Yes. Well, I played a lot with the local children and as a teenager I had quite a lot to do with other ones of my own age, but nevertheless I was a loner because very frequently I would go on very, very long cycle rides all on my own. I used to cycle from Tunbridge Wells down to Hastings a lot. I used to cycle a lot from Tunbridge Wells to Maidstone all on my own. I used to cycle to Gravesend a lot. And then I, because I was interested in industrial locomotives I used to visit the cement works in North Fleet and Greenhithe a lot. And also on the other side of the river in Purfleet and Thurrock. Yes, Thurrock. And the great big rubbish tip at Rainham Marshes, next to the Dagenham's car works where they had loads of these steam engines that

pulled the rubbish around the tips and so on. So I used to cycle all over the place looking for railway engines.

*Things that we wouldn't entertain a young person doing on their own today.*

Not at all, not at all. No.

*What about school? Tell us a bit about your schooling.*

Well, the first school I went to, primary school, was Christchurch School in Tunbridge Wells. That was right next to the Tunbridge Wells central railway station. I can remember my mother taking me there on the first day. I can remember having a mate, was the one I sat next to, and we got into trouble for talking. [laughs]

*What did you like doing at school?*

I was very good at multiplication and division, long division, very good.

*So this is like primary school we're talking about now?*

Yes.

*So a talent for arithmetic then?*

Yes, yes.

*Yeah, again...*

I can't remember much about anything else, except for sewing, which was unusual to me.

*Sewing?*

Sewing, yes. Yes, most children, boys were taught sewing in those days.

*So after primary school you...*

Well, I went to another primary school because the war broke out and I was still walking – and we had moved house, from one end of the town to the very opposite end of the town – and I was still walking to school right the way from that far end of the town, through the town centre, through to Christchurch School. And the local authorities decided that I shouldn't be doing that and so they transferred me to St John's Primary School.

[00:15:21]

*Was that any different?*

It was still a long walk but not as long as the other one. I couldn't catch a bus to St John's School, because there weren't any. I could catch a bus into the town centre and then go back out of the town centre to go to St John's School, but that was like doing a big V shape, yes? So although it was a long way to walk, I used to walk to school, yes.

*And then you went to grammar school?*

I did, yes, I got a scholarship to Skinners' School, which was just along the road from St John's Primary School. It was a boys-only school, of course, in those days and yes, I was there until I was sixteen.

*So when you say you got a scholarship, that pre-dates the days of the so-called eleven-plus, does it?*

I sat some kind of exam when I was eleven that caused me to go there.

*And does the word scholarship imply that...*

It was free.

*... if you hadn't passed that exam you would have had to have paid to go there?*

Yes, yes. That's absolutely correct.

*This meant that you got to go to a good school free.*

Yes, yes, that's correct.

*And what did you like doing at the grammar school?*

[pause]

*What subjects were your speciality?*

I liked English because I liked the teacher who taught it, he was great fun, ever such fun. He used to tell us stories [laughs] off his, invented off his head. Quite amusing. I quite liked the physics and the chemistry and the biology. Didn't have much of a thing for mathematics there. Our headmaster tried to teach us calculus and I'm afraid it didn't sink in at all. [laughs] It seemed utterly boring. [laughs]

*What about sports and things like that?*

You could volunteer to go running instead of playing rugby or cricket, and so I was always one of the runners.

*Right.*

I wasn't into [laughs] team sports or anything like that.

*So that's another reflection of the loner.*

Oh yes. But I was with other kids then, and what we used to do was our route took us about, well, the whole route there, round and back, was about four miles, I would



think, maybe more, and it took us into the countryside. This was because our sports field was not at the school, it was about two miles from the school, quite separate. It was where the headmaster's home was. But on the route that we were supposed to run there was a big abandoned quarry all overgrown with trees, yes? And we used to play commandoes on the faces of this quarry until the rest of them who did the running came back the other side of the wood, the other side of the quarry and then we'd join them. [laughs]

*So a bit of cheating going on then?*

Yes.

[00:19:44]

*And you left school at sixteen...*

Sixteen, yes.

*... with the school certificate.*

That's correct.

*But what does that mean in today's exam terms?*

I don't quite honestly know.

*It's like O levels or GCSEs or something?*

GCSEs, I guess, yes.

*So that covered all of, well, which subjects did it cover?*

Oh, well everything that we were taught without any exceptions as far as I can... oh yes, they didn't have a music part of it and we were taught music. Oh, and there was a woodworking part which I didn't do, but apart from that, yes.

*So there you are, sixteen years old, educated, school certificate, what happened next?*

The War Damage Commission was after a lot of fresh staff and so there were about eight of us, I think, who were recruited by the War Damage Commission to go and work for them in a great big mansion built in about 1776, which was in a park then owned by the local council. There was a great big boating lake down at the- the mansion overlooked a parkland and it was up high and there was a lake down at the bottom, so to speak, and like most old mansions of that time, or age, there were balustrades all around where you could sit and look over the parkland. That was a beautiful place to work in.

