Oral History of Rich Page

Interviewed by:
Hansen Hsu

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Hsu: The day is November 7th, 2018. I am Hansen Hsu with Rich Page. Welcome. So, to begin with, we'll start with where and when were you born?

Page: Born in the Bay area. Actually, Vallejo. May 15th, 1951.

Hsu: And could you talk about your family's background?

Page: I think my father was the youngest of seven, I think. And his mother and him came out from Upstate New York, I think, just before World War II and somewhere around there met my mom. She was from North Dakota. And he was working at Mare Island Naval Base, I think making submarines, I think. And, so, first few years, grew up in Vallejo, moved down to the peninsula around 1959 or so. And been in the Bay Area my whole life. Yeah.

Hsu: So, you said your father had worked on submarines--

Page: During World War II.

Hsu: --during World War II.

Page: Yeah.

Hsu: When-- after the war, when you moved--

<overlapping conversation>

Page: Sometime after the war, I don't know exactly when, but he got a job at a company called Cutler Hammer. And when I was little it was in San Francisco. And they had a handful of facilities around the U.S. and they had another one in Southern California. And they had a fire in the late '50s in the facility in San Francisco and moved down to Belmont after that. And my dad had been taking the train into the city and decided Vallejo to Belmont was too far. So, that's when we moved down to San Carlos. And right about that time is when they ripped out the train tracks over the Bay Bridge.

Hsu: Oh.

Page: So, up until about that point there was a pair of train tracks across the Bay Bridge lower part and couple lanes for buses. And traffic upstairs was two way. And around that time they ripped out all that and then they have one-- they have one going to Oakland, one going to San Francisco now. Yeah. Kind of funny. Progress.

<laughter>

Hsu: And your mother was a--

Page: She worked as a bank teller mostly, yeah, and did some other clerical stuff. Yeah.

Hsu: Did your family have any strong religious or political views?

Page: My mom was Presbyterian. My dad much less so. So, you know, I ended up going to Sunday school with my mom and my older brother. My dad tended to stay home, yeah.

Hsu: Ah. Siblings, you mentioned a brother?

Page: Yeah. He's about five years older than me. Yeah. Yeah.

Hsu: What's your family's ethnic background?

Page: Mostly English and German. Yeah. My grandmother, who-- my dad's father was German. She was born in 1884 and they came over to America like one or two years later. So, she was a baby, basically. And she grew up in the Midwest before electricity, before cars and radios and everything. And I found out at some point that she used to hide under the bed when the Indians would come.

Hsu: Whoa.

Page: So, they were living in the Midwest and this was just 20- 25 years after the Civil War and the Indians were still running around in the Midwest and seems like a long time ago, but--

Hsu: Wow.

Page: Yeah. So, a funny thing with regards to her, obviously, she didn't see too much technology. I mean, she saw record players and stereos and TVs. But when I got out of school I first worked at Fairchild for a few years, then Hewlett-Packard. Well, we'll talk about that later, but the last time I saw her I had just started at Hewlett-Packard and she knew I was working. And she was like 92 at this point.

Hsu: Wow.

Page: So, she knew I was working, but not completely there at that point. But she asked me where I was working and I said, "Hewlett-Packard." And she says, "Oh, the car company." And I don't know if you know, but there was a car company in the first half of the 20th century called Packard.

Hsu: Oh.

Page: Packard Automobile. And when I said, "Hewlett-Packard," she associated it with the car company. So, I paused for a moment and I decided, "I'll leave it there."

<laughter>

Page: Otherwise we've got to get into a lot of things that-- too difficult to explain.

Hsu: Right. So, where did you go to high school?

Page: Carlmont. It's on the borderline of San Carlos and Belmont.

Hsu: Oh, okay.

Page: Yeah, a big school. They closed some of the schools down from the Sequoia Union High School District, you know, after the '60s I guess. Maybe after the '70s. But it was like 3,200 kids, 800 per class, which is pretty big. Yeah. Yeah.

Hsu: And what were your favorite subjects?

Page: I guess math and science. I-- there was a program each summer by the National Science Foundation where they picked two chemistry students from each state. So, 100 total. And I ended up going to that for California in between my junior and senior year. So, I actually kind of started off in chemistry and then over time moved away from that. But when I first went to school I was a chemistry major and after a while I decided, "No, thanks."

<laughter>

Hsu: Any interests, hobbies, as a child or teenager?

Page: So, I guess I was tinkering with electronics early on, building a variety of things. And I started-- early high school, I started reading about computers and things and I started tinkering with how to build something. But I built a few bits and pieces, but couldn't get too far. <laughs> Yeah.

Hsu: What sorts of books did you read?

Page: Mostly science stuff, yeah.

Hsu: Any mentors, teachers, heroes?

Page: I don't know. I guess my chemistry teacher was very good, yeah. So, Stanford Linear Accelerator got started in 1962, I think, and it got completed somewhere around '66. And I saw an article in the newspaper about that. And, you know, it's like 1.9 miles long. Probably something in kilometers. And periodically there's a set of klystron tubes that are used to drive the magnets to accelerate particles. And, so, I read about this in the newspaper and Varian was down in Palo Alto. They're still there today off of Page Mill Road and El Camino [Real]. And, so, I road my bicycle down from San Carlos. It wasn't too far. And found somebody in marketing. And I got a reference manual for a klystron tube, took it home and studied it. And for my science fair project I built a prototype of one. And I decided that was interesting, but kind of a mistake, because I'm not sure that too many people understood what it was, right?

<laughter>

Page: So, later I was like, “Okay, I see. You’re supposed to do something for your science fair project that people are going to understand, right?”

<laughter>

Page: So, that was funny. Yeah. But anyway.

Hsu: So, that was 1968 and you were what year in high school?

Page: Third year.

Hsu: Third year.

Page: Yeah. Second or third year. Somewhere around there. Yeah.

Hsu: So, then you started at San Jose State in 1969?

Page: Yeah. So, I had this sort of introduction to chemistry and I’d done pretty well with it. You know, I took the SAT tests and I took the chemistry thing, their equivalent of their AP test or something back then. And I did pretty well on that. And the mistake I made was I got into the Honor’s chemistry program. And the reason I say it was a mistake, it was taught by the department chair.

Hsu: Wow.

Page: And it was the Honor’s program. And she felt like the only class you had was her class. And you could spend all your time on her class. You didn’t have anything else to do in your life. And, so, that was a little over the top for me. So, I stayed with it for the first year and then decided it was too much. But I was taking math and moved into physics. Physics was easier. A funny thing happened back in high school when I took the SATs. Like I said, there were, like, 800 students. And I had a half a dozen friends that were, you know, sort of my peers. And we all had about identical SAT scores. But the difference was-- and I-- even to this day I wonder how the hell did they do this? They all got, like, 800s in English and something less in math. And I had an 800 in math. I couldn’t finish the English part of it. I did pretty well, but I-- you know. So, we had reasonably identical totals, but for very different reasons, yeah. And I remember blasting through the math test and getting down to, like, the last two problems and spending 10 minutes on the second-to-last problem and another 10 minutes on the last one. Right? And actually finishing it, right? Yeah. I guess I got them all right, but it was-- you know, they get progressively harder as you get near the end. Yeah, I learned that. So. It was funny.

<laughter>

Hsu: And why did you choose to go to San Jose State?

Page: I guess because it was nearby and it was cheap. My parents didn't have a lot of money. And, so, I was working as I went to school. I told a friend this recently and I'll tell you his response in a second. I was making about $2,400 a year. And that was enough to cover rent, food, tuition, and books.

Hsu: Wow.

Page: So, $200 a month and that's about half rent and about half everything else.

Hsu: Wow.

Page: And, so, and my friend said, "When was this? The 19th century?"

<laughter>

Page: He couldn't believe that-- and he's only, like, 35- 36. He couldn't believe that, you know, A, that anybody would only make $2,400 a year and, B, you could actually live on $2,400 a year and go to school. Right?

Hsu: Yeah.

Page: But tuition was really cheap at San Jose. It was-- and books were pretty expensive. I mean, not compared to today's standards, books were pretty expensive. They were more expensive than tuition.

Hsu: Wow.

Page: And-- but the total wasn't too bad. Yeah. Food was pretty cheap. Yeah. So.

Hsu: So--

Page: I guess the other thing that happened was about four or five months after I started at San Jose, the company my dad worked for, Cutler Hammer, combined its facility from Belmont and down near L.A. into one down in Southern California, because they decided California was too expensive to have two facilities. And he decided he wanted to stay with the company. So, my parents moved down to L.A. about five months after I started at San Jose.

<laughter>

Page: I was like, "They're leaving me!"

<laughter>

Page: That wasn't really the case, but I understand. Yeah. It was funny. So, I-- you know, I worked for a couple years, you know, various jobs, you know, basically at hourly minimum wage, like, a buck-10.

Hsu: So, what kinds of jobs?

Page: Oh, I worked at--

Hsu: Like, on campus or--

Page: I worked at the bookstore for a while. I worked at a couple of gas stations over the summer, those kind of things. Yeah. And then middle of while I was going to school and working, in the middle of all that, I-- around 1971 I decided I wanted to build a digital clock. And there was--

Hsu: Was there a reason?

Page: What?

Hsu: What reason?

Page: I don't know. I got enamored with the idea. And there was a company in the valley back then. They're gone now. They're part of Philips, I think, called Signetics. So, most people maybe never heard of them. They got acquired 15- 20 years ago, I think. And, so, I wrote a letter to them and asked them for some MSI, medium-scale integrated circuits. And I wrote another letter to Monsanto and got some seven segment LEDs. So, I got both of these, you know, just for writing a letter to them. And I built this digital clock. And, so, I had it for about-- I don't know-- six to nine months. And one day I went to this interview at Fairchild and it was, like, summer of '72 I think.

Hsu: How did you decide to interview at Fairchild?

Page: I don't remember. I saw the-- I think I saw the ad in the newspaper that they were hiring and so I just decided, "I'll go there." And, so, I packed up my clock with a towel wrapped around it and in a cardboard box, put it on the back of my motorcycle, rode over to Fairchild. You know, met the guy and took the digital clock out of the box, plugged it in, and you know, he was pretty shocked.

<laughter>

Page: And within, like, 20- 30 minutes they hired me. You know.

Hsu: Wow.

Page: So, yeah, it was kind of funny. So, I started at Fairchild in the middle of the '72-'73 recession.

Hsu: And you were still--

Page: I was still at San Jose [State].

Hsu: You were still at San Jose. So, this was a summer job?

Page: Well, I started there-- no, it was a full-time job.

Hsu: Oh, really?

Page: Yeah.

Hsu: So, how did you go to school while you were working?

Page: Well, I'd been working full-time mostly anyway and going to school. And then I was working full-time at Fairchild and going to school. So, it really wasn't-- hours weren't any different.

Hsu: Oh, wow. Okay.

Page: So, some interesting things. When I first joined there, from a business point of view, I guess the interesting part was Fairchild was growing and shrinking as the economy was-- had some volatility to it. And the crazy thing was, you know, Fairchild was hiring and firing people as their success changed, which I thought was kind of odd, but, you know, I understood. And as I first got there, adjacent to manufacturing there was this big room, probably 8 [to] 10,000 square feet, and it was filled with an IBM 360.

Hsu: Wow.

Page: And just after I got there they started tearing it apart. And Fairchild had bought its first IBM 370 Model 158, which were pretty big, but it was, like, 10 times smaller than the 360. I mean, still big, I mean, you know, it probably covered 1,000 square feet or something and water cooled. It was kind of interesting. But I mean, the 360 was mammoth and then the 370. So, I worked in manufacturing, did mostly test engineering for Fairchild. At the time, integrated circuits were pretty simple, but this was the MOS group and they had some processors, some memory, and a bunch of logic stuff. One of the most interesting chips I worked on was-- Intel was working on something called 1103. And Fairchild was working on its equivalent.

Hsu: Was this memory?

Page: Memory, 1K. And, apparently, this was the second attempt at a dynamic memory.

Hsu: Oh, okay.

Page: And, apparently-- this is before me, but apparently there was something called 1101, which was 256 bits. And it failed for some reason. And the 1103 was a 1K, so 1024 bits. And I remember it sold for $99. Which seems expensive, and it worked out to about nine cents a bit. And you think where memories have gone in the last 45 years, right?

Hsu: Yeah.

<laughter>

Page: So, the 1103 was a difficult part for people to use. But both Intel and Fairchild were successful with it. And up to that point everybody was, for the most part, building computers with core memories and the 1103 enabled people to push aside the core and go to DRAM. So, I worked on that. There was a processor chipset that Fairchild-- and by "chipset" I mean, multiple chips that formed a processor.

Hsu: Oh, okay.

Page: Because they couldn't get enough on one chip. And they did it for a company called Springer. And it was targeted to military. So, relatively low performance, but also relatively expensive at the time. And, so, this was sort of a precursor to things like the 4004 and other things that came right after that. And then I guess an interesting one-- there's this thing back in Fort Meade <laughs> the No Such Agency.

Hsu: Ah, yes.

Page: I'll let you figure out what you want to do with that. <laughs> And they sent a design to Fairchild which was basically a polynomial generator. So, long shifter with some exclusive ORs on it and pretty simple circuit. But I think it was, like, 64 flip-flops. Couple exclusive OR gates and on a die in a package. I ended up doing the test program for that. That was kind of fun. You know, they were kind of camouflaging themselves, who they were. And I kind of realized who they were and--

<laughter>

Page: --they were trying to be kind of secretive about the details and stuff. So, it was kind of fun.

<laughter>

Page: But I was still-- so, I was at Fairchild for a couple of years. Working too many hours, I guess. So, you might ask how did I get school done? But, anyway.

Hsu: Yeah.

Page: Yeah.

Hsu: Speaking of school, so were you a physics major?

Page: So, I was a physics and math major.

Hsu: Oh, double?

Page: Double major. And a friend of mine, he was in the same program, same thing: physics and math. And we both graduated with double majors. And I think San Jose didn't intend you to do that. But we turned in our-- everything we needed, turned the paperwork [in] to the physics department, and we turned everything we needed in to the math department--

Hsu: Oh, okay.

Page: Separately.

