Dr Hermann Hauser

Interviewed by

Richard Sharpe

26th April 2018

At the

Offices of Amadeus Capital

Welcome to the Archives of Information Technology. We are here to capture the past and inspire the future. It's Thursday the 26th of April 2018. I am Richard Sharpe, and I have been covering and researching the IT industry since the early 1970s. I happen to be in Cambridge, Silicon Fen as it is called, and our subject today, Dr Hermann Hauser, happens to be in London, such is his importance that he was called there last night when I was up here, but technology connects the two of us, and hopefully then, the sound quality, although not up to its normal high quality in the archives, will be enough for you to relish his contribution. And what a contribution it has been as well. He is, for instance, known as a co-founder of Acorn; he is known for helping develop the BBC Micro; he is known for spinning out ARM; he is a KBE, a CBE, a Fellow of the Royal Society, and I could go on and on but we don't have enough time in the day to go on with the awards and accolades that have descended on him as a result of his work.

[01:20]
Dr Hauser, you were born in Vienna in October 1948. What did your parents do?

My father was a, a wine merchant, a wine wholesaler I should say, in the Tyrol. And my mother was Viennese. So, I had grown up with a bilingual and bi-cultural background right from the start.

And, where did you go to school, in Vienna?

No. My mother moved to the Tyrol to join my father when they got married, so actually, although I was born in Vienna, I grew up in the Tyrol, and that's where I went to school, in a place called Wörgl.

And that was more a rural than an urban setting, was it?

Very much so. In fact it was, not even Wörgl itself, which at that time was 6,000 people, but it was a suburb of Aubergit[?], which had about 200 people, and probably more cows than people.

And what was the quality of education there?

Well the first, the primary school I remember was a very simple school really, and because it was such a small school, I remember we had four, four years in one class. So I don't think the, the sort of, detailed personal attention that we got was very good. I then went to the *Gymnasium* in Kufstein, and I think that was a, a fine education and I'm very grateful for it.

[02:57]
And was that a selection process, or did you just move automatically to that higher level of school?

No. In fact it was quite a dramatic selection process, because, the *Gymnasium* had an entrance exam, and, the teacher that I had at the primary school was told that I was going to do this entrance exam by my mother, I think a month or two before the entrance exam was due, and he was horrified, because, he thought I would fail. And my mother insisted that I go to the *Gymnasium* rather than the *Hauptschule*, which would have been the, the normal way to go; the *Gymnasium* was really for, you know, the bright, the bright kids. And, I then got some special tuition, and only just scraped through.

Did you think you would get there?

I didn't know. Because, although I always had a, a bit of a, an aptitude for mathematics and, and physics, I did struggle with German, so, and that was indeed the one, the one problem that I, I had at the time.

[04:15]
How did your parents contribute to your, moulding of your character?

Well, my mother has always been very keen on education, and neither of my parents were university educated, and, so they, they, my mother in particular was very keen that I would go to the *Gymnasium*, not just the *Hauptschule*, so she really pushed this hard. And my father, when I was fifteen, came home from Innsbruck with some language school brochures and, and told me that I was going to learn English. And I said, 'Well Father, but, but why should I learn English?' And he said, 'Well English is the most important language in the world now. You choose a language school in England and you go there for the summer.' So I, I went through all these brochures, and Exeter and Cambridge were the, the last choice. And I knew nothing about Exeter, but neither did I know anything about Cambridge. I didn't even know there was a university there, because as a fifteen-year-old, why would you? But, the train connections to Cambridge were more convenient than the ones to Exeter, and that's how I ended up in Cambridge at summer school.

[05:27]
And then you went back to Austria for your university education?

Yes I did. My first degree, in physics, I have from the University of Vienna, in the Boltzmanngasse. And that was a wonderful three years there, which I enjoyed very much, because it is of course also so history laden, with Boltzmann, Mach, Schrödinger, all these great physicists, and I remember working on a blackboard that Boltzmann used to use in the theory department. So it was all, it was a very nice time.

[06:03]

Did you indulge in the cultural life of Vienna as well?

Yes. My family, my mother's family was still there, and their relatives of course, and they always had subscriptions to the Burgtheater, which is our national theatre, and the opera, which is arguably one of the best operas in, in the world. And then of course, the famous Musikverein Zeil, which is, the Austrians think the concert hall with the best acoustics in the world, and, and I'm sure it's very good. Well, actually, the acoustics is a very interesting case. Later on in life I befriended a New Zealander who is one of the great acousticians in the world, and he designed a number of the great concert halls all over the world, and he told me that this particular structure of the Musikverein Zeil, which is basically two cubes, is, is close to ideal for the reverberations that you need in order to have a high quality concert hall.

[07:11]
And you decided to do a PhD, and decided on Cambridge.