*When you say you were recruited, it kind of implies somebody came and found you rather than you applying for the job.*

They came to the school, yes. I didn't apply for the job, that I do know. They came to the school and interviewed a number of us and...

*So they kind of picked you out?*

Kind of, yes. They took about eight of us, yes.

*Right.*

And then after about four months, maybe less, they asked me to go and sit the civil service exam in London, and I passed that and became a clerical officer, and apparently it was quite unusual. Apparently I was the youngest civil servant in the country and it was...

*Because you had a talent to pass this exam?*

Well, seemingly so, yes. I don't claim any particular credit for it, but I did.

*So what kind of work was it that you had to do?*

It was examining war damage claims, both from domestic premises and also from factories and so on. And going through all the voluminous documentation relating to the claims and so on and liaising with the inspectors who actually went out to the places and inspected them to see whether we felt that the claim was justified.

*So what did you have to know about in order to do that?*

I was not taught anything at all.

*So it was applying some common sense was it?*

Exactly so, yes.

*Did you have to write reports or...*

Yes.

*... do sums? Do calculations?*

Not very much. Not very much, other than a few additions, that kind of thing, nothing particularly. The main thing was going through the correspondence, basically to see what the history of the claim was to determine, given the circumstances, whether we ought to pay it. That was basically it.

*So having got recruited into this and qualified as a civil servant, was this, did you think this was your career direction determined?*

I didn't really think about it, to be honest with you. I mean I didn't have any grand ideas, oh, I'll end up being a chief executive officer or anything like that, no way, I just didn't think that way.

[00:25:10]

*But somehow National Service intervened.*

It did. I was called up in 1948, must have been 1950 because I would have been eighteen.

*Right. So that was the criterion for National Service, that you were eighteen?*

That's right. But because I'd been to grammar school, who had a CCF unit, Combined Cadet Force unit, it meant that I had the option of choosing, or a choice, two choices of what service I joined. And so I said I'd like to be either in the REME or the Royal Air Force, because I had a distinct desire to be an electronics engineer, at least a radar engineer, and I knew that that was what REME did, and I also knew they had them in the RAF. So that was what I thought would happen to me, but it didn't work out that way. After the first six weeks I was transferred to Feltham in Middlesex, which was a REME vehicle depot workshops and they were just about to take over a camp it transpired, an army camp, about three miles down the road in Ashford in Middlesex from the Royal Army Service Corps. And so I was told you're not going to be a radar engineer, you've been a civil servant and we need administrators and you're being assigned to a captain quartermaster and staff sergeant to take over a camp that we've just acquired down the road. And so I had to join them and do an inventory of the entire camp [laughs], all its furniture and everything, along with these two, before we could take over the camp. And so that was the end of any hopes I had for being a radar engineer. However, it turned out that it was very peculiar, this captain quartermaster and his staff, quartermaster sergeant, staff sergeant, they were buddies and there was a local golf course and all they wanted to do, every day of the week, including Sundays, was go off and play golf all day, which they did. They didn't do anything to do with running the camp.

*So that was your responsibility?*

That was my responsibility. Willy, they used to call me.

*Sorry, what did they call you?*

Willy.

*Willing?*

Willy. And all I had, what I had to do was go into their office before they went off to play golf every morning at 8 o'clock in the morning and get all my requisition documents signed for vehicles and manpower and whatever I needed and that was what happened. I didn't see them from 8 o'clock one day to 8 o'clock in the morning the next day, ever.

*Well, that sounds like quite a responsibility for an eighteen year old...*

If it didn't move...

*... just mobilised.*

If it didn't move, I was responsible for it. And that meant not just all the supplies, but the fences, any maintenance that needed doing. I didn't have to do the maintenance, but I had to organise it to be done.

[00:30:05]

*Was this typical of National Service, do you think?*

No, not at all. Far from it. I didn't do any military duties at all. I didn't go on parade, I didn't go on guard duty, nothing. My responsibility was the whole camp and the stores, I had to organise all the laundry services, all the food for the cookhouse, all the ice for the refrigeration, collection thereof, all the boot repairs, all the bedding laundry, the coal supplies, the library. I was in charge of the library. I was in charge of the dancehall, we had a dancehall just outside of camp perimeter fence, and I had to

run that on a Friday night and sit at the door taking the money from the civilians who came in. I had to organise the band for it.

*So looking back on this experience, what do you feel about it now?*

I was very happy. I was my own boss, utterly. I was one up from a squaddie, from a private. I was a lance corporal, with all this lot to look after. [laughs]

*How long did this go on for?*

Two years. Well, nearly two years.

*So that was two years of National Service.*

Correct, yes.

*You had this amazing, amazingly responsible position of organising the camp.*

Yes. Even had to, we had gardeners, by the way, who used to look after all the flowerbeds and also the sports field and that needed mowing, so all of that had to be organised and they told what to do and so on.

*So it sounds like you enjoyed this.*

I enjoyed it very much, yes, absolutely I did.