<laughter>

Page: And they didn't really have a choice but to give us both degrees.

<laughter>

Page: And I think, like, a year or two later they-- Ralph and I noticed that they changed the rules so you couldn't do that anymore.

Hsu: Oh, really?

Page: Yeah. I thought it was kind of funny. So, I stayed at San Jose and I got my Master's in Computer Science.

Hsu: Oh, wow.

Page: And I think it was like, maybe the second year that they had the Computer Science department.

Hsu: Right.

Page: Yeah.

Hsu: So, you decided that partly because of Fairchild or--

Page: Partly because of Fairchild, partly because-- I guess when I was doing math and physics, I kind of got interested in computers.

Hsu: Right.

Page: Yeah. So, combination.

Hsu: Yeah. And was there a computer at San Jose State?

Page: Yeah, they had a CDC 3300. And, like the IBM machines of the time, you know, its primary input was punch cards and primary output is line printer paper. So, kind of the same as most mainframes at that point.

Hsu: Right, right.

Page: Yeah. So, second year, John Couch and William Barrett had been working on this compiler book. And John was teaching at San Jose and brought out a loose-leaf copy of his book to class. And he was working at Hewlett Packard. And, so, I started the class and I realized that, you know, John and Bill had done a really good job on this book, but I think all their examples and stuff-- they had, like, worked out manually. And, as I read through it, I realized there were lots of errors. So, I wrote some software to emulate their little stack machine they had.

Hsu: Wow.

Page: And I started running all their examples and fixing them up. And, so, I marked up the book and after a month or two I took the copy of the book that I had made and gave it to John.

<laughter>

Page: And he was surprised. And then I realized after that maybe I'd made a mistake, because almost every time I came to class he was trying to recruit me into HP.

<laughter>

Page: And I was like, "This class has got a long ways to go," and "if every time I see him he going to try to recruit me, how do I stop this?" right? So, after a couple months I broke down and I don't know, somewhere around December or something I went over and interviewed at HP and in January I ended up at HP.

Hsu: Mm-hm. January of--

Page: '75.

Hsu: '75.

Page: Yeah. And, so, I worked for John, who worked for Tom Whitney. And Tom reported into Ed McCracken.

Hsu: Oh, okay.

Page: And Ed ran the HP 3000 division.

Hsu: And that was a-- what kind of machine was that?

Page: It was a minicomputer, 16-bit. Sort of HP's answer to DEC. Yeah. They're about the same size, about the same speed.

Hsu: To the PDP-11?

Page: Yeah. Kind of a-- better answer to the PDP-11. Yeah. So, we can take this out later if you like, but, anyway, I'll say this and you can decide what to do with it.

Hsu: Okay.

Page: So, didn't really get to know Ed while I was there, because Ed was several levels above me. But I kind of learned that there are two groups of people. There are the people that work in the organization for Ed and there's the people who are outside that, namely, his peers and his boss. And what I learned kind of secondhand was you wanted to be in the organization, you didn't want to be Ed's peer or his boss, because he was really hard on people. Very protective of the team, but really hard on his peers. And it's kind of like, "Your resources are mine and my resources are mine. And I'm going to take everything I can get," right? Yeah. Apparently, he was pretty aggressive. So, the HP 3000 division was called GSD. And it was big. It was, like, 3,000 people. And the normal flow for a division was they'd start off with 200 people or something or a couple hundred people. And they'd grow up to over 1,000. And the plan was by the time they got more than 1,000 people the plan was to split the division in half and take the two divisions and grow those. Right? So, the HP plan was when it gets to be more than 1,000 people you should split it and make two divisions and then grow those. I guess [the] HP 3000 team couldn't figure out how to do that. I mean, you know, it's like we'd build one product; we got 3,000 people, but there's no way to split it, so it just grew and grew and grew. Yeah. So, I was part of that for a couple years. I did pretty well there I think. It was the first time I'd changed jobs, really, because, you know, I had these smaller jobs when I went to Fairchild. And then but this is a transition from Fairchild to HP. And, you know, I don't know what John said to his peers when I joined, but I guess, you know, he must have said something like, "Rich is really good."

<laughter>

Page: I don't know how he phrased it, but because when I got on board at HP, I sort of felt like some people were like almost against me.

Hsu: Ah.

Page: You know, but over time then they kind of warmed up, right? But when I was first there I kind of got the cold shoulder from a few people. And I think they thought like, "Well, John's exaggerating." <laughs> "Nobody could be as good as John says." Right? Yeah. So, I thought that was kind of funny. And then in the fall of '78 John and Tom Whitney went to Apple. And I don't know, by accident, a few months later I was talking with John and John said, "Well, why don't you come over and talk with us." Now, there was no

real reason to talk to John or Tom, because they both knew me. And John said, "Well, when you come over, find Mike Markkula's office. Talk to Mike. And go from there." And Apple was really small. And this was late '78. And, so, I did that. I found Mike's office. I talked to Mike for 15- 20 minutes. And Mike said, "Oh, I don't know who's here today. Why don't you go wander around the building, see who's here, and talk to a few people."

Hsu: <laughs>

Page: "Come back and then we'll talk again." And that's what I did. But I thought, "Well, this is an interview?"

<laughter>

Page: So, I don't know. Apple was really small and maybe I got the wrong idea, but a day or two later I went back to John verbally and I said, "I don't think this is going to work." <laughs> So, at the time, when you compare it to today, HP wasn't that big, but back then HP was 70,000 people compared to today is, what, 350,000? Or whatever they are. And Apple was tiny compared to the 70,000. And I don't know. I just kind of felt like maybe this is too risky. Too small. So--

Hsu: Do you know why did John and Tom go to Apple?

Page: I don't know. I don't know how they ended up at Apple. I never asked them that question. But a couple days later I got a phone call from Steve [Jobs].

Hsu: Mm.

Page: And I guess John said something to Steve about-- because I hadn't met Steve and Steve was away, I guess, the day I was there. And I guess John said something to Steve about "Well, you know, we gotta get Rich to come over from HP." So, I got a phone call from Steve and Steve says something like, "Well, John tells me you're a really smart guy, but obviously you made the wrong decision."

<laughter>

Page: So, oh, I don't know, two- three days later, I went over mid-afternoon, spent a couple hours with him, and then after a couple hours we went to dinner, spent a couple more hours. It got to be, like, nine o'clock. And I'm like, "This has been about six or seven hours." And I was wondering, you know, "When's the day going to be over?" And it kind of dragged on and dragged on. And I realized it's going to be over when I say yes.

<laughter>

Page: Meanwhile Steve's going to keep selling Apple until I agree to join. So, I caved and I joined and [it was] probably the right thing.

Hsu: What was your first impression of Steve?

Page: I thought he was pretty good. I mean, he was really selling Apple really hard. I guess later I thought, “Well, he wasn’t off that by that much.” I mean, the picture he painted that first day when I met him and what happened over the next few years was really pretty close. You know? So, he was a smart guy. So, when I joined Steve and John were just getting this project off the ground, which ended up getting called Lisa. And the idea was that we would use an AMD 2900 bit-slice. And we would microcode it to build an instruction set and then we’d do a compiler and build a machine this way. And since I’d been working on microcode over at HP it seemed like I was the perfect candidate for doing the microcode for this machine.

Hsu: Right.

Page: So that's why John wanted me to join. So, I don't remember exactly when it was but spring or so, summer, working on this and in parallel with that Motorola had come out with the 68000. And so, somewhere around the summertime I went down and visited them and I kind of decided, you know, we can do our own little thing and or we can just buy the single chip, you know, 16 bit [sic] micro from Motorola. It'd be a lot easier just to buy it than-- And I didn't think that Apple understood that doing this was a long project, right. In other words, I think maybe they thought like, we're going to do this one time and then we're going to use it. And I don't think they realized that you get to do it and then you got to push it up the hill and redo it and redo it and redo it because you've got to make it, you know, faster and smaller and cheaper over time, right. You can't just stay with the first version. And I don't think that they realized the cost of supporting a processor, right, so--

Hsu: Why did they want to do their own processor?

Page: Well, you mean why?

Hsu: Yeah.

Page: I don't know how they got the idea of wanting to do that but they had and like I said, I joined to do the microcode for it but I realized that A, that's a lot of work and B, Apple was probably underestimating it, and C, we could just use the Motorola 68K. <laughs> So, I went down and I visited Motorola once or twice and I came back and I sold Steve and John and others on why don't we stop what we're doing <laughs> and just use the Motorola 68K. Because Motorola will spend the money to push it forwards and we don't have to do that and we can work on building a system, we don't need to-- <laughs> to do a processor.

Hsu: What was it about the 68000 that was attractive?

Page: Just the fact that it just showed up, I guess, and you know, it looked like it was--

Hsu: Did you look at any other CPUs?

Page: Didn't really look at much else. I guess I could have looked at Intel at the time, but I don't know, somehow just kind of decided to go with the Motorola one and then that's how Apple ended up with the 68K, yeah.

Hsu: Yeah. Was it because it was 32 bit and--?

Page: It was, it had some 32-bit capabilities. It felt a little easier to use, you know. Yeah. So, so when I was at Apple and NeXT, I ended up being the interface for Motorola and a few other suppliers. And, you know, Steve was not the easiest person to work with. <laughs> And I mean, I think he and I got along reasonably well, but between everyone and between Steve and everyone there was a fair amount of friction. So sort of two problems with that. One is inside the company Steve liked to treat everyone equally and I'm not sure you can do that. In other words, if you have more senior people and less senior people, I'm not sure someone like Steve can treat the more junior people the same as the senior people for two reasons. One is maybe they don't have as much invested and they don't have the practice of working with Steve. If they only see him once a month or once every two months, that's a lot different than seeing him every day or a couple times a week, right. And so it was hard on employees that didn't interact with him much. And there was another group of people or two that also had trouble and that was the suppliers. So, you know, a supplier would have a meeting with Steve and then Steve would be yelling at them and the supplier didn't realize that what they should do is argue with him and push back.

Hsu: Right.

Page: But if you're the CEO of a company and you're trying to supply into Apple, you probably don't feel like you should argue with the customer. <laughs>

Hsu: Right.

Page: It doesn't-- It's not in the Sales 101 Handbook of, you know, yell at the customer. That isn't--

Hsu: <laughs>

Page: That's not the normal approach. But Steve wanted people to engage with him and so it was kind of hard on suppliers, right. So the Motorola guys in particular, you know, had met with Steve a number of times and you know, they didn't like getting yelled at <laughs> and after a while, they kind of decided, well, we're not going to meet with him anymore. So, the Motorola guys would meet with me and then I'd fill in Steve afterwards. Now the funny thing was, when the guys from the factory would come out to Cupertino, they didn't even want to include their own sales people and the reason for that was if you're a Motorola GM and you're visiting a customer and then there's a local salesperson and you don't know the salesperson too well, then it seemed like that person's a risk because if the person's there in a meeting between Apple and Motorola and then they learn things, maybe some of the things shouldn't go outside that.

Hsu: Right.

Page: And sometimes sales people are the source of leaks. Not always, but it happens. And so the factory guys, the GMs and stuff, didn't want the local sales guys in the room. So every meeting I had with Motorola turned out to be three meetings. There was a meeting with Motorola and then I'd meet with Steve and fill him in and then I'd meet with the local salespeople and give them the highlights to kind of keep them included, right. So I thought that was kind of odd. But, you know, so I ended up working with a couple of the suppliers and kind of being the go between because it was hard on people, you know.

Hsu: How did you become the hardware lead on the Lisa project?

Page: On Lisa?

Hsu: Yeah.

Page: I wasn't really the hardware lead. I guess I was to some degree. The person who really picked up and ran with it was Paul Baker. What I did was when we chose the 68000, I built the first couple of prototypes that got used by the Lisa team and a few months later when the Mac team got formed by them and because it was the only prototypes we had. <laughs>

Hsu: Oh, I see.

Page: And--

Hsu: The Mac team was originally going to use a different processor, correct?

Page: Right, and then they switched.

Hsu: Right.

Page: Yeah. And so I spent most of my time-- after I built the first few prototypes, Paul picked it up and built the real prototype for Lisa.

Hsu: Oh. So you weren't formally part of the Lisa team at that time.

Page: I was, but I was kind of adjacent to it in the sense that I was doing things for Lisa team and Mac, right.

Hsu: Okay.

Page: Yeah. And, and Burrell Smith was the one who went and did the real Macintosh, yeah.

Hsu: Right.

Page: So, I spent most of my time, you know, I mean, I built the first few prototypes but then spent most of my time doing some development software.

Hsu: Oh, okay.

Page: So we had a small team that consisted of myself and Bruce Daniels, Chris Franklin and Ken Friedenbach.

Hsu: Okay.

Page: And we were responsible for the editor and the compiler and the linker and the debugger and the assembler.

Hsu: Right, okay. This was Pascal?

Page: This was Pascal, yeah. So, it ended up being an object oriented Pascal, which was pretty early, because this was, you know, 1980. <laughs>

Hsu: Yeah.

Page: Yeah. But it worked pretty well, you know. And so I sort of spent my time working on the low level stuff, doing the debugger, fixing lots of bugs and stuff in the compiler. Bruce did the editor for the most part. Chris mostly picked up the compiler and did the compiler and Ken did the linker and some of the other tools. I sort of managed the team and spent my time fixing bugs trying to make-- trying to improve the quality. <laughs> And that was kind of a full-time job.

Hsu: Right. Was the Lisa influenced by UCSD Pascal?

Page: Not too much. I mean, the little operating system that I built was. I built sort of a hand-built version of that, kind of hand-assembled version of that and we put our tools on top of that and it kind of looked like UCSD Pascal but it had nothing inside it.

Hsu: Oh, okay.

Page: It was just, you know, all 68000 kind of. [ph?]

Hsu: [Not] a real implementation? [ph?] <00:46:14> Okay, right.

Page: So, a funny thing happened. There was a young guy, his name was Bill Shotstead. And Bill worked for me. I think he was straight out of school or maybe just finishing school. And, you know, in general, engineers can't write or they're too busy to write.