Yes I did. Because I, I had fallen in love with Cambridge after this period of, of being at language schools for a number of summers. My father also sent me to Paris to learn a bit of French during that period, but Cambridge really became a, a place that I, I really, rather liked, so I, I wanted to return there to do my PhD, and fortunately I could do that, and I did that in the Cavendish Laboratory.

[07:49]
I presume it was that period that you met your first computer.

Yes it was indeed. There was a wonderful group of people that banded together in the Cambridge microprocessor group. And microprocessors really were a sort of inspiring, an inspiring component, because, a microprocessor was so cheap that people, ordinary people with an interest in computing, could buy a microprocessor and build a sort of home brew kit, and compute. Whereas computers until then were, had to live in an air-conditioned room and were only accessible to PhD students or professors, and you had to have special permission to use a computer, and here you could build one yourself and use it yourself. It was one of those revelations that people just, were very excited about, and I joined that microprocessor group and got to know many bright people who then alter joined Acorn and, and produced all these wonderful products for us.

[09:04]
You were 30 when you joined Acorn. Can you sketch the development of your career from the end of your PhD until the formation of Acorn in 1978?

Yes. Well first of all I should say that, because Austria still had National Service, of course I had to spend some time in the Army. So that cost me a year. Then, the transition to Cambridge, I think I finished my PhD in, '76 or so. Then, I was a research fellow at the Cavendish Laboratory before starting… Actually, it was called, the first company was called CPU, for Cambridge Processor Unit Ltd, in 1977. So I was 29 then. And then, a year later we started Acorn Computers and we finally merged the two companies into one.

[10:06]
What was the incentive to be so adventurous and entrepreneurial?

Well, as I later found out, one of the best correlations of course is whether your father was an entrepreneur or not, and mine certainly was. He built this wine wholesale business, that he actually inherited from his father, but it was a very small outfit then, to a company of 30 people. And, he was very entrepreneurial, and very, very productive throughout his life. So he always built something, he always did something new, he, you know, he, he produced mini schnapps, so we had a distillery. We, we produced champagne, we produced fruit juices. [laughs] He was just very entrepreneurial himself. And then, one of the wonderful things about the Cavendish Laboratory, which is our physics department in Cambridge, is that, the Cavendish itself has always been very entrepreneurial, very supportive of, of researchers that wanted to try new things and different things. And I suppose, that culture helped me, you know, and then branch out and, and star a completely new company. I should say, with Chris Curry, the partner that I did this with, was also very much an entrepreneur and, and a like-minded person that I could do this with.

Before the European Union descends upon us, I had better for the record say that your father couldn't have made champagne; he made his sparkling wine.

Indeed, and, it wasn't called champagne. Of course we used the German word for champagne which is *Sekt*.

[12:00]
Excellent. So, '78 was the big take-off year with the formation, with Chris Curry, of Acorn. Who did you think your first users were going to be?

Well, I often think about whether I would have invested in… I… If, if I came to myself now, would I have invested in Acorn Computers, if I had come to myself? And the answer would have been a clear no, because, at that time… You know, we now need business plans, we need a clear vision of what we were doing. Well we did actually have a clear vision, but, that was it. There was no business plan. And the vision was, that it's all happening in microprocessors, and we wanted to be part of it. That we would produce the world's most successful microprocessor was really not part of the business plan, or, we could

never have expected that. But of course as it turns out, we did with the ARM, which now outsells Intel 20 to one. So, it was really the excitement of participating in what clearly was a, a new wave in computing that brought computing to the ordinary man.

[13:16]
I notice that there isn't much mention there of the software. The hardware was the big challenge at the time, was it?

Very much so, because, although the software of course eventually was very necessary, the fact that you could write little programs that did anything at all automatically was, was close to magic. So the fact that we… We then had to produce all these different layers, like an operating system and applications and user interfaces and, and network protocols, which we all did, and we also had a subsidiary called the Acornsoft, which produced games and lots, and word processors and spreadsheets. This all came later, and in fact became a major part, in fact it probably was then the, the majority of developers in Acorn then were actually software developers rather than hardware developers.

[14:18]
What was your major role in Acorn?

Well, the… I am a physicist, of course, not a computer scientist, and, my first education in computing was to buy myself a book on microprocessors by Adam Osborne, you might remember him, of the famous, he produced the first portable computing, computer, called Osborne 1, and that was a revelation. And because of course computing builds a lot on mathematics, and mathematics is the basis of, of physics, I had no, you know, no big problems understanding software and what computing was all about. But my main contribution really was finding people, very gifted people, that had both the passion and the ability to produce the, the wonderful products and software that, that we really produced in Acorn. Arguably Acorn at that time was the most innovative computing company in the UK, and that had to do with the quality of the people that we assembled. So if you asked for my contribution, it was really assembling and motivating that team.

[15:39]
That seems to me, from there on, a pattern of your work. Rather than necessarily being the technical brains of this, you are the assembler and motivator of teams that do these things. Is that right?