*And then at the end of it you went back to the civil service, did you?*

No. They asked me to.

*Right.*

I didn't go. I can't, to be honest with you, remember why I didn't go, is the truth, other than I suppose I'd got used to doing what I was doing. And so I did a similar job with the Royal Army Service Corps Airborne Brigade in Southall. In Middlesex.

*Sorry, in where?*

Southall. In Middlesex.

*Right, yes.*

Which was not far away. That was – how far from Ashford? Was about ten miles, I suppose, probably. Yes. And there I worked with another fellow and the two of us did that. I was there for probably about three years, I would think, most likely. One of the reasons I did that was I had an idea of being a pilot, a helicopter pilot, only to be told finally that one of my eyes wasn't fifty-fifty vision and so I could only be a navigator. And I didn't want to be a navigator, so I opted out. [laughs]

*So all this time you were a military person, were you?*

Yes, yes.

*You were a service person, yeah. So what brought that to a halt?*

[00:34:29]

Oh, I went and joined a firm called International Air Radio in Southall. That was right next to the BOAC - British Overseas Airways Corporation, for the record – where they trained the stewardesses, yes? But I wasn't part of that, I was in International Air Radio which supplied all the Middle Eastern air traffic control units in places like Sharjah, Bahrain, all those kind of places, yes? And I very much remember one of the components I had to deal with were klystron valves. Now I doubt whether many people have ever seen a klystron valve, but they're about, hm... four feet high, and they come supplied in a wooden crate, open latticed wooden crate, and they look just like an old-fashioned radio valve except they're enormous, exactly

the same shape, yes? That's my biggest memory of the stuff that I had to deal with at the time. However, they decided that for my job I needed an electromechanical calculator. So they bought me, at great expense for those days, a Marchant electromechanical calculator, which cost them £350. £350 in 1953 or thereabouts was an enormous amount of money, really enormous. But that's what they bought for me and because I had that knowledge and skill, it greatly affected my life later on, yes? Anyway, I went on from being there to working for Thorn EMI at Hayes in the audio wire recorders unit. Wire recorders were what preceded magnetic tape, yes? So you had reels of wire that you recorded upon. I well remember there was another make at the same time as well as Thorn EMI's, which was Grundig, because I actually bought one later on. That was a wire recorder. And then I got fed up with that and I went and worked for George Wimpey's.

*As in the homebuilders?*

Yes. But that was on a part of George Wimpey's that were dealing with industrial sites. So in there, it was not with the homebuilders. And then a chap who had worked for the Territorial Army where I had been met me one day and he said, Ron, he said, I've landed myself a very, very well-paid job, it's night work, and so on, and he told me all about it. And he said, I know the foreman there and if you want a job I could probably arrange it for you. And so he did. So I ended up there. I had become involved with an intellectual group in Hampstead and Highgate, which included Bertrand Russell and Barbara Castle and various other such people, yes? Oh, and Hugh Schonfield. Hugh Schonfield in fact especially, because he's been a very great influence on my life. He lived in Highgate and I also had another friend whose name I've forgotten now, who seemed to be the one who kept all these people together and acted as the liaison man, and so he introduced me to Hugh Schonfield. Now, Hugh Schonfield had a great big house in Highgate and at weekends he used to entertain, or used to have loads of young Jews and other youngsters, have barbecues in his back garden, which was enormous, and a lot of them were ones who had families living in the then newly established kibbutzim in Israel and I got to know an awful lot about the Israel kibbutzim. He was a scholar, very profound scholar, of ancient Aramaic and of ancient Hebrew and of ancient Greek and he wrote about probably at least eight books on the time of – and I will use my preferred term here – of Yeshua, the



Nazarene. He wrote a book, another book, called *The Authentic New Testament*, which was his total translation of the New Testament. And he taught me many, many things. He's been a great influence on my life: philosophically, ethically, and many, many others.

[00:41:50]

*So this is a kind of parallel thread to your technical interests?*

Yes, indeed.

*So how did all this fit with your technical interests?*

It didn't really, frankly. I'm a polymath, is all I can say. I have loads and loads of different interests, all going at the same time, yes?

*I mean looking at your career, you ended up, I think in 1961, at this calculator place.*

That's correct, yes.

*How did that happen?*

Peculiarly. [laughs] For a couple of weeks I went to work for a firm that made knitting machines.

*Right.*

And I didn't get on with that at all, it was rubbish. My father saw an advert in one of the London papers from a calculator, calculating machine company and I thought to myself, I know about those, I used one for a long time. And so I went for an interview and they were at the back of Fleet Street, next to Van den Bergh's & Jurgens. And it was a firm that had been set up by the father of two sons from Eastern Europe in 1912 to produce and sell all sorts of such things, such as mechanical calculators, electromechanical calculators, adding machines, cash registers, that kind

of thing. And they also had a factory up in Wood Green where they made calculators. And this involved getting, or this... just at the time there had been a new educational project set up that initially was called the Southampton Mathematics Project. It very soon became the School Mathematics Project, as I recollect it. And they were introducing mechanical calculators and, well, mechanical calculators into all the schools across England at least, and this involved talking to HMIs, the education inspectors. Forgotten what it stands for now.