<laughter>

Page: Pick your poison. And so, Bill was in my group and everybody was too busy to write things down and so what I did is I had Bill go around and interact with Bruce and Chris and Ken and I got Bill to document everything and he did a pretty good job. But I think if he hadn't been there, not much would have gotten documented because everybody was just too busy So, what's interesting is, and I saw this a couple times in my career but Bill was the first one, I think Bill had just finished school. He was still living at home and he was working at Apple and he had a few shares and Apple goes public. So, so Apple goes public and I think the few shares that Bill had gave him, like, the equivalent of, like, $200,000 dollars or something, which was a good chunk of money, you know, but maybe to others not so much. But after Bill had this money, you know, after a few weeks he comes in and he resigns.

Hsu: <laughs>

Page: And, you know, and I kind of understood and, you know, because it seemed like an infinite amount of money to him because he had no expenses, right. He's living at home, you know. He had to pay for his car and gasoline and insurance and some food and that's about it, right, and he had all this money and, like, why work, I guess.

<laughter>

Page: So I remember I told Steve what happened and Steve couldn't believe me. I mean, he, Steve was like, "It's only $200K, I mean."

<laughter>

Page: "It's not that much." Steve just couldn't believe it, you know, it was-- I thought it was funny. So, let's see. Another thing that happened in that timeframe, so I--

Hsu: This was, what, this was still 1980?

Page: Oh, '80, '81.

Hsu: '80, '81.

Page: But in that timeframe, a couple things happened. Somewhere in there I became an Apple Fellow. So did Bill Atkinson.

Hsu: Okay.

Page: And--

Hsu: Was, that was-- That was directly related to the Lisa?

Page: And all the tools and stuff that I'd built and--

Hsu: Oh, okay.

Page: So I built all these low level tools and Bill had done all the low level graphics.

Hsu: Oh, right.

Page: And so we both became Fellows because of that.

Hsu: Okay. And this was prior to the shipping of the Lisa?

Page: Yeah. Or, yeah, probably. Yeah, I think maybe a year before or something.

Hsu: Okay. Because my impression was that Bill became an Apple Fellow because he had felt that he hadn't gotten enough credit when the Lisa was launched, but the timing doesn't seem to work out.

Page: Hmm.

Hsu: So they gave him--

Page: I thought we became Fellows around, you know, '82, '81 or '82 and--

Hsu: Okay.

Page: And then Lisa was like a year later or something.

Hsu: Okay.

Page: Yeah. I mean, Bill and I were really good friends. Later there was kind of a funny situation after Apple goes public. I mean, Bill worked really hard. I mean, so did I. But Bill equated his efforts to the share price.

Hsu: Oh, really?

Page: And he thought the more he worked the more the share price should go up.

Hsu: <laughs>

Page: And that's true, to some degree. <laughs> But I think it was a rude awakening for him when he learned that really his efforts were really sort of like tertiary because I mean, there's the overall market. Is the market up or down?

Hsu: Yeah.

Page: And then there's sort of the computer sector or technology sector. There's computer. And the fact that IBM could do something wrong and IBM shares would go down and take Apple with it.

Hsu: Yeah.

Page: I mean, was, like, a rude awakening to Bill because, right, like, he thought he would do things and the share price would go up and IBM does something bad and IBM goes down and Apple goes down and he's looking at the share price like, "How come it's going down?" <laughs> So that was funny. So, what I was going to say was, I think I told you this the other day, I didn't meet with Mike Markkula very much, but I met with him one day and we're talking for quite a long time, which seemed unusual because Steve and Wayne and the two Mikes were all very direct with people.

Hsu: But you worked for--?

Page: I worked for Wayne and--

Hsu: You worked for Wayne--

Page: Then I kind of reported to Steve.

Hsu: So Wayne Rosing.

Page: Yeah. And--

Hsu: So you worked for Wayne Rosing directly but you also sort of reported to Steve?

Page: Yeah. Because Steve, Steve was kind of protective of the Fellows and he thought of the Apple Fellows as his resource.

Hsu: Oh, I see.

Page: And then in general he was kind of floating around anyway and, you know, so, you know, he would get Bill and I to do things, right and, yeah, and so it was kind of natural. But this one day I met with Mike Markkula and we're talking for a while and I realize he wants something but after, like, 45 minutes I still don't know what he wants, which I thought was really odd. And, and then a bit later I realized that Henry Singleton had early on had bought an Apple II. He came up to Cupertino six, eight weeks later, whenever it was, and he put in I think $14 million dollars and got, you know, one-seventh of Apple.

Hsu: Okay. So this was an outside investor.

Page: Yeah. And because he had such a big chunk of Apple, this was pre-IPO, since he had such a big piece, he had a board seat, right.

Hsu: Yeah.

Page: And I think there were, like, I don't know, ten people on the board at this point and Henry was going to the board meetings but Henry had had a doctorate out of MIT in electrical engineering and he's a business guy but very technical and he was enamored with the Apple II and he had all these questions. And Mike was looking for somebody to help Henry just with his questions and things. So I realized it after talking with Mike for a while, that's what he wanted and I said, "Sure. I can help him out." And I thought about it later and I was like, why was he so indirect? And I realized, I guess maybe he felt like I didn't need to do this and I guess he was afraid I'd say no. <laughs> You know? And which I thought was kind of strange because, you know, I was way down here and Mike was chairman at the time and, you know, so, I was like, "Well, if you want me to do something, just tell me." <laughs> I just thought it was funny. So, I helped Henry for a long time. We became good friends then. That was kind of fun.

Hsu: I want to go back to sort of the question of Steve's role on the Lisa. So, you know, a lot of what's been written about that period was that Steve was sort of controlling the Lisa project but then Michael Scott who was the CEO didn't want him to and so somehow got him off of it, which is how he ended up on the Mac. But what was his exact, his--

Page: What happened?

Hsu: Yeah. Like, and, and--

Page: Well--

Hsu: And then did John Couch officially became the lead but was he already--?

Page: So, I don't-- I don't know exactly what happened because this kind of happened at Mike's executive staff level and I was one level below that. But I think what happened was that, you know, Steve was a little rough with people and I think that there was some pushback with Steve of “look, you can't be so harsh with people.” And so I think there was sort of a tug of war between John and Steve and I don't know if it was caused by John or Mike but--

Hsu: John?

Page: Couch.

Hsu: Okay, John Couch, yeah.

Page: I don't know if it was because of John or because of Mike, but one of them trying to push Steve away. And that's the point where he, you know, joined, you know, went off and worked on Mac.

Hsu: Okay.

Page: And that was probably a mistake, but, you know, even to this day of-- And we'll get to this a little later, but I'm working with a handful of companies and, and sometimes, you know, somebody will, one of the CEOs will say to me something like, "Well, you know, this person is really very aggressive and kind of harsh on the others on the team. And maybe you've seen this." And I'm like, "No. <laughs> I mean, this is nothing. I mean, you're talking about a little bit of squawking and this is like nothing compared to what I'm used to," right.

<laughter>

Page: So I think most people have no clue, right.

Hsu: Right.

Page: Yeah, yeah.

Hsu: What was--

Page: It's funny.

Hsu: What was Michael Scott like as CEO?

<00:57:04>

Page: So I didn't interact with Mike that much and what I remember is the few times, and he was softer than Steve, but the few times I interacted with Mike, it was like boom, boom, boom, boom. Boom. You know? I mean, every time-- each time I met with him, it was like really short and I mean, you know. And he wasn't rough, but he just, you know, very efficient, you know, and so. And I mean, I thought he was good, I just didn't interact with him too much.

Hsu: He and Markkula came from Intel, right?

Page: Yeah. Well, Markkula came from Intel.

Hsu: Markkula came from Intel.

Page: I think Mike came from National.

Hsu: Oh, right. National, yeah.

Page: Yeah.

Hsu: Was there, I mean, was there-- I'd heard that, like, early Apple there were, you know, there were a lot of HP people and then there were a lot of people from the semiconductor companies, Intel, National.

Page: Yeah, I think that's accurate. Yeah.

Hsu: What was the culture like between those two?

Page: I don't think that was a problem. Yeah. So, you know, Mike was there for several years and I don't remember which year it was, but Wednesday-- <laughs>

Hsu: Oh, you're talking about Black Wednesday?

Page: Yeah.

<laughter>

Page: And I don't know if Mike thought about this ahead of time or he just decided that morning, but, you know, the Apple III project wasn't going so well.

Hsu: Right.

Page: And it had some problems. And I guess Mike felt that it was the fault of Apple III management. And so I think he made a distinction between the management team which was six or eight people or something and then the engineers and marketing people. And so that morning, he came in and he gathered just the managers together and I don't remember how many there were, six, seven or eight, he let them all go. And I guess you would think that a president could decide to let someone go. I guess presidents don't usually let a group of people go. That's maybe a little unusual. And Apple wasn't real big at that point. I mean, Apple was probably less than 1000 people.

Hsu: And it was only the six to eight managers that were fired.

Page: Yeah. But the news that he had-- that this had happened went through the company quickly and I think that probably some people thought like, well, who's next, right. I mean, what's Mike going to do next?

Hsu: Right.

Page: There wasn't any next, but. And somehow, and I don't know how, but somehow the board found out and I guess by mid-day or something the board met by phone and they decided to move Mike out as president and turn him into a vice president. And then I guess that afternoon, they had a long meeting and talked about who should replace him. But what I think happened was after Mike became a VP that day, the next day he went on vacation and never came back.

<laughter>

Page: Surprise, surprise. Which I think was really unfortunate. So, I guess the lesson learned there is if you're going to make some significant change in the company, maybe you want to pick up the phone and call a couple of board members and tell them you're going to do it so they're not surprised, right. But you'd think the president could do that on his own, but obviously they thought it was a problem. Yeah. So, I mean, obviously, I wasn't involved, but apparently what happened was the board discussed it at long length, should Steve become president or should Mike Markkula and they decided to put Mike in as president and then Steve became chairman.

Hsu: I see.

Page: So that's how Steve became chairman.

Hsu: Right.

Page: Yeah. So, that was-- I thought that was unfortunate because I think Mike did the right thing but in the process of losing those eight we had to lose the president. <laughs>

Hsu: That's interesting.

Page: That seems like a mistake.

Hsu: Yeah.

Page: In the bigger picture.

Hsu: So you thought Mike Scott was a pretty decent--

Page: I thought he was really good, actually.

Hsu: Yeah.

Page: Yeah.

Hsu: Did you have any input into the Apple III or was that completely separate?

Page: No. Not much. I was sort of too busy with helping all my friends on Lisa and Macintosh, yeah.

Hsu: So getting back to Lisa, you were part of the group that visited Xerox PARC?

Page: Yeah. So Steve and Bill and I, and I don't know if there was anybody else, we went up and visited Xerox and saw their Smalltalk and their system. They had a full-page display and a pretty good machine and we saw the menus and other things.

Hsu: Yeah. This was the Alto?

Page: It's the Alto. Right. And it was kind of neat. And so, you know, object oriented and, you know, WYSIWYG, menus and, you know, kind of a precursor to what Apple did with Lisa and Macintosh. So we came back and Bill started working towards what he'd been doing, trying to work towards the pull down menus and things.

Hsu: So the Lisa had been very different before that?

Page: This was pretty early, so this was, I don't know that Lisa was that far along in terms of user interface.

Hsu: I see.

Page: So, I think this kind of caused it to go in that direction, but I don't know if they had much before then. Yeah. Which kind of begs the question of I guess of why did Xerox let this happen?

<laughter>

Page: Because had this been anybody else there would have probably have been a lawsuit or something, you know. One thing I learned from the Xerox guys was that, you know, they were doing all this at PARC and like once a year they would go back to Rochester, New York and they'd take what they'd been working on and go back and show the guys at headquarters, at Xerox. And you know, they had their little research group here in Palo Alto and I guess the guys in New York put up with it.

Hsu: Yeah. <laughs>

Page: And, but they would present what they had and the strangest thing is the only response they could get out of the guys in Rochester was, "That's not a copier."

<laughter>

Page: You're right. It's not a copier. It's a computer. <laughs> But they had done the Alto and they, you know, and all the graphics and the WYSIWYG and Smalltalk and I mean, they did a lot, but I don't think the guys in Rochester had a clue as to what it was, you know. So, I mean, Xerox had all this and never really monetized it, which seems kind of criminal. <laughs> A little crazy, you know.

Hsu: Did any of-- I mean, I know it affected Bill a lot. Did it change what you were working on?

Page: Not so much, although maybe it gave us impetus to do the object oriented Pascal.

Hsu: Oh, I see.

Page: Because object oriented languages were just starting to happen in that timeframe.

Hsu: Yeah.

Page: And so probably making Pascal object oriented was probably the right thing. But, you know, maybe that we maybe got encouraged by the visit to Xerox PARC to do that. Because had we not done that, I don't know if we would have moved that quickly.

Hsu: Yeah.

Page: Yeah.

Hsu: Could you talk more about your collaboration with Bill?

Page: Well, he and I kind of worked on things pretty separately in the sense that I was working on low level tools and you know, supporting him with the assembler and the debugger and the compiler and things and he was off working on the graphics. And so, you know, we kind of worked together but on two very separate areas, you know. So he was more of a big customer. <laughs>

Hsu: So he was a consumer of your tools.

Page: Yeah, the tools, yeah.

Hsu: I see, okay.

Page: I mean, you know, and he, of course, he had one of the prototypes and stuff and I was trying to support him and others, right. Yeah.

Hsu: I'd read that Ken Rothmuller was the original project manager on Lisa?

Page: I think so. So Ken came over from HP before me and I think for the period-- I think about, I don't remember the exact sequence, but something happened between Ken and other members of the team, like John and Wayne and Steve. And I don't know how much had to do with that and how much it had to do with the fact that we kind of decided to move away from the microcoded machine to the 68K.

Hsu: Ah.

Page: But I kind of think that Ken left first and then we decided to move to the 68K. I think those were separate. But, yeah, Ken was running the project for the first four, five, six months. Yeah. But something happened. I don't know exactly what. I mean, it's possible that, you know, it's very possible he kind of had this-- a falling out with Steve and the six month clock hit.

<laughter>

Page: So,--

Hsu: So then John Couch took over.