Yes, I think that's correct.

So that, were you… You were portrayed in the Micro Men, a fictional documentary of those times, were you portrayed realistically or not?

Well, there are lots of people that came to us, almost every year for a period, to write the history of Acorn Computers, and when they approached me and then said they wanted to do a docudrama, I said, well that's another lot that's trying to, to talk about what happened with the BBC Micro, and the growth of Acorn Computers and spin-out of ARM. But I think they did a fabulous job actually. Most of it was accurate, in particular the, the scenes that nobody thought were accurate, they were actually accurate, like the one when I, when I cut the umbilical cord between the development system and the, and the first BBC Micro demonstration about two hours before the BBC team arrived.

And portrayed in that was Sir Clive Sinclair, who at that time was very prominent in the development of this technology, and particularly in Cambridge. What was your relationship like with him?

Well one of competition, so… But he was the main competitor in Cambridge, and he also was Chris Curry's boss before he left Sinclair, so, Chris Curry had a lot of the Sinclair genes in him in terms of, you know, being very innovative, of knowing the supply chain, and knowing how to advertise and market the products. So we owe a lot to Clive Sinclair. And, I, I don't think he came off so well in that docudrama. I think they've been slightly unfair to Clive. They showed a lot of, of his bad sides, of which there were many, but they didn't really stress his good sides, of which there were more.

And he eventually sold Sinclair to Amstrad.

Yes, he did.

For £5 million.

Yes, which was rather a shame, because, I think, there was a lot of intellectual property there that would certainly be worth more than £5 million.

I notice that that point is made in the computer history museum up here in Cambridge, of which you are a patron, one of the many roles that you play.

Yes. That's a wonderful museum that people ought to go and see, and, it has lots of really interesting historic computers, of course many Sinclair computers, many Acorn computers, but also lots of other stuff, from, ICL and from, from that time right up to, to the present.

IBM and, even French computers.

Yes, and of course, the PET and the, Commodore 64, all these very memorable computers that were the main products of the time.

[19:20]
And you were chosen then, your company was chosen by the BBC to provide the BBC Micro as it was called. I remember at the time, the correspondent, the journalist covering microcomputers as we called it at the time, was trying to find out who the BBC has chosen, and he came into the office one day and he said, 'Curry and Hauser have got it.' And so ran the story, that you had won this prestigious order for the BBC Micro.

Yes we did. The story is that they had been working with Newbury Laboratories for two years on a computer called the NewBrain. And after two years they still didn't have a working prototype, so they decided to go out to six companies. Now let's see if I can remember them. They were of course Sinclair; Tangerine; Dragon, a Welsh company; Orange I think; NewBrain; and Nascom] I think. I think I got that roughly right. And, Sinclair of course told them that, that they should look no further, there is no option for them but to adopt the Sinclair computer, because it was the best in the world. We were rather more humble, and said, 'Well what's your specification?' And of course they had everything and the kitchen sink in the, in the spec. But very fortunately, Stephen Furber, who was one of the people that I recruited from the Cambridge microprocessor group, had a design in his, in his drawer that we had called the Proton, because our first Acorn computer was called the Atom. And Proton, by luck I suppose, and by ambition I should say, by Stephen's ambition, actually had most of the features that the BBC was asking for. And then, you know, there was this, this famous week where, on Monday the BBC, a group came to us and told us the specification of the machine that they wanted, and they said they would return on Friday to discuss it more. I then said, 'Well guys, can we build a computer by Friday?' I phoned up Stephen and said, 'Do you think that's possible?' He said, 'Absolutely no way, we cannot do that.' So I phoned up Roger and said, 'I've just been talking to Stephen. He says, if we really work hard we might be able to do it by Friday.' [RS laughs] 'You must be crazy, there's absolutely no way, but if Stephen is in, I am in.' And then, we worked, you know, three days and, and two nights to get this going. And, and it worked, and I think, the BBC was impressed that they had got something in one week. They had been working with Newbury laboratories for two years and still didn't have a prototype.

[22:29]
Why weren't they able to do it over two years?

Well, I think, this is a sort of secret of, of the Cambridge phenomenon, that, we do have access to extraordinarily gifted people, and if you get these, you know, five-star wizards and you put them together and you really motivate them, they can perform miracles. And they did.

[23:01]
It was simply the people, and also, what is it about Cambridge that creates this Silicon Fen approach? Is it the water, is it the air, is it the flat landscape? What is it?

No, it's a, 800-year-old filter. So, if you, if you have a nation of now 66 million people, and you pick the top 3,000 of such a big nation every year, and you keep this up for a few hundred years, it is not surprising that you end up with a, a high concentration of very gifted people. I think that's it.

It's rather like the greens in front and in the middle of the colleges, as the tourists come and say, 'How do you get the green so green?' And you say, 'Well, you put the seed down 300 years ago, and you keep mowing it.'