*Yeah.*

[00:45:05]

And getting them to try the brands that we were associated with and leaving them with them and leaving them in schools and going to primary schools and showing the teachers how to use them and showing the children what to do with them, and it was quite fascinating.

*So these were the kind of calculators where you set up a number...*

Yes, with levers.

*... and then turn the handle a number of times to do the multiplication?*

Yes. So instead of a keyboard there were levers you pulled down, so the lever, the positions for the levers were numbered nought to nine in each column and so on. And had a moving carriage, yes, in which there was a register and you had another register which was a counter, the number of times that you turned the handle, but the carriage could move relative to that so you could move over a number of tens positions at a time, yes? And you could wind the handle backwards to undo what you'd done. And some of them had an extra register that you could transfer down what was in one register to another and so on.

*Accumulator, yeah.*

Yes, yes. And you could even do square roots. Everyone who worked with mechanical calculators knew how to do square roots with them, which was what we called a 13579 method. I've since turned it into a computer algorithm, but it doesn't matter.

*So who was using these, apart from schools, who was using them?*

Oh, all the big research places. RAE Farnborough, for instance, National Physical Laboratory, National Institute for Research in Dairying at Shinfield. Masses and masses of places.

*So we're talking about around the early sixties here?*

We're talking about 1961, yes. '62 etc, '63, yes?

*Yeah.*

And, because I was in the right place at the right time, when the electronics revolution began and transistors were invented by Fairchild's, yes? Which promptly started getting incorporated into calculating devices, yes? The mechanical and electromechanical calculator industry started turning over to electronics. So I had to handle all sorts of varieties of these which my firm were looking at with the possibility of taking up the option of being the agent for them, yes? So I saw all sorts of early systems of that kind that never even made it to market, yes? All of which I've recorded in fine detail in there.

*Yes, yeah. Which I've read, yeah.*

Me picking up Resurrection issue number 96.

*So just going back to the mechanical ones, and you said they were used in research establishments, who would be using them? Would it be the scientists...*

The scientists, the scientists and R&D engineers, all of those kind of people.

*Because there was this use of the word computer at one time.*

Oh yes, human beings.

*It was a human being with a calculating machine.*

Absolutely, yes.

*So these...*

There were loads of them in the National Physical Laboratory, they were all called computers.

*Yeah, using your machines. So those with the handle, which I did use once upon a time, gave way to the electronic calculator then, with the transistors in.*

That's correct, yes.

*But was that a kind of push button thing, or something similar to the earlier...*

It had a numeric keyboard.

*Yeah.*

[00:49:55]

The numeric keyboard was such – just making sure of my facts now – yes, it was a ten-key keyboard numerically, together with the keys that you'd get on a modern pocket calculator.

*So the times and plus and...*

Exactly so. And you've very often a square root as well.

*Yeah. And the display was...*

Nixie tubes, yes?

*So this was the technology of what, the mid-sixties we're talking about here?*

Yes, this started in 1964. Which was when I saw my first electronic calculator. I have every reason to think that it was the first one that ever went to market. I don't know of any other one that did before it. And of course it was marketed by Muldivo, the company I spoke about earlier. And it was produced by an Italian company called Indus... I don't know if my Italian's any good, Industria Macchine Elettroniche.

*IME, it sounds like.*

IME, yes. That's right. And they first produced an IME 84, still with Nixie tubes, and they produced a programmable unit with it.

*A programmable unit?*

Yes. Which consisted of a gramophone turntable with a bit of baize, green baize on it and a spindle sticking up in the middle, and a read-write head, which was just like a gramophone head, yes? With a pivoted arm. And so it utilised real floppy disks. There was literally a circular sheet of mylar, yes, with no covering on it whatsoever, coated with magnetic oxide on both sides so you could record on both sides if you wished to, and so you connected it to the actual electronic calculator and you switched it to record mode, having put a floppy disk on it and placed by hand the read-write head somewhere you thought to be appropriate on it [laughs] and then tapped away on the keyboard of the calculator the sequence that would accomplish a particular calculation.

*So what was stored on the disk then, a set of instructions?*

The instruction set, one by one, yes.

*So...*

As you typed on the keyboard of the calculator. When you got to numbers it stopped recording the numbers and didn't record the numbers and recorded a pause instead. So when you'd finished you could then switch it to replay mode and then it would go off on its own and light up the display for you to key in a number at the first point required. There was no alphabets, by the way, with this at all, so there were no messages, yeah, because they didn't have any provision for it, yes? And so you had to keep track of where you were in the sequence for what you entered. So it would come to a pause and you'd key in a number and press continue and it would go on until it needed some more numbers, or another number, and you key that in and press continue, and so on until you'd got to the end of the sequence.

*So who was using these machines?*

Offices doing accountancy, that kind of thing, yes?