Page: John took over and, yeah. So as a lot of people found out, you'd get hired in to work for Steve, if you make it in, <laughs> and then there's this sort of this six-month window where maybe you continue, maybe you don't. <laughs> And then there's after six months. And what I noticed with a lot of people is a lot of people kind of fell out in that four, five, six, seven, eight month window or around six months, a lot of times Steve would kind of pull the ripcord and get rid of somebody. When people would make it through 12, 18, 24 months with Steve, I don't know exactly when, but at some point around there, I think what happened is if you made it to that point, you probably could stay with Steve as long as you wanted to, right. In other words, once, you know, once you've worked with him for a year and a half or two, you probably could work as long as you wanted to, you know. Because most people ended up falling out in less than a year. Yeah. Interesting. So, let's see. I think it was in one of the books about Steve, interesting story. When he was 17, he somehow got Bill Hewlett's home phone number.

Hsu: Right.

Page: And he calls up Bill and talks himself into an internship at HP. And at the end of the call Bill says, "Well, go to HR up on Page Mill Road and they'll have your name and you'll have a job for the summer." So that's how Steve got into HP. I think because of that, the old HP, he had a real appreciation for it. I think the later HP, less so, but the older one, he had a strong appreciation. But if you interviewed with Steve, you wouldn't know it.

<laughter>

Page: Because Steve would pick up your resume and he'd say something like, "Oh. Hansen. Why did you waste 12 years of your life at HP?"

<laughter>

Page: And what he was trying to do is push on-- He liked to push on people's buttons and kind of get the adrenalin flowing and get them in a sort of uncomfortable situation. Because he doesn't want to know how you're going to answer questions if you're comfortable--

Hsu: Ah.

Page: What he wants to know is how you're going to answer things if you're uncomfortable, right. And sometimes people would misunderstand the question and the right answer to that question is, "Because HP was a great company.

Hsu: <laughs>

Page: But, you know, sometimes people would fold on that, right. They didn't know how to answer that and they kind of would back off and they should push back and he felt like if they couldn't push back with the obvious answer then they're useless. <laughs> Because he didn't want people that would just agree with him.

Hsu: Right.

Page: You know. So, something I learned at Apple and NeXT, and I think it's a problem that many, many companies have. In most technical companies, I don't know about others, but most technical companies, it's often too easy to start a project, especially if the project gets started by a senior VP or the president or the CEO or whatever. If somebody very senior in the company wants to do something, often without much thought, the company is off doing it. And surprise, surprise, within a few months you got 75 people on the project because if the company has the financial resources to do it, it's just a matter of getting people onto the project. But what's really hard is if it turns out to be the wrong thing to do, at some point, somewhere you have to think about shutting it down and so it's unfortunately much easier to start something than it is to shut it down and it's painful to shut it down. And the problem is, if you got 75 or 100 people working on a project and then you decide to shut it down, engineers get attached to it.

Hsu: Yeah.

Page: And some of the best ones get upset and they might leave. But if you lose 5 or 10 out of the 100, especially if they're good, you don't want to lose them. So I think the right answer is, not that you can always make the right decision, but I think the right answer is do a little more homework and make sure you really want to do it before you start it. Because sometimes things would just, you know, take off.

Hsu: Yeah.

Page: And you know, I heard Steve say a few times, you know, it's really easy to hire people to do things. It's much harder to hire people to tell you what to do. <laughs>

Hsu: Yeah.

Page: And trying to decide what to do and trying to have people push the company in the right direction, that's much harder than just executing things, right. And he was right, you know, that's true, yeah, I think, so.

Hsu: So, yeah, you worked-- So you worked under Wayne Rosing.

Page: Kind of dotted line to Steve.

Hsu: Yeah. Other people on Lisa were Trip Hawkins, Larry Tesler, Steve Capps.

Page: Yeah.

Hsu: Did you work with any of these--

Page: Yeah, so, so Trip was running Marketing. He was very good. I think he later started--

Hsu: EA.

Page: EA, yeah. He was really good.

Hsu: Larry came over from Xerox.

Page: Larry came over from Xerox and he was senior person in the software team. Yeah, Larry was also very good. And Steve Capps was on the Lisa team for a while but moved, I think at some point transitioned over to Mac.

Hsu: Right, yeah.

Page: Yeah. I liked Steve.

Hsu: Who else did you work with closely?

Page: Well, on the marketing side, I didn't work with them that closely, but I remember Rick Tompane was part of the marketing team and Rick worked for Trip, I think. And much, much later, I met his brother John, <laughs> which is kind of funny. Small world, you know.

<laughter>

Page: So who else was there? I mean, there were, I mean, a ton of software people.

Hsu: Yeah, I know.

Page: So, most software guys in the last 10 or 20 years probably think that the way you manage software is you, from a source code point of view, is you have something like CVS, right, and you edit your software and you check it in from time to time.

Hsu: Yeah.

Page: Well, back in 1980, '81, '82, there was no equivalent of a CVS. And when the team was modest sized, people just kind of worked on things and they kind of knew who was changing what, but it was all kind of word of mouth.

Hsu: Really?

Page: Yeah. Which is a little difficult. So what we did one day is I think Bruce and I did this, I'm not sure, we went to a stationery store and we bought a bunch of 3" x 5" card recipe boxes with the alphabet in them, right. And we got a bunch of those, one for each project, and filled them up with 3" x 5" cards and the project managers put the name of the key modules on the 3" x 5" cards. And then if you wanted to change one of the modules, you went to the box and you pulled out the card and you looked to see if it's in or out and you put your name on it and then you worked on changing it. And then when you got done and checked it back in you went back and dated it out, right. And then if you went to one and you saw somebody had it, then at least you know who has it--

Hsu: Right.

Page: And who's probably changing it, right.

Hsu: Right.

Page: So that helped a lot. But that was sort of a paper version of a CVS a long, long time ago. Yeah.

Hsu: <laughs> How much did the software and the evolving graphical interface affect the hardware design of the Lisa?

Page: Not so much. I guess, maybe one thing it probably should have done is I don't know how, but I guess before the team really decided to go with the graphical user interface, I guess the team wasn't really paying attention to the raster size and the number of pixels and stuff real closely.

Hsu: Yeah.

Page: And maybe they were thinking about something more character oriented. And the Lisa didn't have exactly square pixels.

Hsu: Right.

Page: And I think that, you know, had the graphical user interface and its impact been understood earlier, probably Lisa could have-- would have ended up with square pixels.

Hsu: Oh, okay.

Page: Because it-- it wasn't the end of the world, but it made Bill's job a little harder, you know, because they weren't dramatically rectangular, but it did impact things. I mean, it's relatively easy to adjust for, but, yeah. <laughs> But funny.

Hsu: Yeah.

Page: So maybe if the decision to go with a graphical user interface was made earlier, maybe we would have noticed that oh, they're not square pixels.

<laughter>

Page: Maybe we should fix this.

Hsu: So, so who was responsible for the design of the hardware and the specs?

Page: I think largely Paul. I mean, I helped him, but.

Hsu: Okay.

Page: Paul Baker.

Hsu: Paul Baker, okay.

Page: You know, a funny thing is, the last time I talked to Paul, he's still there.

Hsu: He's still at Apple?

Page: He was at Apple for maybe 8 or 10 years from around 1980 to around 1990. He left for a very short period of time, maybe a year or two, and then he went back. And, yeah, I saw him a few years ago and he was still at Apple.

Hsu: Wow.

Page: So except for that one or two years, I mean, he's been there since the 1980s.

Hsu: Wow.

Page: Now, I haven't talked to him in the last few years. Maybe he's, maybe in the last few years he finally retired, but.

Hsu: Yeah.

Page: And then I think he has two daughters and I think they both work at Apple.

<laughter>

Page: That's kind of funny, yeah, but anyway.

Hsu: Yeah.

Page: Yeah. I like Paul, yeah.

Hsu: So the Lisa had these two Twiggy floppy drives.

Page: Yeah.

Hsu: That were kind of not super-reliable.

Page: So, let's back up and talk about storage. <laughs>

Hsu: Okay.

Page: So, somewhere along the way, you know, Steve realized that, you know, there's software, there's hardware, there's memory and there's storage.

Hsu: Yeah.

Page: And fortunately, Apple never got the idea they should build their own memory. <laughs> But a lot of other companies in the seventies and eighties did. I mean, Data General and a lot of companies did try to venture into the memory space and try to do their own DRAM and stuff. Fortunately, Apple never, you know, did that. But, you know, the original 5-1/4" floppy was a Seagate mechanism with Apple electronics that Woz did. And so, that had the advantage of, you know, Apple earned some markup for that and that was a pretty successful floppy drive. But Apple didn't have to do the mechanism, Apple just did the electronics. So that actually worked really well. So subsequent to that, there were a couple of disk drive projects, both floppy and hard disk.

Hsu: Okay.

Page: And some of these got to be pretty big and have quite a few people working on them and stuff and some of them didn't work as well as others. And Twiggy was, it worked but it was kind of marginal, you know.

Hsu: Right.

Page: One of the more successful ones is I think the hard disk that Apple did for a while did pretty well.

Hsu: Was that the ProFile?

Page: Yeah.

Hsu: That was originally for Apple III but--

Page: But got used by everybody.

Hsu: Used by everyone including the Lisa.

Page: It got used by Apple II, it got used by Lisa and Macintosh. Everybody. You know, everybody had a ProFile, yeah. And, yeah, I think Apple executed pretty well on that one. So, so Steve kind of learned that, you know, storage is a big part of the cost. If the company can execute well with storage, then, you know, it's good for the company. So, for the most part I think the company did well with it, both Apple and NeXT, but it's, you know, but they're big projects. Yeah.

Hsu: And I mean, was, you know, were there issues with the Twiggy drives?

Page: I think they worked pretty well but maybe not as well as they should have. I mean, they worked well enough to get used but, yeah, but they had some problems.

Hsu: Were they not reliable or--?

Page: I don't really remember real well, but yeah, I know that there was, you know, there was some problem.

Hsu: After, so after Steve moved over to the Mac there was sort of a competition between the Mac and Lisa teams?

Page: To some degree. Like I said, I don't know that Steve should have ever gotten-- been pushed out. And I think that created some friction because I think to some degree he was trying to prove himself a little bit.

Hsu: Yeah.

Page: And that probably wasn't really the best move. <laughs> Yeah. So I think Bill and I were kind of helping both, you know, helping both teams and kind of floating back and forth between the two.

Hsu: Kind of both, okay.

Page: And so we were a little bit disconnected from the two, right, you know, since we're trying to help both. Because my attitude was it's not like win or lose, it's like how do we get both of these to succeed.

Hsu: Right, right. Okay. But so you didn't see that the two might possibly cannibalize each other. You thought that they could both stand on their own?

Page: Well, I kind of thought so, but yeah, but eventually, yeah.

Hsu: Interesting. So the Lisa was launched in January 19th, 1983.

Page: That sounds right, yeah. A year before the Mac then.

Hsu: Right. And so what was-- So the market response to the Lisa was not great?

Page: Yeah, I think it was too expensive, probably.

Hsu: It was, like, $10,000 dollars about?

Page: Yeah, roughly. Yeah. Yeah, I think it came out at either $8995 or $9995, somewhere around there, yeah, so, yeah.

Hsu: So what was-- What do you believe was the issue with that? Was it just the price? Was it too slow?

Page: I think it was the price because I think, you know, in 1980, '81, or well, '83, '84, I think, you know, $9K is too much, yeah.

Hsu: Yeah. Was it--

Page: I mean, to some degree, Apple with the Mac had similar problems later. And the Mac eventually gives way to the Mac II and then there's a couple of different versions of them, Mac II and eventually there's the fx. And the Mac IIfx I think was, like, $14-$15K. And that one didn't do very well.

Hsu: Right.

Page: So although that was a Macintosh it didn't do well and I think the big problem was price.

Hsu: Right.

Page: So I think with any product you can make it succeed or fail by <laughs> adjusting the price, right? Yeah.

Hsu: Right. But I mean, part of the reason why it was so expensive was because it was state of the art technology, right, or--?

Page: Well, and maybe it ended up with too much memory.

Hsu: Too much memory.

Page: Yeah. Because one of the big changes that Steve pushed with the Mac was for the original Mac to come out at 128K.

Hsu: Right.

Page: Which was probably too little, but it enabled the lower price point.

Hsu: Right.

Page: And I think the Lisa went out the door at 512.

Hsu: Oh, really? Okay.

Page: So, you know, had Lisa gone out at 256K or 128, then maybe the price could have been lower and maybe it would have been a bit more successful, so.

Hsu: Right. But then would that have been, I mean, it was already, would that have been enough memory to run the graphical user interface? It would have been too slow or?

Page: Well, but Mac made it work.

Hsu: Yeah, but the Mac had a very different--

Page: Approach.

Hsu: I mean, yeah, the OS wasn't multitasking.

Page: Right. I mean, so you got to make a set of decisions and maybe taking the high road with Lisa was a couple of the decisions were not the right decisions and at some point somebody should have said, "Well, this is too much memory. It's going to be too expensive. We should shoot for lower," right.

Hsu: Right.

Page: And to some degree, Steve did that with the Mac, right.

Hsu: Right.

Page: And drove a set of decisions that made it possible.

Hsu: Right.

Page: So--

Hsu: So do you think maybe the software, the OS on the Lisa was too ambitious for the hardware constraints?

Page: Probably, yeah. Or for the market constraints.

Hsu: Or for the market constraints.

Page: Yeah.

Hsu: Okay.

Page: But you roll the clock forwards not too far--

Hsu: Yeah.

Page: And 512K or 1-Meg or 2-Meg on the Mac wasn't a problem.

Hsu: Right.

Page: But, but that's a couple years later and in 1983, 512 was too much I think.

Hsu: So was, I mean, was the team designing with, you know, too aggressively for Moore's Law?

Page: Maybe. Or maybe they didn't-- weren't paying enough attention to it.

Hsu: I see.

Page: Yeah.

Hsu: Did you work on the Lisa II?

Page: Not really.

Hsu: Not really.

Page: Yeah.

Hsu: Okay.

Page: So, though, at some point, which was maybe the right thing to do, and I don't remember how long it lasted, but they kind of put the Mac software on top of the Lisa.

Hsu: Yeah.

Page: And they ended up calling it Mac XL.