That's it. [laughs]

[23:51]
That's the way to it, isn't it? This then boosted your company tremendously. You had some management difficulties in fulfilling orders sometimes, and sometimes you, I understand, were dealing with rogues, so Chris Curry has said in his contribution to the archives which we have so far.

Yes, this is indeed the case.

And people were coming up and saying, 'We want large amounts of your computers,' and they were buying them wholesale from you. What was your chain to market, what was, what was your distribution pattern and your distribution model at that time?

Well it was actually the Sinclair model to start off with, which was to advertise in magazines like *Practical Computing*, *Practical Electronics*, and, with full-page ads which were very expensive. And then people would buy mail order from us. So this was of course very, very cash effective, because people would pay for the computers and then we had three weeks to send them out, so, the working capital, cash flow was very good. and later on of course we went through all the normal distribution channels like Dixons and British Home Stores and, and all the, you know, the major distribution chains in the UK.

[25:15]
And, across in the United States, two things were happening. One in the long term had a tremendous impact, was that, through the same type of process, around Silicon Valley, Apple was being formed, and, IBM was beginning to look at the market and decided on a completely new process of development for the IBM PC. And eventually the shoe fell, did it not, and IBM entered the market.

Yes, they did. They actually coined the phrase personal computer, was the IBM PC. Things weren't called personal computers before they, they were called home computers, or microprocessor kits. And, and they, because IB was such a, a big name, they finally became the standard.

And you decided not to follow that standard.

Wisely, yes, we did not. Because that standard meant that the early differentiation that hardware vendors had was to, was price. And, the reason why Acorn survived for another ten years after the IBM PC was, was launched, is that we had our own operating system, which actually was much more efficient than the Microsoft operating system. And, we had developed a new processor for ourselves, which was much better than the Intel processor, especially when it came to graphics, and that was the ARM chip.

It isn't very difficult to write an operating system which is more effective that Microsoft's at any point in its history, but it is quite difficult to develop hardware which is better than Intel. What led you down that particular route, which enabled you, not only with the Acorn and with your processor, but also with ARM, to so comprehensively beat Intel?

Well, I always… Well the history is that, we used the 6502 for the BBC Micro, which indeed was the same microprocessor that Apple used for the Apple II.

And that came from…?

That came from quite a few companies. It was very close to the 6800, from Motorola.

Yes, OK.

The rest was produced by companies like Western Digital, and, and a few others. But it was by far the, the nicest microprocessor with the nicest instructions. But it was an 8-bit microprocessor, and it wasn't powerful enough for what we wanted to do with our next generation computers. So we then evaluated all

the 16-bit and 32-bit computers that were available at the time, which was the 68000 from Motorola, the 8086 – actually the 8286, from Intel, and the 32016 from National Semiconductor, which was actually architecturally the nicest one that we want to go to. And I remember going to Intel and saying, 'Your 8286 actually will do, it's a reasonable processor. You just screwed up the pinout, because you put both the data bus and the address bus in the same pins. Nobody can produce a sensible computer with that. But if you allow us to do our own pinout, we might… and you sell us the die, we might, you know, be able to do something with your processor.' And they basically said, 'Get lost.' You know, 'Who are you to ask for the die rather than buying the chip as we, as we envisaged?' And, because we were riding rather high and were very young and, and arrogant, we said, 'Well, *you* get lost. We'll do our own.' So if they had given us the die at the time, the ARM would not exist. So we, we produced the ARM because we really couldn't find a processor that we felt had the right performance and architecture that we needed for the next generation Acorn computers.

[29:29]

And then, I gave two advantages to our design team that neither Intel nor National Semiconductor or Motorola ever managed to give to their design teams, and the first advantage was, I gave them no people, so it's the only microprocessor in the world that was designed by just two people, Steve Furber and Sophie Wilson; and the second advantage I gave them was, no money, because we didn't have any. So rather than 50 people burning through many millions of pounds, we had to keep things incredibly simple and cheap. As it turned out, this coincided with an architectural breakthrough at Stanford and Berkeley by John Hennessy and Patterson at Berkeley called RISC, for reduced instruction set computer. And when we got the papers, and Andy Hopper actually was head of the Computer Lab now, realised that RISC was very important, sent us the papers, I was in Silicon Valley, heard that this was a fantastic breakthrough. And then, our two geniuses looked at these papers and said, 'Yeah, that's so simple, we can do it ourselves.' And we did. And the, the breakthrough was really quite stunning. Just to give you one parameter. The Z80, which was one of the most popular 8-bit processors at the time, used actually in the Sinclair computers, had 30,000 transistors. The ARM1 also had 30,000 transistors, but the performance, with the same number of transistors, was actually 20 times that of the Z80. Yes. So, so it was a stunning architectural feat to get so much more performance out of the same number of transistors.