[00:54:46]

*Right. So this was, I guess the state of art of computing at that time was...*

It didn't last long because the floppy disks were so unreliable [laughs]. Imagine picking them up continually. So they changed over within about six months, or less possibly, to an electronic memory recording system. So exactly what the technology of that was I'm not able to say now, I can't give it a modern technological name, it was too early for it. But it was like being able to have, it was like being able to record into a ROM, if you understand what I mean. That was the kind of technology then, which was far superior. And that model of the machine itself was called an 86S. 'S' was for square root, because it had a square root key on it.

*So this would be people doing payrolls or invoices?*

That kind of thing. But the 86 was so much better that I was going to places like Harwell with it, yes?

*And what were you doing exactly then?*

I was demonstrating the use of it.

*Right.*

And showing off all sorts of mathematical equations by the use of it, yes?

*Right. So were you selling them, or just demonstrating?*

I was just demonstrating them, basically, yes.

*So somebody else would go and get the orders and you'd demonstrate it?*

That's right, that's right, yeah.

*So how long did that...*

Period last?

*Yeah, how long was that era of those machines?*

Well, I... I certainly wasn't with, I left Muldivo at the end of 1967, in December 1967, to go and set up the UK branch of an American desktop computer firm, called Wang.

*This is famous Wang?*

Dr An Wang from Taiwan.

*So this is where Wang started?*

Yes. Okay? But he was in America. And he had patented a very special thing which he called a logarithmic generator, it was also an anti-logarithmic generator as well. So his systems uniquely as electronically programmable machines did arithmetic via logarithms and anti-logs.

*So we're talking still about a calculator...*

Programmable.

*Programmable calculator.*

Yes.

*And by programmable calculator we mean something where you can tell it to do a sequence of operations...*

A linear sequence.

*... on a set of numbers?*

Correct, yes.

*We're not talking yet a stored program computer which I can loop and make decisions and change the program.*

No. Correct, yeah. So basically, what we employed with Wang were things that looked a bit like a toaster, because they opened up like that and they used Hollerith cards, one Hollerith card per unit, yes? But you can join them in series, so if you had a very long program you could have half a dozen of these units linked serially, yes? With a Hollerith card in each of them, yes? So that would then get activated by the computer so as to read – and they were eighty-column Hollerith cards, which you punched by hand, by the way, using an IBM handheld card holder, and I used my



wife's crochet needle to push the chads out after working out what the opcodes were, yes? So...

[00:59:50]

*So what was your role at Wang then? Because it sounds like you were employee number one of Wang in the UK.*

Yes, I was the one who set it up. We set it up in the British Medical Association offices in Tavistock Square.

*And you ran the whole thing?*

I ran, well, I was lucky. When I'd left Muldivo, Muldivo had made several particularly important people in Muldivo redundant, including the chief clerk, an accountant, and so I recruited them, it was just the right moment, they needed a job and I could give them the job, yes?

*So did that reflect the decline of Muldivo then?*

Yes, it did, yes.

*Times were getting difficult for the calculator business.*

Yes. So this was, I set up Wang, I think it was 1<sup>st</sup> January '68, so far as I recollect. And then, on 1<sup>st</sup> April 1968, Hewlett-Packard suddenly announced their desktop programmable computer, which is illustrated in there, yeah? And that was so superior to what Wang had got, and what's more, I should have said with Wang, Wang had got about eight patents, I should think, in the USA, at least, for his logarithmic generators and so on, and I had to know all the detail of them, fine detail, yeah? So I knew all of that and I knew the methods that he used. And there we are, we had Hewlett-Packard come out four months later – January, February... - no, three months later, with this new desktop calculator, programmable calculator that used tiny little magnetic cards, yeah, not much bigger than a cigarette card, yeah, and had all the transcendental

functions there and all the inverses, hyperbolic and trigonometric and rectangular to polar conversion and polar to rectangular and so on, and it was wonderful. And I stuck with Wang for another nine months and by the end of that I couldn't stand it any... Meanwhile, we'd had an exhibition at Olympia or Earl's Court, Olympia I think, as was done every year then with business machines, and whilst I was there with Wang, two chaps from Hewlett-Packard had come up to the stand and buttonholed me as an expert in the marketplace for these devices, yes? One was from the Hewlett-Packard European headquarters in Geneva and the other was the newly appointed sales manager for these calculators in the UK. And they, neither of them knew anything about such things whatsoever, so were picking my brains about it.

*So your expertise in all of it, you understood how the things worked?*

I knew exactly who needed them, who used them, what for and so on, yes? What professions.

*Did you understand the electronics and the...*

Oh, I understood it to... I could not understand it at a service engineer's level, okay, so I wasn't competent in that way, but I was competent enough to understand what, how they worked, yeah.