Hsu: Yeah.

Page: And that was kind of a neat product for a short period of time.

Hsu: Right.

Page: But it was kind of, by that point the Mac had already grown up to 512 or 1-Meg and that was a good fit for the Mac, for the Lisa hardware. And so the Mac XL, you know, was kind of a good fit.

Hsu: Right.

Page: You know.

Hsu: Yeah.

Page: So.

Hsu: So you thought that was a decent-- that was actually a decent product?

Page: Yeah.

Hsu: Yeah.

Page: But I don't think it lasted real long.

Hsu: Yeah. We did an interview with Joanna Hoffman and she said that she felt that it was killed too early.

Page: Probably.

Hsu: That, you know, they were actually selling pretty well.

Page: Yeah. I think I would agree with that, yeah.

Hsu: <laughs>

Page: So, I guess what happened was although I sort of helped the Lisa team and helped Mac, I spent less of my time working on the end products and more time on tools and prototypes.

Hsu: Oh, okay.

Page: So, you know, after helping Lisa and Macintosh and Mac was on its way out the door, I worked on a really crude Mac portable.

Hsu: Okay.

Page: And I did a color Macintosh. And then eventually, I did a big screen Mac.

Hsu: Oh, okay.

Page: Which we called Big Mac.

Hsu: I see.

Page: And one of the funny things is if you think Joanna, you know, thought that why did the Mac XL get killed, there were a bunch of people that had Big Macs at Apple. I mean, it never made its way outside the door, outside the building.

Hsu: Right.

Page: But I think we built about 20 of them.

Hsu: Oh, wow.

Page: And, you know, all the software guys, you know, inside Apple had-- they all wanted one, right.

Hsu: Yeah.

Page: And I think it was for a long, long time it was like, "No way you're taking it away from me."

<laughter>

Page: "Rich gave this to me and I'm not-- I'm not letting it go."

Hsu: Right.

Page: Yeah. Because it took a while for the Mac II to catch up with it.

Hsu: Yeah, yeah, yeah.

Page: Yeah.

Hsu: Yeah. So the Lisa and Mac teams were officially merged in 1983?

Page: I guess.

Hsu: It didn't affect you because you were already working on them both.

Page: Yeah. I was just-- I was just kind of working with both.

Hsu: Yeah.

Page: Maybe that happened and I didn't notice, yeah.

Hsu: So you were still working on tools but you were also developing hardware prototypes?

Page: And also doing-- and I was doing these prototypes, right.

Hsu: Interesting.

Page: So once I became a Fellow, I guess the bottom line is I could sort of do anything I wanted.

Hsu: Ah, right. Right, right.

Page: And so I spent a portion of my time doing stuff that Wayne and Steve wanted me to do and I spent a portion of my time tinkering with, you know, new machines. And I kind of thought eventually Apple needed a laptop. <laughs> A flat-- something with a flat screen.

Hsu: Right.

Page: And I sort of felt like, you know, Apple needed a color machine.

Hsu: Right. And this was as early as--?

Page: Well, I think I did the color machine in '83.

Hsu: '83, wow.

Page: And I did Big Mac in, you know, sort of started it in maybe middle of '84 and finished in spring of '85 or something.

Hsu: Okay, wow.

Page: Yeah. And somewhere in between I did the little crude portable.

Hsu: Right.

Page: But there were probably two important things-- Relative to hardware in computers, there's probably two important things that happened in that decade. One of them is-- or two important choices, let's say. Should you do black and white or color. And the problem is, as you'll notice, that a lot of the products that came out of Apple and NeXT were black and white and color was slow to get adopted.

Hsu: Right.

Page: Okay. So why is that? Well, the problem is that you could build either a larger screen or a full screen black and white product and have fairly high resolution or you can even do a smaller screen and have fairly high resolution like the original Mac. Or you could do color and the resolution was horrible.

Hsu: Right.

Page: And so, and then and at that time there weren't any good ways to do printing. And you really want to be able to prepare documents and print them. <laughs>

Hsu: Right.

Page: So, you really want to have a computer where you can have a decent resolution and you can print it. And that kind of, in that timeframe, kind of says do black and white.

Hsu: Right.

Page: But the customers don't really understand and appreciate that. Customers want color. <laughs> So, but the problem was the electron gun size for all the color monitors back in the early eighties and mid-eighties, they were too big and you didn't get very good resolution on a color monitor. By the late eighties, you had Sony Trinitrons and you had other suppliers making pretty decent monitors, but they were really expensive.

Hsu: Right.

Page: But you had people like SuperMac and Radius, eventually Apple, you know, all doing color monitors, but they were kind of expensive, right. You end up spending almost as much money on the monitor as you did on the system back then.

Hsu: Yeah.

Page: So, I think, you know, when we left Apple and we started NeXT and then we came out with this black and white computer, I think a number of people thought, "Oh, Steve and George and Rich, they must be color blind."

<laughter>

Page: "I mean, they were responsible for the Mac and everything else being and the Lisa being black and white and now they go to NeXT and they do another black and white. They're obviously color blind."

Hsu: <laughs>

Page: Steve and George and I weren't color blind, it was just that if you wanted to be able to have decent resolution and reasonable size fonts,--

Hsu: Right.

Page: You couldn't do it on color

Hsu: Right. And you need the high resolution to do WYSIWYG.

Page: Yeah, if you want to-- if you want to put a document up on the screen, yeah. Yeah.

Hsu: Yeah.

Page: So, so eventually we, you know, at NeXT we eventually do-- It took us a while, but eventually we did a decent color product, but, you know. But then you had the problem, we finally had a color product but we didn't have a real good color printing solution I think, yeah.

Hsu: Yeah. So the color prototype that you did in '83,--

Page: Yeah.

Hsu: That was, what size screen was that?

Page: I think it was, like, 14-inch or something.

Hsu: Fourteen-inch, wow.

Page: Mm-hmm.

Hsu: And was it still built into the chassis like the original Mac? Or was it a separate module?

Page: Well, like a lot-- like a lot of my early prototypes, a lot of times when I build a prototype of something, I didn't worry so much about the packaging.

Hsu: I see.

Page: I sort of built the computer and I had the monitor and I just kind of put it together and often without a package.

Hsu: Oh, okay.

Page: So a lot of the early prototypes that I built like it's a piece of wood with-- sanded off with a board mounted on a piece of wood and--

Hsu: Oh, okay.

Page: You know. So that was a sort of typical.

Hsu: Right.

Page: Because, like, because if you're going to take this idea and then revise it and make it into a product, there's no sense in working on the packaging. Yeah.

Hsu: Right.

Page: So I rarely worked on the package part of it when I was at Apple, you know.

Hsu: So did, I mean, the, you know, later on, Apple did do a Mac II which was its first color Mac--

Page: Yeah.

Hsu: And Apple did do a Macintosh Portable. Did your prototypes have any influence on those, eventually?

Page: I think maybe just the impetus to do them, but they were separated in time and you know, kind of restarted and, you know. So probably not too much, but I was just trying to push the concept, you know.

Hsu: Okay.

Page: We need to do this eventually. <laughs>

Hsu: Right.

Page: And at the time, you know, I kind of thought I was still going to be at Apple for a long period of time, you know.

Hsu: And then the Big Mac, that was, so that was how big was the screen on that?

Page: So I took a landscape display in black and white and rotated it and made it portrait.

Hsu: Okay.

Page: And you could put pretty much a full page up on it.

Hsu: Oh, okay. So a full 8-1/2" X 11" page screen.

Page: Yeah. And--

Hsu: And was it also modular or built all in one like the original Mac?

Page: It was also modular, sort of. You know, a board with 68020, a bunch of memory and everything and then the chassis with the monitor, yeah. I wasn't-- I wasn't really-- but, like, but I ended up setting the monitor on top of the product, so. But I wasn't really worried about the packaging. I just wanted to get-- I just wanted to get it built and put them in the hands of people so they could-- Software guys didn't care. The last thing they worry about is the packaging. <laughs>

Hsu: So what was-- Because you mentioned the 020. What were the specs of the machine? How much memory?

Page: It was the 68020. It had I think a megabyte of memory, roughly, and the display was probably, I don't know if it was a full million pixels, but it was close. So it came pretty close to a 3M machine, right.

Hsu: Oh, okay.

Page: You know, in the CMU style of the megabyte of memory, at least 1 MIPS and a megapixel. It was, it was pretty close to that. And so it had one flaw. <laughs>

Hsu: Oh.

Page: I did it before Steve got pushed aside at Apple and it sort of had my-- well, it had my name on it kind of but it kind of was associated with Steve, too.

Hsu: Right.

Page: And but it already existed when Steve got pushed aside, so after Steve's gone and Jean-Louis Gassée took over the Mac division, right or wrong, I mean, I didn't blame him, but right or wrong, anything that was more than a few months-old he killed it.

Hsu: Right.

Page: I think partly because going forwards, he wanted to be able to dictate everything and have his name on everything, so he didn't want to have things lingering around that were from before, right.

Hsu: Right.

Page: So, I don't remember when he became the GM of the Mac division, but it was in the spring of '85. And so, shortly after that, my project got killed. But my project was mostly just to build the prototypes.

Hsu: Right.

Page: But people were starting to think about taking that and making a product out of it.

Hsu: I see.

Page: And he kind of nixed that.

Hsu: How many did you build?

Page: What?

Hsu: How many Big Macs did you--?

Page: I think we built close to 20.

Hsu: Twenty.

Page: Yeah.

Hsu: And the various software people--

Page: Everybody wanted, yeah, because it was the fastest thing we had, you know.

Hsu: <laughs>

Page: Everybody wanted one, yeah.

Hsu: Right.

Page: Yeah. So, so then what happens, you know, is after Steve got pushed aside,-- Well, maybe I should back up. You know, the Mac went out in January, '84. It slowly ramped up in '84 and did quite well. But I think by early '85, the unit volume was starting to taper off a bit because there were only a few apps from Apple and the third parties really hadn't got any apps out yet and so you have sort of this normal S curve problem and I think Steve just thought that unit volumes were just going to keep going up, up, up, up and he didn't realize that unit volumes were going to fade and what would really bring them back up would be third party apps. So I think that gap in the unit volumes is what caused the friction between him and Sculley.

Hsu: Oh, okay. Right.

Page: And then, so he kind of gets pushed aside. He goes to Italy for a few months. While he's gone, Jean-Louis Gassée takes over and then the notion of turning the Big Mac prototype into a product got killed or at least reset. <laughs> And, and then I, you know, I saw Steve when he got back and that was, like, oh, sometime in early July or something. And, and then Steve and the five of us ended up meeting a few times at Steve's place over the summer <laughs> and--

Hsu: You mean the five co-founders of NeXT?

Page: Yeah. So Dan'l and Bud and Susan and George and I. And this gained some momentum, you know, by, oh, maybe mid-August or late-August or something.

Hsu: Before we get into that--

Page: Okay.

Hsu: Because I know that we're going to-- That's we're going to talk a lot about that.

Page: We'll go there. Okay.

Hsu: But I wanted to go back to the, I guess the-- Well, we've been talking about the Big Mac. There was also, Burrell was also working on a Turbo Mac?

Page: I think so, yeah.

Hsu: So there were multiple, like, next generation Mac projects going on?

Page: Probably, yeah. And that's kind of typical in most companies is--

Hsu: Right.

Page: People are kind of building things and sorting ideas out.

Hsu: Right, yeah.

Page: I don't know how far Burrell went with that and I don't remember how long he lasted. At some point, he left.

Hsu: Right.

Page: Yeah, but I don't remember the timing.

Hsu: And--

Page: Oh, one other person-- I just thought of someone. One other person you should look up and talk to some day, because he had so much to do with the Macintosh, was Bob Belleville.

Hsu: Oh, yes. We've done an interview with him, yes.

Page: Oh, you have, okay. Okay. I just remembered Bob.

Hsu: Yeah.

Page: He was good.

Hsu: Yeah. You mentioned--

Page: But I remember-- I remember, so a lot of people, I think including Steve, think that sometimes when you're doing a product that gee, the product would be so much better if it just had this one other feature.

Hsu: Yeah.

Page: Now, Steve always liked to lobby for adding this feature and this feature. He'd, you know, I mean, not too bad, but he'd lobby for things.

Hsu: Right.

Page: I don't know if it came through in Bob's interview, but I remember Bob was like, Bob always made the argument that well, these features are, like, you got, you know, on the top of the hill you've got this big plateau and these features are like little mountains on top of this big plateau.

Hsu: <laughs>

Page: And but they're not very tall mountains and they're really not that important but, you know, people want that actual feature or they seem to claim we should do it. But they're really not that important. But the top of the mountain is really flat and it doesn't matter from a features perspective, it doesn't matter where you are in-- as long as you don't fall of the edge. <laughs>

Hsu: Right.

Page: As long as you don't, you know, go off one end or the other, you know, the top's pretty flat.

Hsu: Yeah.

Page: And little spikes, you know, are not that important. That was his perspective. I don't know if it came out in the interview, but I remember, you know, that was his view.

Hsu: But they could push back the release, right, if they--

Page: Oh. You mean adding a feature?

Hsu: Yeah.

Page: Okay.

<laughter>

Page: Not if you lobby for it correctly.

Hsu: I see.

Page: <laughs> Steve would come to you and say, he'd want to add something and he'd make the argument that, "Well, you know if you add this the product will be simpler. We're actually going to get done sooner."

Hsu: Really?

Page: <laughs>

Hsu: Okay. Is that reality distortion, I mean?

Page: Yeah. I mean, he tried.

<laughter>

Page: And I was, like, "It's 11:59. The couple years is almost over on the 24 hour clock."

Hsu: <laughs>

Page: "We're near the very end. We really shouldn't change anything. We really ought to just get it out the door."

Hsu: Yeah. <laughs>

Page: And one thing I learned at NeXT that was sort of true at Apple, was if you only have one product and you're working on it with him [Steve], there's not much escaping it because he's trying to optimize the one product.

Hsu: Right.

Page: If you get to a point where you're doing a couple of products, and you're trying to finish one but you got, let's say numbers 2 and 3 that are new,--

Hsu: Right.

Page: Your job when Steve comes to you and wants to change 1 is to distract him with 2 or 3.