[31:26]

Are you now, therefore, a believer in small, tight development groups, who are highly focused, and under some degree of pressure?

Very much so. Yes, this has been the theme of many projects that I have been involved in since then, and it's also something that I look out for when I invest in companies now.

[31:50]
There's a large, there was a large Italian computer maker and an office equipment maker called Olivetti. And Olivetti became the, one of the number one IBM compatible vendors, certainly in Europe, and was awash with cash, and came, and recruited you, in effect.

Yes, they did. But the way this came about, they also bought a majority of Acorn Computers, at the time we were a publicly-quoted company. We got into financial difficulty, and we actually needed to be rescued, and, Olivetti rescued us. And, in, in these negotiations, they realised that Acorn had an R&D department which was the envy of Olivetti, and they asked me to become VP Research for the whole Olivetti group. Olivetti was riding high and was the number one PC company in Europe, it was a seven billion euro company at the time, with a very charismatic leader in Carlo de Benedetti. And Elserino Piol, who was the Vice Chairman of Olivetti, became Chairman of Acorn, and we struck up a very strong personal relationship, he sort of called m his younger brother, and he wanted me to do this, and, and I did. And I spent three years at Olivetti, they were three of the best years of my life.

[33:19]
So you had been working with small start-ups, you had been working with small groups, and suddenly you jump into this corporate arena of Olivetti, an Italian company, well-known for its internal fights, well-known for a huge amount of energy spent on the political arena. How did you survive those three years?

Well, I suppose, because I had this very close relationship with Elserino Piol, and also Carlo de Benedetti, and, I set up seven research labs for them all over the world, there were five in Italy – no, four in Italy, one in Cambridge with Andy Hopper which became spectacularly successful with a number of spin-outs, so one becoming a $5 billion company, there was Virata, one in Nuremberg for, because, Olivetti had bought[?] [inaud], and, one in Silicon Valley, which also became a great laboratory. So, I provided Olivetti with the research capability that they really didn't have, because their history of course was in typewriters. So I never had any, any problems of any kind within Olivetti, I always got the support that I needed right from the top, and I think, the divisions liked what I was doing as well, because, they saw that we were coming up with new innovative ideas that benefited the whole company.

[34:52]
And you were Vice President of Research, and you set up Olivetti labs here in Cambridge. I remember going to it. I wonder if you can check that my memory is correct. As I walked along a corridor I looked into an office through the round windows, you had round windows on the doors of the offices.

That's, that's right, yes.

And did not see Maurice Wilkes reading a journal in there?

You did indeed. So, Maurice was the head, well the, actually the, the creator of the Mathematical Laboratory in Cambridge as it was called, and produced the first programmable computer in the world with the EDSAC, which by the way we're, we are re-building now at Bletchley and we hope to fire it up this year, under the leadership of Andy Herbert. We're very excited about this project. He then went to DEC, to Digital Equipment, in America for five years, and then decided to return to Cambridge and came to me to see if… And Andy Hopper was head of the Computer Lab at the time and the head of the Olivetti Research Lab, and said, if he could work with us. And I remember going to him with a contract and said, 'Maurice, here is the,' you know, 'employment contract. If there is anything that you would like to change, just tell me, I'll, you know, I'm very happy to, to change things.' So, he took this contract, and said, 'Herman, you are a young man in a hurry. I am an old man in a hurry.' Signed it and gave it back to me.

And here he was, by then probably in his seventies.

Yes. He returned at the age of 70, and he remained very productive for another ten years.

Is that a sign of what you are going to do?

Well I hope so. I have no, no intention of retiring at the moment, although I'm sort of, winding back a little bit, but, I, I'm very excited about all the new technologies that will change our lives within the next five to ten years, especially three that I am, I am particularly keen on, which is of course machine learning, because it's the most powerful tool we have ever developed; blockchain smart contracts, because they will allow us to get rid of bureaucracies, of automating business processes; and probably the most, the most important of the three is synthetic biology, because they will allow us to get control of our own lives, not just the software but the hardware. And I, I am making investments in all these three areas.

[37:48]
You are. But before we get there, you left Olivetti in '88 was it?

Yes, that sounds right.

You formed, you helped to form a company, was it called Active Book Company?

Active Book Company, which then became…

What was the idea behind that?

Well interestingly, when we first formed Acorn Computers, we thought that the way microprocessors would be first used was in, in a book, that you… Because people couldn't really imagine what you would do with a computer, with a home computer as we called them at the time. The nearest sort of metaphor that we had for getting hold of knowledge and doing something with knowledge was a book. So, at that time, we already thought about the microprocessor being like a book. So this idea of a book computer had been with me for a long time, and the Active Book Company was just a, you know, a pre-runner of the iPad. So we did actually finally become an American company called EO, which was the main competitor to the Apple Newton at the time, but it was, it was ahead of its time. The display wasn't good enough, the, the applications weren't good enough yet, but, it was basically an iPad, but a bit early.