[01:04:28]

*And what was the sales pitch then? Why were people buying these things?*

Because they had heavy duty computations that required this. I'll give you some examples. People in the optical industry, yes? Regardless of whether it was for ophthalmic purposes or for optical instrumentation, they do what are called- when you put a number of lenses in a device you have to work out the ray tracing, ray tracing, that's it, yeah. You have to work out the paths according to the spectrum of the light involved and all this kind of thing and involves sines and cosines and all that kind of stuff, masses and masses of it, yes? So those. Land surveyors, doing it all the time, yeah? Colourimetry, colour measurement, yes? Gear design and gear hob design,

which is a totally different thing, designing the hobs to make the gears, yes? Masses and masses of trigonometric calculations, which up until then they had had to go to log books to look up, yes? And now at the touch of a button you could have the answers, and what's more, you could program a whole sequence. For instance, gear designers used a function that I've never known anyone else in the world use, which is a trigonometric function but I don't think any mathematicians would recognise it. It was called arc involute.

*It was called what?*

Arc involute. It's the inverse of an involute function and it's a truncated, it's a truncation of a tangent series and the only way you can calculate it, and there aren't any tables for it, is iteratively, yeah? So you have to write a program for it to get the arc involute value and it's absolutely essential for designing gears, yeah?

*I mean these days you'd get out your laptop, wouldn't you, and there'd be a program on it for designing a set of gears or whatever, but in those days the computers were mainframes that...*

Exactly. People didn't use mainframes for that kind of job.

*Yeah. Presumably because the, I don't know, the overhead of buying time on mainframe and programming it...*

Yes, exactly so. Too inconvenient, yeah.

*Yeah. So is there still a place in the world for these calculators?*

That's what I believe. I believe, well, you see there's another end to my story, which is all about Windows and the development of, which I was... that was ten years, I mean... I greatly regret the effect that it's had, both upon the world and upon such devices. I believe there is still a very strong place, like there always was, for specially designed computational devices for technical computations. And one doesn't want a general purpose laptop or whatever, it's a pain, a great pain, and you need a specially

designed device to cope with that kind of thing. Proper research and development establishments, including RAE, use these desktop programmable computers by the dozens, yeah? Harwell was absolutely full of them, so was AWRE. At Harwell I was in there so frequently that they gave me a refrigerator to keep my milk in, and what's more, I was treated like a member of staff there. I could just go and wander round the whole site, it didn't matter. [laughs]

*Do you remember how much they cost in those days?*

Well, I can remember the 9100, which was 1968, that was the one I told you I joined Hewlett-Packard for, and that was £2,500, but you could also have a printer sitting on top of it for another £500. It was only a strip printer.

[01:10:00]

*Sorry, what year again was this?*

1968.

*Right, yeah.*

April '68. And you could also have a box that was about as big as the actual machine itself, which was for the memory. Memory in those days was ferrite core memory put together by nifty ladies in Singapore threading the ferrite cores, which were tiny little things, yeah? And one of the beauties of ferrite core memory was that when you switched it off it didn't lose anything.

*Non-volatile.*

Yeah. And so you could, come to 5 o'clock, you could say, oh, I'm taking this home, switch it off, in the middle of a long program, take it home, switch it on again and it would carry on working as though nothing has happened in between, yes? [laughs]

*So what was the kind of progression then?*

Well, I kind of set up a marker, which is 1972 and that is when switchover occurred from ten-key numeric keypads and the associated arithmetic keys to having full typewriter-like keyboards. And that was in 1972, at the latter end of '72.

*You're talking here that was a milestone for HP and their products?*

Ah, yes and probably for some of the others. I can't remember chronologically exactly, but it's not much different for any of the others, like Olivetti, for instance. Wang were still in the game. Olivetti were in the game. Tectronics were in the game and Hewlett-Packard.

*And of course somewhere around there the famous Sinclair calculator appeared.*

Oh yes, that came out about six to eight months after we produced the first pocket calculator, yes?

*Yeah.*

However, it was only an add, subtract, multiply, divide machine, whereas ours was an all-singing, all-dancing sines, cosines, tangents.

*And how much did yours cost?*

£199.

*Really? Well, that was quite good value compared with the Sinclair, wasn't it?*

Oh yes, yes. The first one non-programmable, but it did everything apart from the programming that the original Hewlett-Packard 9100 did, because Bill Hewlett had his own R&D team, personal R&D team, and he used the 9100 all the time. And one day he said to his team, I want that in my shirt pocket. And they took six months to do it, and that's what they did, came out with the HP35 in November 1971.

*And what was the breakthrough in technology to achieve that then?*

Well, involved our setting up an IC plant, that I do know, in Portland, Oregon, which was the start of the calculator division of Hewlett-Packard. So we had to fork out a lot of money for an IC plant. We'd got one already in Fort Collins... but was a lesser calibre one than we had in Fort Collins.

*So, these calculators could run complex programs. I mean in what sense were these only calculators rather than computers?*

Well, they were too fiddly to do anything really serious, far too fiddly. I don't know of a single instance where anyone changed over from using a Hewlett Packard desktop computer to using a Hewlett-Packard programmable calculator. I remember lots of people who had both, but... yeah.

[01:15:06]

*And I suppose when the personal computer did come along it was used for all kinds of different things, wasn't it?*

Oh, absolutely, yes.