Hsu: Right.

<laughter>

Page: "Look at this bright shiny object over here."

<laughter>

Page: Get him off of that one and talk about the new thing, yeah.

Hsu: Right.

Page: So it was easier when we had multiple projects because you could talk about some new bright shiny thing and not have to worry about the older one so much then.

Hsu: Right. You can ship the current one--

Page: Let's just ship that one, yeah.

Hsu: And push the other one off to-- Yeah.

Page: Yeah.

Hsu: You know, we talked earlier about Xerox. They came out with the Xerox Star in 1981,--

Page: Okay.

Hsu: Which also-- which was--

Page: Based on the Alto?

Hsu: Which was based, somewhat based on the Alto. There was a graphical user interface. It was also over $10,000 dollars.

Page: Yeah.

Hsu: I think maybe $15K or it was significantly more expensive.

Page: Yeah.

Hsu: It also did not do so well.

Page: I guess too expensive.

Hsu: How would you compare the Lisa to the Star?

Page: I didn't really pay much attention to the Star, so I guess it's going to be hard for me to-- you know. I mean, I remember it existed, but that's about as-- You know, that's about it. One other thing I learned at maybe at HP and at Apple, which, I made the comment about when you're starting a project, you've got to be careful not to start them too easily, right? It helps to do a little homework. The other thing I learned along the way is you might think that there's a short project somewhere, or you could like do something in two months or three months, but what I learned is that's almost impossible. So, why? So what happens is you push some version of the product out the door, and at the point where you'd-- but the day you push it out the door it's already been locked down for several months. So there's changes that the world wants to make to the product that by the time you got it out the door they're already maybe three, four, five, six months old, because it takes time, once you freeze, it takes time to push it out the door, both from an engineering point of view and a marketing point of view. The day it goes out the door there's already bits and pieces of things that people want to change. So a couple months later if you find something you want to change that's small, and you have this crazy idea, well, I'm just going to go make this small change to the product, I'm going to open it up, make the change, close it up, and we're going to push it out. Not going to happen, because as soon as the world realizes that there's a spin to the product, everybody comes out of the woodwork with they want their changes, and there is no two month, three month project. Everything is at least nine to twelve months. It's impossible to have a three-month project. It can't be done. I mean, it's not completely true. You've got engineering working with manufacturing to make small changes for like cost reductions or something, but the moment you start to change any features then you open up the can of worms, which I thought was interesting.

Hsu: Earlier you mentioned Sculley, so how did things change when Sculley came in, became the CEO?

Page: Well, at first I think it didn't change too much. The complication in '85 was Steve not understanding the unit numbers on the Mac, and I think Sculley understood that '85 was going to be a weak year in the computer industry, and unfortunately though the low part of the S-curve for the Mac coincided with this weak period in the computer industry, and rather than Mac volumes kind of dropping off and coming back up, they pretty much went to zero for two, three months and then came back. So maybe on the outside people didn't notice so much, but, you know, the relationship between Apple and suppliers it was kind of shut down for two, three months. So that dip hit pretty hard, and then came back quickly. But I think Sculley realized that somehow that '85 was going to be a-- Maybe he had a friend at Wall Street or something. Somebody told him, watch out, this year's going to be soft, right? He understood there was going to be a bit of a downturn. Yeah. I think that added to the friction between him and Steve, you know.

Hsu: What was your relationship with Steve like in the early Apple years, and what was he like?

Page: Well, I don't know that my relationship with him changed that much over the 14 years. When I first met Steve--I don't know how to describe it--but he was pretty aggressive, and over time he slowly tempered a bit. But when I was at NeXT, and people joined NeXT, a lot of people would come to me and others and they'd all ask the same question, "Has Steve always been this way?" "Is he always like this?" And the answer was, no. He's much better now. <laughs> It used to be really bad. And I think when he was like in his early twenties and started Apple he was pretty harsh with people, and by the time we started NeXT in '85 he already was a bit more mellow, right? With Steve, he would kind of get upset and

get excited, and there would be sort of this big spike, but usually it didn't last very long. He got upset, and then it would like dissipate quickly, and as long as you understood that he was for the most part acting, and he was trying to win an argument or he wanted you to do something or whatever, as long as you could just kind of put some distance between that and yourself, then you were okay. If you got a little too wrapped up into it emotionally, then that wasn't good, but as long as you could kind of really just realize he's doing this for a point, he's not doing this because he hates you. <laughs> He's trying to win an argument or something, but a lot of people had a hard time with, you know, he'd come into our cubicle and he'd start yelling at them, and they didn't know how to deal with it. That was hard. But I think by the time we started NeXT and then a couple years later, right, I think he had softened. Everyone does as they get older, but even at NeXT he was pretty harsh.

Hsu: So let's get to talking about Steve's-- the big blow up between him and Sculley and the board. From your perspective what did you see happening there?

Page: I'm not sure I knew much more than what I've already told you and that is I think it was mostly over the Mac unit numbers and the fact that the unit sales were going down, but Steve still believed they were going up, and I think he was making the argument we need to build more Macintoshes, and Sculley's like, "No, we can't afford to do that. Sales are declining." So I think that was the big reason, but in terms of what happened between them, I don't know.

Hsu: So then Steve was essentially--

Page: Pushed aside.

Hsu: Pushed aside.

Page: He went off to Italy for a few months.

Hsu: So then he decides that he wants to leave and start a new company.

Page: One thing I thought was kind of interesting was the formula back then was the board meetings were, I believe, the second Friday of the third month of the quarter, and in the third quarter there in 1985 that would have put the board meeting on Friday the 13th. Somebody, I don't know who, probably one of the assistants, moved the board meeting to Thursday the 12th. So long before the board meeting happened everybody knew it was Thursday the 12th. By late August, early September, we'd kind of decided we wanted to start a company, and Steve made up his mind at some point that he's going to go to the board meeting and resign. And so we'd been over to his house a few times, and then Wednesday the 11th we go over to his house and have dinner and we talk about it, and he says he's going to go in tomorrow and he's going to resign. And then Thursday evening we get together again to see what he had done, and he wanted to know if we were all going to go in on Friday morning and resign. And none of us were in the board meeting, but apparently what he said was that he's leaving and he's going to take a handful of people with him, and I guess what I thought was a little odd was because he didn't tell the board who the five were, and the board didn't ask, and I guess the board didn't know until Friday morning,

and then when they found out that it was Dan'l and Bud and Susan and George and I, the board blew up. And then by Monday morning there was a lawsuit against Steve and I, and I think they thought, well, if we get rid of Rich, then they can't do hardware. If they can't do hardware, then we don't care. If they build a software company, that's okay.

Hsu: Oh OK. So they only sued you and--

Page: They wanted to see if they could get me to not go with Steve, I guess, and I guess they felt they had to sue Steve because, you know, fiduciary responsibility.

Hsu: Why was it the five of you in particular?

Page: I guess that's a really good question.

Hsu: First of all, like, why did Steve pick the five of you?

Page: Or why did the five of us go with him?

Hsu: Yeah, why did the five of you decide to go with him?

Page: I think part of it-- Maybe I should ask Dan'l that question, but I think part of that was that, at least for myself, and I guess I need to ask Dan'l or Susan or Bud, you need to understand that I didn't feel like I was that close to Steve, and I don't think for the others, [they] felt they were that close to Steve either, but what I think we didn't realize was the rest of the world viewed us as very close, right? In other words, we viewed it as there was some distance between us and him, but the rest of the world looking at the six of us I think viewed us as this little group, very close-knit group, and so relatively speaking we were a close-knit, tight group, but I think that-- and very strongly associated with Steve, right, but only we realized that.

Hsu: And had the five of you worked closely together at Apple? It seemed like you were all in different parts of Apple, right?

Page: Dan'l, Bud, Susan, George and I were all part of the Mac team to some degree. I mean, they all had sort of joined the Mac team either earlier or later, and I was kind of strongly connected with it, so the five of us were kind of working together with Steve on Macs. Susan was the Mac controller, Dan'l was on the marketing team for higher ed, higher education, and George was doing analog stuff and I was doing digital things, and Bud was doing software, and I don't know, it just kind of came together. But I just didn't really feel, maybe because it seemed like we were always arguing with him, I didn't feel that close to him, but what I didn't realize was we were a mile apart, but everyone else was 3,000 miles away. Everyone else thought we were the little, close group. I've got to ask Dan'l that.

Hsu: So Steve resigns from the board on September 13, 1985--

Page: It actually was on the 12th.

Hsu: Or the 12th, right. Okay, yeah, the 12th.

Page: And then the five of us turned our resignations in on Friday.

Hsu: On Friday the 13th, and then you get sued, you and Steve get sued the next Monday.

Page: And then it takes about six months to get rid of that.

Hsu: Was that a difficult process?

Page: Uh, it was a bit frustrating. I guess I can't say too much, because of this piece of paper I signed many, many years ago. It says I won't talk about it again.

Hsu: I guess the resolution--

Page: If anything, like I said, I think maybe Apple thought we can push Rich out, then they won't have a hardware team, and if they don't have a hardware team, then we don't care. Probably it had the opposite effect, probably suing us probably brought the team together.

Hsu: Oh, I see.

Page: You know. Now, if there had been a way, maybe it's impossible, but if there had been a way to stay at Apple and do this at Apple, I think it would have been better for everybody to just start another project at Apple, but given the falling out between Sculley and Steve, I guess that was not possible, but I think if this could have just stayed at Apple, it probably would have just been better.

Hsu: We did an interview with Mike Markkula, and he felt that it was improper of Steve to have already made a plan to take the five of you to start the company. If he had just left by himself, and then started a company and then hired the five of you individually that he would have been okay with that.

Page: But, the fact that it kind of got discussed before that—yeah. Because what I don't know is when were the papers for NeXT filed, but they were filed around about that time. But the question is how much before September 12th? Was it the day before or a week b-- I don't know. I know who filed them.

Hsu: As a result of the resolution of the suit, NeXT had a non-compete agreement with Apple?

Page: I don't remember that. Maybe.

Hsu: I read that the non-compete agreement specified that any computer that NeXT made had to be either more expensive--

Page: Oh, that's right.

Hsu: --or more powerful--

Page: You're right.

Hsu: --than Apple had--

Page: Yeah, I think that was in there, yeah. Yeah, you're right. Yeah.

Hsu: Which suited you fine.

Page: Which was fine, yeah. Maybe the original NeXT was a little too high-end, a little too much memory, the software a little too big, maybe a little bit ahead of itself, right? A little bit like Lisa kind of, and Mac kind of grew into a sweet spot. Maybe the NeXT kind of had the same problem. Maybe the first version was a little too expensive because of the memory requirements and disk requirements, and sometime when you're a little bit ahead of the game it takes a couple years for the technology to catch up and [you're] free to grow into it.

Hsu: You know you mentioned earlier that the Big Mac was kind of a 3M machine. The NeXT was also sort of intended to be a 3M machine?

Page: I mean, it was only six months apart. The world hadn't changed that much and people liked saying, you know, we're looking for something like that. I can't remember when we went out to higher ed, but I think some time in '86. We went and started talking to CMU and Michigan and Georgia Tech and Princeton.

Hsu: Why was 3M such a big milestone?

Page: Well, I guess, I don't know maybe one part of it was because it was kind of a simple thing to say is just, megabyte of [memory], 1 MIPS and a megapixel. But probably the big change is the megapixel, because up to that point other than more expensive workstations, it was really hard to get a big display. The original NeXT machine tried to go out the door at $4995.00, and I think it ended up going out a little bit higher than that.

Hsu: Yeah, like $69[95.00], and that was only to higher ed.

Page: And so it ended up being a little too expensive. So it probably kind of had to grow into it again. Another thing, so I was more involved with packaging at NeXT than I was with Apple, and a couple of interesting things there. When you do a whole computer system, the tooling gets to be pretty expensive. So we did a pretty good job I think of working with Frog [Design], creating models, getting the mechanical engineering done and then eventually releasing it. I think Steve understood pretty well that you're going to go through this process and at some point you're going to get the design done and then you're going to release it to tooling. And I think he understood that when that train left the station, there's no bringing the train back. Because once you start writing big checks, $500K, $1 million, $2 million, there's no bringing it

back. I mean, you could, but it gets prohibitive. So I think he understood that you've really got to make up your mind about the design, make sure it's what you want, and then you let it go. I think we made one mistake. Computers before the original NeXT machine and later versions of the NeXT machine were all metallic things with plastic outsides. The NeXT machine, the Cube, was a magnesium thing, and it was sanded and painted. The nice thing about starting with a metal chassis—the reason I say metal is, sometimes it's like steel and sometimes it's aluminum, so that's why I'm saying metal, but when you start with a metal chassis and you put a plastic skin over it, the nice thing about the plastic is once you get the tooling right for the plastic, it's easy to control the color and the texture is frozen. Not true with the magnesium cube. With the magnesium cube, you've got to paint it and you paint a bunch of these and not all are going to turn out identical, and as you mold the magnesium and as you sand it and stuff the texture's going to be a little different, and we had this problem from time to time where Steve would go to the factory and look at some of the units and he was unhappy with the fact that, well, that one doesn't look right. Subsequent to that we kind of went back to the model of, okay, we're doing a metal inside and a plastic outside, and that was much better.

Hsu: And that was on the later NeXTstations.

Page: Yeah. You saw the NeXTstation and the Turbo and the Color. Susan was CFO, and I learned something from her, which I thought was really interesting. Susan learned not to trust engineers. I mean, come on, especially when they talk about schedule. <laughs> You don't trust the CEO at all, and you only trust the engineers a little bit, right? And what she did, which I learned from her, I found very interesting, was the problem is that engineering team grows to be a certain size, you're paying salaries and other costs, and the burn rate for the team is fairly flat or proportional to the team size. But there's a big spike somewhere when you finally release the tooling out to manufacturing, and you've picked a time for that to happen, and it's a big number, right, I mean, when all of a sudden you spend $1 or $2 million in a quarter or two, that's a big spike. Okay. If you were supposed to spend it in the third quarter and it doesn't happen, your savings is in money. And when Susan saw you saving her money because it got delayed, she got upset because it's not really saving money because you're going to spend all this money until you finally do release it, because that money's going to get spent, it's just that maybe you lost a quarter or two and that quarter or two is extra money, right? So she would kind of ignore the schedules and other things, and she would pay attention, when does the tooling go out the door, because until the tooling goes out the door and comes back and it gets approved, there's no way the product's going out the door. I thought that was an interesting observation on her part. Ignore the engineers, what they say, and just follow what they do.