[39:20]
So here you were back in small company entrepreneurial mode, after having spent three years in Europe's largest, then, IT company pretty well. And you were bought eventually, were you not, by AT&T.

Yes, we were indeed. It was Bob Cavanagh who was the… Actually it was quite a, a remarkable event for me how we got the AT&T investment in the first place, because, I did a deal with an American company called PenPoint. Because, of course, in those days, this book computer was mainly, one of the ideas was that everybody, or a large, a very high percentage of people, knew how to write. So if we could do a computer where you could write on the display, that will open up the market substantially again, because anybody who could write, could then use the computer. And, there was an American company that was riding high called PenPoint and they had a hardware division. And PenPoint was financed by Kleiner Perkins, I did a deal with Kleiner Perkins that we merged the hardware division with Active Book Company, into a company called EO. And, because they had a close relationship with AT&T, Bob Cavanagh in particular, the CFO of AT&T, who was one of the supporters of Sun, and Bernie Lacroute was one of the, the Sun people, and of course Vinod Khosla was one of the Sun founders KP, we did that deal, and that was about to go through. And what happened there is, AT&T bought NCR for seven billion, it was one of the biggest acquisitions at the time, and NCR had a computing division. So, then, Cavanagh had to make a decision on whether he was going to have two pen computing activities in AT&T, or whether he would not do the EO deal. But the only people who could decide whether to do both or just one, of course was the board of AT&T, because any division would have a potential conflict of interest. So here I was, travelling with my slides on the Active Book Company to, Basking Ridge, presenting this project to the chairman of AT&T, Alan, to the CFO of… Now AT&T you must, you will remember this, was *the* most important company *in the world* at the time, and was also one of the biggest companies in the world. So to present to

the chairman of AT&T was a, a very unusual event. So I had four board members there with my slides, and they just loved this vision of pen computing, and they decided that AT&T was big enough to have two pen computing divisions. They invested in EO and it was, it was just one of the great experiences of my life.

[42:42]
AT&T was allowed to do something, as IBM was allowed to do something, they were allowed to get into each other's marketplaces. So AT&T went and bought NCR's computer division.

Yes.

Probably, not the smartest thing it had ever done. And IBM was allowed to drift into and fight in telecommunications.

Yes, indeed. And, I will also remember, well never forget, when we launched the EO pen computing in Las Vegas. Of course, a key component of EO was that you could write on the surface, but, it had a, a data channel to the mobile phone network. Now the mobile phone, it was a thing called CDPD, you know, long before we had 3G or GSM or anything like that, it was an analogue, a data channel, which was very slow and actually it didn't work very reliably. And it was the early days of mobile computing. So we had to demonstrate this on the, on the stage in Las Vegas. And, so what we were going to demonstrate is, that, we were sketching a road map of where we're going to meet, and we were going to transmit this sketch over the mobile phone network, into somebody in the audience. Now AT&T was of course absolutely scared that this wouldn't work, because, actually, it didn't always work. So, being AT&T, what they did is, they shut down the mobile phone network in Las Vegas, and reprogrammed it so that only one call would go through during that hour that we had. Now this is unimaginable at the moment of course, because, everybody uses mobile phones. But in those days maybe there were ten or 20 people using mobile phones in the Las Vegas region where we were. So they could do that. And, lo and behold, the call went through, the person in the audience could show that it had received the sketch, and the journalists were very impressed, because this was the first time, never been done in the world, so it was all very exciting.

It must break your heart today to see people texting on these very small screens with their thumbs then.

Well indeed, indeed it is. And as you know, it's a complete fluke that SMS was indeed included in the GSM standard. It was just, one of the engineers thought that this was a neat thing to do, and everybody thought what a stupid extra feature, why should we have that in, but he managed to pass it through.

[45:36]

1990 is an important year for you and for Silicon Fen. It was the spin-out of ARM.

Yes indeed. I was working on the Active Book Company at the time, or, which became EO later, and I met Larry Tesler at Apple, who was working on the Newton. And he had been using a, actually an AT&T microprocessor called the Hobbit. And, AT&T Microelectronics had a microprocessor before that they pushed and then abandoned. And Larry, rightly as it turned out, was worried that they would do the same with the Hobbit. Although the Hobbit was a processor, in fact it, we did lots of performance comparisons with the ARM, and there was very little to choose between the Hobbit and the ARM. But it was very interesting why Larry chose the, the ARM. And h argued, correctly as I turns out, that AT&T will drop the Hobbit a little later so they wouldn't get the support from, then, a $2 billion, the semiconductor company, and he argued that a little Cambridge company called ARM will never abandon its, its processor, because it's the only thing they could live by, so they will make it work. And, of course we did. So, Apple invested one and a half million dollars for 43 per cent of ARM, and, John Sculley is on record, you can find that on the Internet, saying that if Apple had not been able to sell that $1.5 million stake for 800 million, when they were in deep financial trouble, Apple would not have survived. So interestingly, Acorn, one of the competitors with Apple at the time, contributed to Apple's survival.