*Word processing and spreadsheets and games and...*

We were in the thick of that and it's interesting how we got there. We started off, our first computers were very similar to PDP-8s. They were HP1000s, I can't be more specific than that because I never got involved with them. But they were little minicomputers similar to a PDP-8, using paper tape feed-in programs, yeah? And they were used in association with some of our instrumentation, but we were also into mainframe computers, big office computers. We even used them ourselves down in Winnersh, yeah? I'll tell you a story about that in a minute, amusing story. So we needed terminals to go with our mainframe computers, yeah? So we had special divisions, at least two divisions, that produced nothing else but computer terminals of all shapes and sizes. And some of them were graphics terminals, so we provided extra

graphics memory. And it was only a small step from that to giving them an extra processor so that not only could they work online to the mainframe, but they could also do their own jobs locally, being programmable, yes? And so we developed a program language for it, which we called AGL – A Graphics Language. [laughs] Yes? Very clever language, it supported HP plotters, external mechanical plotters and so on, as well as graphics on the screen and all the rest of it, yeah? So they got used not only for office jobs, but for also technical jobs as well, engineering jobs and so on, because it was a very good language. It's the predecessor of what we ended up with later. But because we produced so many terminal boxes that had a certain influence on later developments. We got to one stage in November 1982 when there was a directive came down from on high in Hewlett-Packard, we're not to design any more computer boxes, we've got enough boxes already being produced by the terminal divisions, use their boxes. [laughs] That had direct influence upon the PCs that we were producing. That started life as a terminal. As a standard terminal box for people who hadn't got much desk space. But, we produced not only the terminal, but we also gave it a processor, well, another processor, an Intel 86, probably, and it ran MS-DOS and at that time there were only five and a quarter-inch floppies in use, but Sony in Japan had produced three and a half-inch floppies. And so we placed an order for 20,000 of them, yes? No one else ventured to do it, yeah? And we designed, we had the drives designed so that one of these would sit exactly on top of it, yes?

*Yeah.*

Both whether it was one of the terminals or whether it was one of the ones with MS-DOS as a standalone one, or one of these, which has got a Motorola processor in it. Yeah? So that's got a Motorola 68000 in it, yeah? There's one of the disk drives, sitting down there, yeah? So that's what we ordered 20,000 of.

[01:20:08]

*Certainly a neat arrangement.*

Oh yes. And that sold like mad. Yeah, all of it. Because three and a half-inch floppies were far superior to five and a quarter and it took the rest of the industry at least five years, probably more, to catch up with that, yeah?

*There's a couple of things I wanted to ask you about.*

Of course.

*First of all, the Windows thing. So how did HP end up doing this development of Windows?*

Ah, because Bill Gates approached HP wanting someone to convert MS-DOS into something that looked like an Apple product.

*Yeah.*

Yeah? And we had our software R&D over in Nine Mile Ride where Johnson & Johnson are now, yeah? And so we took the contract. It was like a country campus over there, but it wasn't all R&D. There were other... we taught programming over there, we had a devil of a lot of admin over there, there were all sorts of things went on. Eventually the council got wind of it and kicked us out into Miller House in Bracknell at the top of McDonald's. But the R&D people still remained there. But they were my mates who were doing this.

*It was simply that Bill Gates wanted to contract out...*

Yes, correct.

*So I mean Windows wasn't a big thing at the time, was it? I mean...*

I don't remember it as such. You see, as we started in May 1983, yeah, I think there was a team of sixteen. I don't know how it varied over time, because it lasted ten years to do it, yeah? But they were my mates and I got back from lunch one day about 2 o'clock in the afternoon and the telephone rang and it was one of my mates



round the corner, like about from here to the side of the garden, said, come and look at our new toy, Ron. [laughs] And they'd just had delivery of an Apple Lisa machine, one of the first three in the country. The first one went to IBM Hursley down at Winchester, second one went to Digital Equipment Corporation the other side of Reading, and the third one in the afternoon came to Hewlett-Packard, Nine Mile Ride. So yeah, they'd got this Apple Lisa, yeah?

*So the idea was to emulate...*

That was the idea, yes. To have a look at it and decide how these things worked and so on.

*Yeah. Amazing, isn't it, that what turned out to be the, yeah, the bedrock of, you know, Microsoft's current products was developed by a subcontractor.*

Exactly, and it was all a tightly kept secret. I was speaking to a guy who knew a little bit more of it who lives not far away, down at Kingfisher Drive, and he said they all had to sign secrecy agreements. I didn't. [laughs]

*So, that's interesting. And then you seem to own the rights to a couple of programming languages.*

Yeah. Yes. I was wondering whether it was two or three. Well, I'll stick with two. [laughs]

[01:24:24]

*So why did you feel that was something you wanted to do?*

Well, the BASICs that you're familiar with are those of the Bill Gates' variety, presumably?

*Yeah, yeah.*

Yeah. The trouble was, you see, that BASIC as a language was developed by Dartmouth College in the States in 1964. They developed it for students so that they could use ASR33s – you remember those? Yeah? Teletypes.