<02:11:34>

Hsu: I want to go back to the beginnings. When you founded the company, what was the vision, what was the mission statement of the company?

Page: I think something like make a great product for higher ed or something, you know, roughly.

Hsu: And why was higher ed, why was that the initial target?

Page: I think partly because the Mac had success. I mean, Apple had success, but the Mac had success with education, and partly because Dan'l was coming out of the Mac division and he was doing education at Apple. The team sort of had a higher ed focus. It seemed like a good place to start. Over time, NeXT really had sort of three markets it went after. The first was higher ed. The second one, which was finance, finance people around the world could afford the machine and wanted a faster machine, so it was good for those people. And then the third one, which was kind of interesting, was the agencies, government agencies.

Hsu: The three-letter ones?

Page: The three-letter ones of all flavors, yeah, because they got excited about the machine and they wanted it. One thing I liked about it, I thought was kind of cute, was when you can ship a machine into Langley and they buy it, but they won't ever ship it out, means that the only way it's going to get recycled is if it gets ground up. That's a good market, right? If your customer never gets rid of it and if it fails the only thing he does with it is grind it up, that's a reasonable market, I thought.

Hsu: Those two markets only occurred later.

Page: A little bit later, but pretty quickly after the-- I mean, I think that maybe the first two years or so was higher ed, and then started doing finance and agencies. I don't remember which was first. Those were both pretty good.

Hsu: So around '90, two years after Cube shipped?

Page: But they both could afford it and they both wanted a faster machine, so it was a good fit.

Hsu: What were the very first few years like?

Page: At NeXT?

Hsu: At NeXT.

Page: Well, we were busy trying to get the product done, and I guess the problem that I had was we were really only doing the one product. So there's no escaping that, right? There's no distracting Steve with something else because there was nothing else. And it was a lot like Apple, but a bit more friction because Steve was spending much of his money and eventually we got Ross Perot to put in some money, $10 million I think. And then much later Canon put in a hundred [million], which was interesting. I remember Steve and I both had a strong relationship with Canon and that's why we were able to talk them into making the investment, but the number one guy at Canon was Dr. Yamaji, and Steve had a relationship with Dr. Yamaji, and the number two guy was Tanaka, and I had a relationship with Tanaka, pretty strong. So I remember the four of us went to dinner the one evening, and we talked them into giving NeXT $100 million. Now the crazy part, but it was impossible, unfortunately we were in Tokyo, and I kind of thought since we're proposing that they invest the money that for the first time in our relationship

we ought to buy dinner for them, but Tanaka wouldn't let it happen. They just, no. So I don't think I could ever buy Tanaka dinner. The whole time that I worked with him I don't think it ever happened. I tried, but it just never happened. I just felt that one evening, you know, they kind of agreed to put in $100 million, I kind of thought that was the one time when we ought to be able to pay for dinner, but, no.

Hsu: Any stories about Ross Perot?

Page: Not too much. He was tied into Michigan, Detroit, and General Motors and EDS, and so I guess he was pretty well known in Detroit. One day, it was kind of funny, was the morning after the investment happened, so the next morning when it kind of hit the news, before 8 o'clock, if you were there and the phone rang, the receptionist wasn't there, and there weren't that many of us there, and when the phone would ring at 7 o'clock in the morning, you know, you just kind of pick it up and answer. And I remember somebody called in, and they were calling from the Detroit Free Press or whatever it's called, and the guy wanted to know, is it true that Ross Perot put $10 million into NeXT, and I said, yes, and then he says, "And who is Steve Jobs?" <laughs> And I was like, okay, let's see, Detroit's another world. I thought by then that people would know, right? That was funny.

Hsu: So how were the various features of the hardware decided on? So you stuck with 68000 family, you went with the 68030 instead of going to RISC--

Page: Later we did 040 then eventually we went to RISC.

Hsu: But you didn't go to RISC immediately.

Page: No, we looked at it. We seriously considered the MIPS processor for a while, and push came to shove we decided to stick with 030, 040.

Hsu: What reason?

Page: I guess probably we just felt it was lower risk and just more comfortable. The MIPS seemed like it was a little bit faster, but felt like it was riskier from a supplier point of view. I guess we trusted Motorola more than we trusted MIPS as a company.

Hsu: So it was that existing relationship that you'd had from Apple.

Page: And then eventually we did a RISC-based machine which was PowerPC-based.

Hsu: Some other interesting things about the hardware, there was the DSP built in. Where did that come from?

Page: I don't remember-- This is a little bit like which came first, right, the chicken or the egg or something, but Motorola had come out with the DSP56000, and Bryant Wilder was the GM and I'd been talking to Bryant, and I kind of got interested in the DSP, and then we hired this guy Julius, Julius Smith I

think, and Julius was interested in music and DSPs and all this stuff. Somehow we kind of decided, and Steve kind of caught wind of this, we had decided, okay, let's see if we can afford to add the DSP to the product. So I meet with Bryant, and I told him we'd love to include the DSP into the product, but we can't really afford it, and it was partly true, partly false, but partly I was negotiating. I don't remember exactly what he wanted to sell it for, but I think he wanted to sell it for something, let's say, close to a hundred bucks a chip or more. And I told him, well, that's like 4 or 5 times what we can afford, or at least 3x what we can afford, and I tried to convince him that it would be good for you if you put this in the NeXT product, because then everybody will hear about it and see it, right? So it took me a while to convince him, but he finally agreed, and then when we finally agreed to do that and on a price, he said, okay, we can do this, and I know when you announce the product it's going to go out the door as a DSP56000, but for the next year or so we can't have this on record that it's the DSP, or at least can't have the DSP56000 number on the product, and we can't even have it on the books that way.

Hsu: Really.

Page: Well, because they've got a computerized sales system, and if it's there on the Motorola books as DSP at this price, and anybody in sales can see it then he's going to have other sales people will say, well, I want my customer to be able to buy it at 40 bucks or 50-- whatever, you know, at some price, right? So Bryant says, I'll sell it to you at a lower price, but we can't have the world, at this point, know that's what's going on. So we've got to give it a different number. If you go back and look at an early NeXT CPU part, I don't know if you can see it from a photograph or not, but you'll see that it says where the part number should be, you'll see that it says 4154240200, which was our phone number. <laughs> Because Bryant asked me, well, we need a number to put on this. What number should we use? I was like, I don't know. And so like I gave him our phone number. How about 4154240200? Works for me. He's like, okay. So it was funny. Bryant was-- I really had a good time with him. The crazy thing though was I guess he got into work down in Austin like very late morning, and, you know, like 10, 11, 12 o'clock. It was like he was a software guy or something, <laughs> and he'd work all day long and well into the evening, and sometimes I'd get phone calls from him at home like at 10, 11, 12 o'clock at night, which was okay with me, but I'm like "it's two hours later in Texas." I was like, "Bryant, shouldn't you be going home?" He said, "Yeah, I'll go home soon." You know. The other guy I got to know really, really well was Tom Gunter. Tom was managing the entire 68000 team all the way from the beginning to the end, and he was very good. Only problem was being a GM of all those products he was pretty busy, and it was hard to interact with him. So if I wanted to talk to him what I had to do was catch him when he was first in his office in the morning. So I had to get up like at 4:30, 5:00 o'clock California time so that I could catch him, you know, 6:30, 7:00 a.m. in Texas, right when he first got to the office before he got busy with other things. And some of his guys, Doug and Jack and them, I would talk with them, and they knew that I would be speaking with Tom fairly often, and they would say like, "If you talk to Tom, could you give him this message?" <laughs> So they felt like there's a better chance I was going to talk to Tom than they were, you know, over the next few days, right? Which was crazy, you know. Sometimes people just get oversubscribed. It's really hard, you know. But anyway.

Hsu: The NeXT was, the hardware was marketed as having a sort of a mainframe architecture or a mainframe--

Page: From a marketing point of view.

Hsu: What did that really mean?

Page: Well, I think what Steve was trying to do was trying to say it's really, really fast and more powerful than everything else out there. And so he made the analogy to a mainframe, which I don't know if it was the best one, but that was the explanation, you know.

Hsu: I see.

Page: Eh. You know.

Hsu: Okay.

Page: I guess at the time it was reasonably fast.

Hsu: Another interesting decision on that first machine was the use of the optical drive as the only storage.

Page: So like I said both Apple and NeXT did a number of storage projects, and I don't remember how many we did at Apple and NeXT but a bunch, and I don't know what the odds of success were, but it was pretty high. I would say probably 80, 90 percent of the projects were successful, and we did two. I don't know if the world realized it, but we did two optical drive projects at NeXT. The first one was a Canon mechanism with a little bit of their electronics and then we did the rest of the electronics. We did all the CRC, you know, error correcting code stuff, and they did some of the low-level stuff. And then the second one we did from scratch, and that was pretty successful.

Hsu: The second one? Is that--

Page: Yeah. I mean, technically it was pretty successful**.**

Hsu: Oh, technically it was.

Page: Unfortunately, it was kind of late at NeXT. By the time it got into the product, NeXT was already was already kind of fading a little bit, but, you know.

Hsu: Oh, so wait, what year did that come out?

Page: '91 or '92.

Hsu: Oh, so that wasn't the one in the original Cube.

Page: No, the original one it was the Canon, the first Canon one.

Hsu: The Canon one, okay.

Page: But the comical part on the second one was, I hired two guys to start the project, and I think we started it in like '89. So we had worked on it a for a couple years before they got it done and finished it and got it working, and I hired Rick and Donish [ph?] to run the team, and they're both exceptionally good. But what had happened was I'd been talking to Steve for a while, and he was kind of pushing on me to get this going, and there was one point he was like, "Okay, we need to hire some people. We've got to get this going." I'm like, "Okay." <laughs> I heard it enough, because I guess I need to get going on this. And so I was about to start looking for some people, I had already kind of put out a few feelers, and then I go to one of the Tuesday staff meetings, and then all of a sudden we had this hiring freeze. As companies grow, sometimes then they have a hiring freeze, and then you take that off and then you grow again, and then maybe have another one, right? Occasionally good to slow down a little bit. So I go to the Tuesday staff and Susan announces there's this hiring freeze, and so I made a mistake and I stopped working on looking for the guys to run this team. And later that week, Thursday or Friday, Steve's asking me, well, if I made any progress, and I said, "No, I thought we had a hiring freeze." And he's, "That doesn't apply to you." <laughs> So, anyway. It happens. It's only two people.

Hsu: The optical drive also was kind of not fully reliable when Cube shipped?

Page: It was pretty reliable. It was a bit too slow.

Hsu: Oh, it was too slow.

Page: And the product really kind of came to life once the company had decided, well, if we're going to run UNIX on this, and we're going to be swapping, we can't really swap to the optical. We've got to have a small hard disk, and so the first product was sort of NeXT Cube with an optical as the minimum configuration. And then before too long we started putting small hard drives in there, and then that way you can run UNIX off the hard drive and use the optical more as a removable storage. So once we decided to include the hard disk as part of the product, the product was much better, but it also pushed the price up even a bit more. To minimize that we had a relatively small hard disk, and it didn't hit the cost too much, but it hit it, right? So I think the minimum hard disk was around 100 megabytes. Of course, people wanted more than that, but you had to have something just to kind of get it started with. I think something around 100 was the minimum, and that made like a night and day difference, because imagine swapping onto something that has a 20 millisecond seek time versus swapping onto the optical that probably had a seek time of 3-400 milliseconds. Optical was good, but not the best thing to swap to. That was kind of a misuse. <laughs>

Hsu: So the original Cube did not ship with the hard disk, or--

Page: Did not.

Hsu: Did not. Okay.

Page: And I don't know how long we shipped the optical only, but it was like 6, 9, 12 months, but we had hard disks in them at NeXT, but in the minimum configuration we were shipping it without the hard disk to get the price down. But we came to the realization this is really not very usable without the hard disk. So that's when we put in the small hard disk as sort of an accelerator for swapping and so. And then we had-- the other thing is you could get by with a single optical, but if you don't have the hard disk it's a lot easier with two. Or even if you have the hard disk, it's nicer if you had two, but that was also-- having a second optical was sort of an expensive addition. So the problem is there's making the product more useful and then there's having a low entry point, right? Where do you draw the line?

Hsu: How were those pricing decisions made? I mean, all these features-- You had mentioned there was a similar problem with the Lisa, right? All these features, they all drive the price up, the software is so aggressive that you need, that it becomes-- If you try to cut the price, and--

Page: I guess in reality both times what happens is you pick a price where the margins are fairly low but livable, and you start there, and you make the assumption over time that you can bring the cost of the product down, you know, and maybe hold the price. But the problem is if you have to add anything to the price to make it more usable, that drives the price up, and it takes time to bring the price of the product down. So those two things work against you, and I don't know if you can afford to-- you can't really afford to go out the door, you know, with the product at cost. Or you can't suddenly say, well, I'm going to build it for a dollar so I'll sell it for a dollar, on account you can't make it any cheaper to make money. You can't really do that. Otherwise you have the CFO saying, "You know, it would be cheaper to give them away." <laughs> She did that once.

Hsu: One of the issues with the first machine was that the schedule kept slipping. What was the reason behind that?

Page: Yeah. You mean other than Steve?

Hsu: I mean, well, why was it slipping because of Steve?

Page: Well, let's go back to Apple first. My impression, but like I said, I tended to be supporting and participating with the products, but not so much involved with getting the product out the door, right? Kind of helping them, but not so much on the front lines of getting it out the door, right? But I think every one of the projects at Apple, the way I remember them, they started with nine month delivery schedules, but Lisa took four years and Macintosh took four years. So I always kind of wondered about that, and at least at Apple I thought there were two reasons. One was I don't think Steve trusted engineering, and whatever schedule he agreed to with engineering, he knew it was going to take at least twice as long. So you might as well go with the shorter schedule with engineering, because if you give them a year or two then they're going to make it too long. I think that was part of it. I also wondered how much rope he was able to get from the company and the board. I kind of felt like, well, if he told the board we're going to have a product in less than a year then maybe they'd give him free rein, but if he said, well, we're going to have a bunch of people working on this for 2, 3 years, I don't know if they would have approved it, right? So I wonder how much of this was just him being optimistic versus him sort of, you know, trying to get free rein to do it.