[47:48]
And it was remarkable the technology itself, was it not? Because I understand that you were trying to lower the amount of power that the processor needed, and you came to the conclusion that actually it didn't need any direct power at all. It was taking power from the inputs coming from peripheral devices. Is that what…?

Yes. Yes that was a fluke. It was when Stephen tried to measure the power consumption of the first ARM that he realised that the power pins were actually not connected. So, we thought, well that's rather good, you know, it's one that, we've got a processor here that doesn't need any power at all. And as you say, the secret for why the, the thing actually worked quite well was. the leakage currents through all the, all the other pins was enough to power up the chip. So we, we knew that we were onto a winner on the power front.

And you were onto a winner because, it could be driven by batteries, it did not have to have mains, it could therefore be mobile, it could therefore be in, billions of mobile devices and not tied to the desk top.

That's correct. And it was the adoption of the ARM by Nokia that allowed us to basically become the, the standard in mobile phones with now a 95 per cent market share.

[49:05]

Some years later you formed Amadeus Capital, after going through a number of ventures. Is this a nod towards Mozart?

It is. Yes. We… It was actually my business partner Anne Glover who came out with the name. Because I wanted to call it Cambridge Technology Fund, and she said, she didn't like Cambridge and she didn't like technology but fund was all right. So, she didn't like Cambridge because of course it was too restrictive. We were a venture fund for all, for all of Europe, and technology she thought was, a little bit too restrictive as well. So, so that's… Then, I said, 'Well Anne, if you don't like this, you've got to come up with a better name.' And then, she, thought that Amadeus was a good name and had the Austrian connection, so that's what we settled for.

[50:01]

That was 1997. You have, you have said in other places that you choose your investments by gut instinct.

Well not only, but that plays an important part. Of course you've got to do… I've got three main criteria. One is the, the size of the opportunity, the size of the market, because unless it's a big play, you know, it becomes very hard to build a substantial company. The second criteria is the quality of the team, and I always look for at least one star, because it's so much easier to put a world class team around the star because everybody wants to work with, with good people. And the third criteria, sadly for a [inaud] like me, is the technology. So, I've had so many cases where an A team with C technology would beat a C team with A technology, so the, the team clearly is more important than the technology.

And those are your guiding three criteria. They seem to have been common throughout your career, not just with Amadeus Capital.

Yes they have. It's just that they're now more explicit than they were early on when I did it more by gut.

Where did you learn those principles?

Well, that's a very good question. I think it's again the sort of history of, of my father working with, with teams and forming teams and, and looking for outstanding people to work with. And then, as a physicist I have always been excited and, excited by deep technology, by, by true technical disruptions. So it's that theme of, of new technical possibilities for large markets which I get really excited about.

[52:11]

And Amadeus now has offices in London, which has been called Silicon Roundabout; here in Cambridge, Silicon Fen; and also in San Francisco, Silicon Valley. Can you, classically, Dr Hauser, in a few words, compare and contrast the three different silicons?

Well, clearly, Silicon Valley is still very much the lead area, with more venture capital, access to a much larger home market, and talent that still flows into Silicon Valley. But it's, Silicon Valley is the apex, the East Coast, maybe a little lower, then comes to the UK, and then Continental Europe, and the gradient was very steep in the past. A thing that has happened is that this gradient has become a lot more shallow. So, you know, the East Coast, especially in biotech, arguably is as important if not more important than Silicon Valley. In the UK and in Cambridge in particular we now have fifteen billion-dollar companies when, you know, 20 years ago we had none. London has carved out a niche for itself as Tech City, or Silicon Roundabout, mainly on the software side. So, I think, all these clusters are becoming more alike, and the differences are not as pronounced as in the past.

[53:54]
What is the biggest success you would like to be known for in your career so far, a career which I understand isn't over?

Well, thank you very much for saying that. [laughs] Very much intend to do some more interesting investments in particular also in biotech. Now, I think the thing that I am proudest of is that the BBC Micro contributed to the education of a nation, and creating a whole generation of software programmers that then produced lots and lots of interesting companies, the games industry and the software industry. And, you know, being involved in a, in, in a product that has had such a, an impact on a complete nation, I think is, is very rare and I'm very grateful that I was allowed to be involved in that. What has been financially most rewarding of course is ARM, which was sold to SoftBank for 30 billion, so it's financially the greatest success, and the greatest success also in global terms, because last year we sold 20 billion ARMs, so we sold three times as many ARMs as there are people in the world. So it's, you know, that's probably the most remarkable thing.
[55:29]
But, a thing that long-term maybe it has, will have the, the greatest impact, is revolutionising gene sequencing with Solexa, where we reduced the cost of gene sequencing from $10 million when we started to under $1,000 now, and 90 per cent of all the gene sequencing in the world is now done on our machines. It was sold to Illumina, it's now the Illumina machine.
[55:56]
And if I look forward, the investment that I am most excited about in terms of its impact for mankind, if I can be so grand, is a company called Evonetox, which again uses some of the Solexa team to do again with

gene synthesis, what we did for gene sequencing. So synthesising genes and thereby basically taking control of biology itself, of life itself. You know, this is both a dangerous but also a wonderful thing to do in terms of healthcare and improving, improving the basic human condition.