*Oh yes, yeah. Yeah.*

With paper tape. Yeah?

*Yeah.*

[01:25:07]

Instead of producing punch cards, which would have to be taken to the computer centre and so on and all the problems that arise therefrom and so on. So they then had this interactive system with the language they called BASIC, and what they designed was a very, very good language. The trouble was, that was a time just shortly afterwards when timeshare computing developed greatly and every man and his dog was hiring out computer time, so to speak, via terminals, yeah? And the language of choice was BASIC, yes? But the trouble was, that they debased the language utterly in the process, and what's more, it ended up in so many dialects that they were hardly countable. And then came the age of home computing and so on, and Bill Gates who decided he'd produce virtually as many versions of BASIC language he called BASIC to run on every variety of home computer under the sun and totally incompatible with every other one. [laughs] Yeah? And as a consequence among computer professionals, BASIC got a very, very bad name, exceedingly bad. But it wasn't the fault of Dartmouth College. They later wrote a book, Kemeny and Kurtz, the two of them who designed it, spelling out exactly what had been done to debase their language and what it had been like originally, yes? And it was a very, very good language in its original form. And it was a job dealing with certain computer professionals who only knew the kind of stuff that Bill Gates was dishing out, yeah? And very difficult to convince them that it could be anything else.

*So your version is...*

Is a fully structured language, properly up to the level and way past Fortran in its capabilities.

*What are you going to do with it? You've preserved that for...*

Yes.

*... the scientific community?*

Exactly so, because it is utterly – I am not academically a mathematician but I am de facto a mathematician, yeah, and I'm an algorithmist, is what I classify myself, and always have been, yeah? Since I was involved, yeah? And I design algorithms by the billion, well, not billion, but thousands. And this language is the finest language I have ever encountered, and I've looked at hundreds and hundreds and hundreds of languages, for documenting in a humanly readable form algorithms. And my concern is for future generations to be able to understand and implement algorithms, mathematical algorithms, not the stuff they talk about on the television to do with Google and suchlike, yeah? And to have a system, a type of machine that will allow people of that mindset – scientists and engineers – to be able to get directly to grips with it, without going through the awful palaver of trying to learn languages like C and C++ and whatever. It is a beautiful language for designing and documenting algorithms. We know that for a fact because the Ministry of Defence, throughout the Ministry of Defence use Hewlett-Packard Rocky Mountain BASIC as a prototyping language, yes?

*Right, yeah.*

[01:30:04]

Yeah? There were Hewlett-Packard desktop computers running it on board every ship in the Royal Navy, yeah? Not to mention masses in the RAF and all the rest of them, yeah? You have to be a programmer to appreciate the quality of the language. We put intellectual effort into designing that language that is never likely to be repeated. And I am doing my utmost to preserve it as an open-source programming

language to run under Ubuntu Linux. And I've recruited - one, two, three, four, five, six - about seven individuals so far to assist me in the task, one of which is a proper charity and company up in Thame who already produce a machine of the right kind, which is sitting on that table there, in that box, yeah? That is shaped exactly and looks exactly like a BBC Micro from the 1980s, has exactly the same keyboard, yes, but uses an HDMI screen, has a Raspberry Pi processor, runs Ubuntu Linux, is fully equipped with USB and all the rest of it.

*And who's put that together then?*

The firm in Thame that I am working with, yeah? Who are now getting to grips with the source code of the language that I've been talking about, and there are all sorts of wonderful accidents that have happened that have made it possible, and I can't believe my luck.

*So you're still doing this stuff?*

I'm still doing it.

*We really ought to wrap this up, because we...*

I do understand. I could go on for hours, Tom, I'm...

*I'll just ask you one last question, if I may, because I mean one thing that strikes me, you know, listening to your story is that, you know, you didn't have a career plan and...*

I was in the right place at the right time, all the time.

*We often ask people, what advice would you give to a young person now...*

I can't, because it happened to me by accident.

*But it may be that's a good way to do it.*

Yes. I didn't have any plan.

*Yeah. Did it... but I mean, clearly it's worked well in some sense that, you know, through your various bits of experience you've picked up, you know, certain capabilities and knowledge and...*

Exactly. I've always had a very inquisitive mind, right from when I was about less than four years old.

*That's the key is it?*

Exceedingly inquisitive.

*Yeah.*

I will stick my nose into all sorts of places that other people wouldn't dream of. Even in mathematics, I study what's called digit by digit transcendental functions, where you generate them digit by digit. There's hardly any mathematicians in the world will know what a digit by digit transcendental function is, or its algorithm.

*So if I can sum up then, the moral is that an enquiring mind is perhaps the key to success in this business more than...*

Probably that's so, at least that's the way it is for me.

*... more than qualifications.*

Yeah.

*Well look, we'd better wrap up. It's been fascinating listening to that and I know we could go on for another hour or two, but we'd better not.*

Oh, easily, yeah.

*But thanks ever so much for taking the time to chat.*

[end of recording]