You know, and at NeXT I don't think it was any different other than, well, we didn't have the cash cow of Apple paying for it. He tended to push both on hardware and software for more and more and more, right? So one thing I learned about at Apple about--and it applied to NeXT--is as you're working on the project you make a list of things that need to get done before you're done, and as early on in the project as things are progressing you keep adding to the list, but the amount of work just keeps growing and growing and growing. Eventually, you get to the point where the team's big enough, and you're making progress on enough of these things that you can start to actually cross things off the list, because they're done or almost done or something, and I think that was an important point that until the point where the project turns the corner on the list of-- If the list is just growing, you don't know when it's going to finish, but the point where it turns the corner, the list starts to shrink. Then you can at least start to say, oh, okay, I've got a shot at getting this out in six months, or eight months, or ten-- you know, but until it turns the corner you can make up all the schedules you want, and they're not going to be real, and the reason I joke and I said Steve's help, I mean, Steve wanted to always make it better, and he was always wanting to add things and change it and always make it better, and that-- and you can pretend it doesn't hurt the schedule, but it does. So, you know, fairly early on-- I mean, we nailed it down to 68K and Ethernet, and then we didn't have the DSP at first, but pretty early on we got the DSP added in, and so it got into the design pretty early, but, you know, bits and pieces kind of-- Nothing as big as the DSP later, but bits and pieces got added over time and all these things, you know, take time. The Ethernet was an interesting one. In '86 when we were working on the first NeXT computer, there weren't any really great single-chip solutions for Ethernet. They were all multi-chip and then a lot of them were tied to Intel x86, and there were one or two for the Motorola family, but they were kind of big and expensive and not single-chip solutions, and so we decided to do our own. So I hired a couple of guys to do our own Ethernet from scratch, and so we did 10 megabit Ethernet. First the thick coax and then the thin coax and then twisted pair, right? I don't think we ever shipped the thick to anybody. I think it was all thin and twisted, but we moved to twisted pretty quickly. About the time we took the product to market twisted was just coming on full-speed, so we switched to twisted pretty quickly. For me that was a very successful project, because we kind of hit it at the right time. Everybody wanted it, and we managed to make it part of the chipset at very low cost, because we built it into the big chips that we had. So after NeXT I started Sierra, and what we did is we did is 10/100 Ethernet, and I did it largely because after executing the 10 meg at NeXT, I was like, oh, a hundred's about to appear, we should do a 10/100 design, and we could hit the market in 1994 right at the right point, and the timing was perfect, and I felt comfortable we could do it because, you know, we had done our own 10 meg at the time.

Hsu: I do want to ask about the decision to put Ethernet into the NeXT. So the Mac had not really been big on networking, but at NeXT networking was a much bigger deal. Where did that drive come from to really make networking--

Page: I think because the machine was kind of a UNIX-like machine, and a lot of UNIX machines had networking as part of it. I think it kind of came from there, and so if you would expand the 3M machine definition, it probably needs to say megapixel, 1 MIPS at least, a megabyte of memory and a multi-megabit network.

Hsu: So 4M really.

Page: Really 4M. Yeah, I think maybe people weren't focused on it, but networking was an important piece. Now Apple, you know, the Mac had-- both Lisa and Mac had the SCC chip, and they had the 230.4K Appletalk, right? At a quarter megabit wasn't bad, but a lot better to have, you know, a large percentage of 10. If you can get 3, 4, 5 megabits through that's a lot better than 230K.

Hsu: The decision to make a system UNIX-based was made very early on?

Page: Yeah, I think so.

Hsu: Because of higher ed or was it other reasons?

Page: I don't know if it was tied to higher ed, but they went with-- I forget what it's called. They went from the flavor of UNIX out of CMU.

Hsu: Oh, with Mach, yeah.

Page: Mach. Right. So somewhere early on they decided to go with Mach, and then a bit later, not too much later, Avie joined, and he was at CMU I believe. So he kind of came in with it, so to speak.

Hsu: And so it sounds like a lot of the-- to what extent did the software drive the hardware design? Or dictate certain features needed to be there?

Page: Well, I don't think it drove it too much, but it tends to drive certain minimums. It ends up driving a certain minimum amount of memory and a sort of minimum amount of storage, and it really kind of drove the fact that because it was UNIX and it wasn't going to be completely in memory, then you're going to have to swap, and if you're going to swap the optical doesn't work out. So it really drove a certain memory size minimum. It drove, you know, the need for the hard disk. Unfortunately, what happens is software kind of drives minimums. Not too much way around that. But the world's kind of crazy, think about where computers were in the ’80s, you had a few megabytes of memory or more, maybe as much as 8 or 16, and you had-- could be bigger, and then you had hard disks that were hundreds of megabytes, and you think about how big software is today, right, and how much storage it takes to-- You can't have a computer with less than a gigabyte of memory, and if you have less than a hundred gigabytes of storage I don't know if you can have a computer, can you? <laughs>

Hsu: As the head of hardware, you were in charge of the hardware design, the industrial design of the outs-- like the packaging as you mentioned. What was involved-- You had all of these different hats, right? Maybe talk about all the different things that you were in charge of overall.

Page: So maybe this is really sort of a style question. So I guess it's intentional, but maybe there's a bit of luck to it. I ended up hiring a bunch of really good people, and one thing I've noticed in organizations is, I mean, it's really important that you hire really good people. If some people don't work out, and you have to replace them, which does happen, that's really expensive in the sense that you have the lost time with the first person, and then at some point you let them go, and then you don't have someone for a few

months, then you hire someone to replace them. I don't know that people notice it when they start companies, but if you ever have to let someone go and then you have to replace them, it's really expensive. If not only the money, it's just also the lost time. So I think throughout NeXT we had a lot of really good people, but I think the hardware team, you know, managed to hire a bunch of really good guys, sort of slowly, one by one. I hired Kevin Grundy early on, and Kevin turned out to be very, very good. Later I hired Jon Rubinstein out of HP, Colorado, and Jon ended up being very good. I had a guy, you can cut this later if you decide it's not appropriate, but I had a guy Ross Werner, I'll tell you this story about him. I really liked Ross, but Ross was a little different in the sense that Steve liked to have the offices in big open areas, and whether at Apple or at NeXT he liked to have like at least 30, 40 percent of the space be open, and so to try and rearrange the structure of the building so you had large open areas, so that you could have some tables and couches and people could sit and talk amongst one another and stuff rather than go into a conference room or something. He liked kind of that open feeling. If you came into hardware, I would say half the time you would see Ross was sitting at one of the tables, maybe with someone but often by himself, reading the newspaper, maybe drinking coffee or something, but, you know, he's reading the newspaper, and it was almost to the point where I'll jokingly say you couldn't catch him working. Now in reality I think what he was doing was he would sit there often by himself reading the newspaper, I think he was thinking about what he needed to do, and I think his style was until he understood what he wanted to do, he didn't want to go sit in front of the computer and go pound it out, he wanted to think it through in his head and then go sit down and do it, and then start up the simulation or something and then leave. And so he'd only spend like at most maybe a half of his time in front of the computer, maybe even less, maybe a third of his time. So he would go and bang, bang, bang, bang, bang do some stuff, start up something and then, you know, go back out, and he was--out of the 100 or so design engineers I had--he was probably in the top 5. I mean, he was very efficient, although it was hard to catch him working. <laughs>

Hsu: He was too efficient.

Page: He was really good, and at the end, I won't mention anybody, at the other end of the spectrum I had this one guy, and the poor guy worked so hard. He was working 11, 12, 13 hours a day, but--and he wasn't goofing off--but he just, he, I don't know, he just had a hard time getting stuff done. But Ross was remarkable, you know. Ross and Adam worked on the graphics card. You remember the NeXT Cube had the 3D graphics card? Ross and Adam and Lane, Phil, they worked on the graphics card. He did a good job. So what happened was-- I think what happens if you focus on the hardware team or software, if you focus on hiring really good people, then what happens is they fall into two categories: those that are so good they can do their job without much help, and those that need some help. Well, if the problem is everybody you hire needs help, then you're busy helping everybody. If you hire a bunch of people and some are able to do their job and not bother you, that's great. So I think what happened was I managed to hire a bunch of really good engineers, and a bunch of them were able to do their job, you know, without too much interference, and, you know, and some I had to help, and I jokingly tell people, your job in any organization is to do your job so well that your boss doesn't want to help you. If your boss wants to help you, it's generally a bad thing, especially if his name is Steve. At the point where Steve recognized you're not doing your job and he's trying to help you, it's generally not a good thing. Okay. So and the other thing was—I think if you've asked anybody about me at NeXT, or Apple for that matter, how's Rich? I think

probably the first thing they would say is, "Well, right or wrong, he's brutally honest." If people would ask me a question or want some guidance or want to know what's going on, I wouldn't sugar coat it. I'd just tell them, you know, exactly how it is, black and white, whether they want to hear it or not, right? Sometimes they'd ask me like, "When do I need to get this done by?" And I'm like, "Well, we signed up for x, so it needs to be--" Sometimes your job is just to remind people of what they signed up to, and sometimes that's hard, and another thing was I tried to adjust, I couldn't do this very well, but I tried to adjust my personality a little bit to who am I interacting with. So because if I was interacting with Steve, I'd have to sort of dial up the adrenaline and the energy with him, but when I left that I'd have to like try to dial it down. I tried to calm down, and the people that worked for me learned when Rich comes out of Steve's office it's probably a good idea to give him a minute or two. Don't hit him up right away, as soon as he comes out of Steve's office, because, I wouldn't mean to, but you might take somebody's head off, right? You've been yelling at Steve, and they say something, and you're like <makes a growling noise>. It's not a good idea. Anyway, it's funny.

Hsu: You mentioned hiring Kevin Grundy--

Page: Grundy.

Hsu: --Grundy, and also Jon Rubinstein. What were their roles initially?

Page: Kevin started off as a sort of a senior engineer, became a manager, became a director, because he was there very early.

Hsu: Working on--

Page: Working on the very first product.

Hsu: Right. Part of the first-- Part of the whole thing or--

Page: Working on the electronics, you know. He's an electrical engineer, design engineer. He had a little trouble moving from engineer to manager. It was his first time really managing people, and if you had a little bit of trouble-- how much does he do and how much do the other people do. When you're first managing people you tend to like try to do too much, and then that's often not the right thing to do because there's only one of you and there's five or ten of them and it's better if you help them than try to do their job. So it took him a while to learn that, but he turned out to be very good. By the time I hired Jon the team was already a pretty good size, and I kind of brought Jon in.

Hsu: How big?

Page: We were probably 50 plus, and so I kind of brought Jon in as a peer of Kevin's.

Hsu: To help manage--

Page: Yeah.

Hsu: I see.

Page: Because the team was getting bigger and bigger, and then-- At some point we should talk about the factory again.

Hsu: Yes.

Page: You want to transition to that now?

Hsu: Yeah, let's actually transition to that.

Page: Because the reason I say we need to talk about the factory is as part of that I'll tell you about Kevin in his role. It's no big secret that Steve had a hard time hiring senior people, and when we started the company we had the five of us plus Steve, but really nobody to run manufacturing. And so Steve hired a series of people, and he let most of them go in about six months or so. It varied. The last one was Randy, and Randy was good, and he lasted a bit longer than the others, but there was a falling out at some point, and, right or wrong, there was a point where he was no longer with the company. So then we're back at square one with nobody to run manufacturing. So a little bit like that session I had with Mike Markkula ten years earlier where Mike wanted me to help Henry, there's one Monday afternoon I'm talking with Steve and he wants me to do something, but I don't understand what he wants, and then after like more than an hour I realize, oh, he wants me to manage the factory in addition to hardware. Once I realized what he wanted, I kind of thought about it for a brief period, a minute or two, and I kind of said, okay, yeah, well, that makes sense, and part of the reason I said yes was I know that Steve at that point was just really frustrated with why can't I find someone to do this, and I sort of felt like if he found one more person and then we went through six months and then he got rid of that person, then we're back in this mode again in six months. It's not going to be good. So I was kind of like, all right. I know I can do the job. He knows me. I know him. We've been around one another for 10, 12 years. Okay. I'll do it, and if what it means is that I have to work a little harder so there's peace in the family, and then he can relax a little bit then this is actually better for everyone, because if Steve's not worried about the factory then it'll be easier on everyone. That was part of my logic.

Hsu: Were you concerned about taking on two jobs, because you were still managing hardware?

Page: A little bit, but not so much. So Kevin, so at the point where I took over the factory, Kevin decided-- Let me describe the factory to you. A lot of factories have lots and lots of hourly people. The NeXT factory didn't have so many. I mean, it had an operations team, but there were relatively few hourly people.

Hsu: Well, it was highly automated.

Page: Because it was highly automated. So the bulk of the people were materials engineering and ops, but even ops was mostly salaried people, a few hourly, but because it was so automated there were a lot

fewer people doing assembly and stuff and a lot more engineering and materials. And so since I was going to manage the factory, Kevin decided he wanted to run engineering for the factory, and at that point, you know, I trusted Kevin pretty well because he'd been working for me for four or five years at that point, and so that was a good fit. So he moved over. What?

Hsu: So you took over manufacturing in what year?

Page: I want to say it was like spring of '91 or something. I don't remember exactly.

Hsu: So it's long after the machines were shipping.

Page: Yeah. The machines were shipping, but things kind of fell apart a little bit, and we needed somebody to kind of take over the factory and pick it up and move it forward. Randy had done a good job, but some things happened and it just didn't work out. My main motivation was okay, I can do that, and then Steve will be happy and then everyone will be a little calmer. That was my logic. Yeah.

Hsu: And so Kevin--

Page: So Kevin moved over and ran engineering. I had Matt running Materials, and we had another guy running Ops, and Sam was doing testing.

END OF THE INTERVIEW