[56:41]
So the company is called, or the partnership is called Amadeus Capital Partners. You provide capital. What else do you actually provide to people, apart from investment?

Yes. There are, there are two things that I think venture capitalists ought to provide for their investee companies other than money. One is to help them with the network that we have built up over many years, so, we know most people in the industry in the sectors that we invest in, and, the other is, help with the business model. Because we have got to think through the business models of all our portfolio companies, but the individual companies only have got to get their business model right once. So, we're not any smarter than, than the people in the companies, we just have a lot more data.

[57:39]
Is it absolutely essential that you understand the technology, or, maybe I should put this question to you in a different way. Would you ever allow Amadeus Capital to invest in a technology that you personally didn't understand?

Oh, of course. And it happens all the time. But, it's one of my partners that has to understand it. So… And by understanding I don't mean understanding in every little detail and being able to write papers about it and contribute to the technology itself, but understand the basic principles and the, and the main characteristics of the technology, to see where these new technologies can steal a march on the other technologies that are on the market, and can they really produce the USP that is necessary to make the company successful?

[58:30]
Can you tell me what the biggest mistake is you have made so that you can advise other people not to make it?

Well, where shall I start? There are lots of them. But, the easiest one to make, especially if you come from the technology side, is to underestimate the importance of sales and marketing. This of course is a particular problem in Cambridge where people are, are very excited about technology and they produce very good technology solutions. And I remember having conversations with some of our engineers who argued that it must be a lot easier to take one or two of our brilliant engineers, and take them, and teach them a little bit about marketing, than taking one of these brain dead marketing people and explain our brilliant engineering

feats to them. And of course the truth is that, equally brilliant marketing and sales people, they are extremely bright and understand what people really want, and it's not always what engineers feel people ought to want.

[59:44]
So I'm sitting in Cambridge, you're in London. We have a company here in Cambridge called Cambridge Analytics which is at the moment in the middle of an enormous storm, which seems to bring together a number of factors that people are very concerned about technology. So finally, I would like you to comment on, one, there is great concern and growing concern about the use of social media. There is obviously great concern about big data, driven from that social media. There is great concern about the monopolisation of certain social media, Facebook for instance. And there's great concern about the use of artificial intelligence. Are these just temporary concerns, or do they show that there is some deeper malaise about the technology that we should be aware of?

I think these are very good questions, and I think it's very important that we have this discussion now. You know, arguably, these, artificial intelligence in particular and machine learning, is by far the most powerful tool that mankind has ever developed, and it can be used for good and for, for bad, like any other technology that we have developed. And, at the centre of all this of course is access and availability of data, and, we are writing the rules now concerning data, and the new European directive, and of course these things can only be done at a European basis, and, and I'm just so distraught by, by Brexit as a passionate European, and it's so bad that, that Britain feels this way. But, the GDPR, the European data directive, I think is a good step in the right direction, and it has to come from Europe, because America seems to be incapable of, of writing these rules, because many of these companies that abuse the, the data at the moment are American, and the Asians don't seem to care. So Europe really can take a, and is taking a lead, in regulating the access to data. Yuval Harari makes an interesting point that agriculture, during the period where agriculture was the most important good, we had a class society and we had all the negative things that came about with a very rigorous class and caste system during the [inaud], and that was of course feudalism. During the period when capital became the most important good we had capitalism and we had inequality as the, as one of the consequences, and he calls this new era dataism, where data becomes the most important good, and just as you said, to concentrate all the availability of data in just a few hands of American companies is the wrong way to go, and they need to be broken up. So Google and, and Facebook need to be broken up into, into different entities.

They need to be broken up?

Yes.

1:03:12]

And then you think that there will be some explosion of entrepreneurship as a result of their break-up?

Yes. The data needs to be made available to everybody on our, on a fair, on a fair use basis, and on an anonymised basis, so that the, the principle that everybody is in control of their own data and the data belong to the people, not to, not to Facebook, and if Facebook wants to use your data, they have to explicitly tell you that they are using it, and then also pay you for it, either in, in pounds, dollars, or in a service that they, they give you explicitly. And these rules are just being drawn up.

Thank you Dr Hermann Hauser for your inspiring contribution to the Archives of Information Technology.

[End of Interview]