Oral History of Steven Mayer

Interviewed by:
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Hsu: Hi. So, today is Monday, June 24th, 2024. My name is Hansen Hsu and I'm here with Steve Mayer and so, to begin with, we'll start with where and when you were born.

Mayer: I was born in St. Louis, Missouri in 1944.

Hsu: Thank you. Where did you grow up?

Mayer: I got my streetwise in Chicago to about age nine and then my family moved to Redwood City, California, where I grew up and until I went away to college.

Hsu: Okay. So, about what period of time, like which decade was that?

Mayer: So, I spent the 50s in Redwood City, California.

Hsu: Okay. What were your parents' backgrounds and occupations?

Mayer: My father would pick up insurance policies from San Francisco. In those days, the insurance policies were typed with multiple layers of carbon and he would pick up the insurance policies and deliver them to a home typist in Fremont. He would then return them to the insurance companies two days later. It was a form of off shoring and a gig economy in the ’50’s. My mother was a bank examiner and bank inspector for B of A in East Palo Alto.

Hsu: Oh, wow. Did you have any siblings or do you have any siblings?

Mayer: Nope.

Hsu: What were your parents' religious or political backgrounds?

Mayer: We had a split household. My father was a Republican. My mother was a Democrat. One of my earliest memories was sitting in her lap watching the McCarthy hearings being broadcast. They were both very secular Jews.

Hsu: Oh, okay. What were your favorite subjects at school?

Mayer: Well, my favorite subjects were outside of school. I would take my bicycle and go around the neighborhood and there would be ham radio antennas and then underneath every one of those ham radio antennas was a 43-year-old whose own kids thought he was a complete dork and I'd knock on the door and say "I'm going to become the son you never had." So, I started apprenticing with them.

Hsu: Interesting. So, that was your favorite hobby?

Mayer: It was a hobby and it was actually-- I'm much more of an informal learner. So, I actually learned technology that way. I became a ham radio operator when I was in sixth grade. In tenth grade, I had put a TV station on the air and in my room I also had a radio teletype. So, I would get the radio teletype transcriptions sent out by Mackie Radio to Australia and then I was able to watch and post the radio teletype printouts from the news corporations in the schoolteacher's room. So, you could watch and follow the whole buildup of the Vietnam War. It was an amazing experience. In those days, there were all these people working for Lockheed and other electronic companies that were willing to spend the time with young people and bring them into the trade.

Hsu: Oh, wow. What sorts of books or media did you read or consume?

Mayer: Anything about electronics. So, I started reading the trade magazines; back in those days ham radio had its own publications and then transistors were just first coming out. So, the companies that made transistors made training material. So, you could just read this material. These materials hadn't made it into formal education. So, there was large amounts of material for informal education as the Valley was bringing the engineers up from tube technology to solid-state technology.

Hsu: Great. Thank you. Did you have any influential teachers or mentors or role models?

Mayer: There was a fellow that I would go after school [to see] every day. His name was Farnsworth and he was a blind fellow that supported himself tuning pianos. He was a ham radio operator and he taught me a lot about electronics. He also taught me a lot about other very useful things. Like, if you turn on the hot water to make tea, if you listen very carefully, when the pipes would change to the right temperature, they make the smallest amount of a squeak sound. So, I got a chance to see the world a little bit through his ears. It's a mixed metaphor, but I think it works.

Hsu: And who were your heroes growing up?

Mayer: We had a family meeting when I was in the third grade when I decided to move from physics to engineering and my hero was Robert Oppenheimer. I was a weird kid.

Hsu: Okay. So, talk about going to college. Where did you go to college and undergraduate?

Mayer: There's an argument [about] how long I spent at Berkeley. I went to Berkeley in '62 and somewhere between '62 and '64, I dropped out. There's an argument between Berkeley, my parents, and myself as exactly when I dropped out, but I got very good at bridge during that period.

Hsu: Both how did you decide to go to Berkeley and what was the reasoning behind dropping out?

Mayer: Well, Berkeley was the default. The vision was MIT. But that didn't seem like a good fit for me. Berkeley had just a superb engineering school and at that time they were doing an experiment. It was called an advanced engineering placement, where you could take both engineering courses and liberal arts for the first two years. Berkeley was very political from the fair housing movement and the start of

Vietnam. I had been working on fair housing in the Palo Alto area while in high school. I was also working as a volunteer at a couple of PBS radio stations, and I was starting to make a documentary on the anti-war movement that was happening there and it was just-- for me, to work on physics problems that have been solved 100 million times, dynamic carts rolling down a ramp, versus working on real world problems-- I've always wanted to work on real world problems and see how I can make people's lives better. So, a formal education wasn't for me. Also, as I said, there was a phase transition when I first went to Berkeley. Electrical engineering then was about motors and fields and computer engineering was IBM 704s and punch cards and digital and solid state electronics just weren't part of the curriculum yet. So, a lot of what was happening that was interesting was happening out in the field. I dropped out and actually started work putting a TV station on the air, KCSM TV, in San Mateo and worked as a TV producer during that period of time.

Hsu: So, what was your major originally then?

Mayer: It was called engineering science, where you could take liberal arts degrees, but the engineering was 19th century engineering. By far, the most interesting courses there were sociology and psychology and that really helped me as I transitioned into working at Atari because people don't change. The play fields change, the rules are changed, and you have a computer that might be keeping score and becoming a play field, but all the dynamics and the motivation behind that people have been studying in psychology and sociology, it all was playing out on video games. So, I could take the classic psych experiments and then move them over to an electronic play field.

Hsu: Interesting. So, you mentioned you were politically active at the time. Did you take part in any protests or the free speech movement?

Mayer: I was mostly doing documentary work. I had the good fortune to be really, really bad at it. You save so much time in your life when the universe tells you "Don't do this." So, I discovered that doing the production side of things was just not me. I had a TV program and a couple other things, but my love was actually making the tools and turning the tools over to the real artists and the real communicators that could tell a story and so, my whole career, my whole life, is really making tools for storytellers.

Hsu: And what was your first experience with a computer?

Mayer: It was at Ampex that Al, Nolan, and I were all working. Ampex made videotape recorders-- and there was a division of Ampex that was bringing computers and video together for a document retrieval system. Other than this IBM 704 and the punch cards I used at Berkeley, the one at Ampex was a Love mini. The system we designed used small scale random digital logic circuits for control and a general purpose computer for data matching.

Hsu: Okay. So, you mentioned-- so, after you dropped out, you were working for a radio station or...

Mayer: Well, a radio and TV station, KCSM, was just going on the air and I had the professional licenses for putting the station on the air and I'd work cheap. So, those were the main qualifications for working

there. It was great. So, once the equipment was on the air, then I would alternate doing some television production, some tech work, and a little bit of teaching.

Hsu: Okay. So, talk about how you got from there to Ampex.

Mayer: As I said, KCSM wasn't paying much of anything. I went to Ampex, which in those days, was one of the premier companies in the Valley. I went into the HR department to take a job. They were looking for technicians and a woman in the HR department took a liking to me. Her tape recorder at home wasn't working. So, she said could I come over to her home and fix her tape recorder. I did, and she said "Look, you're great and stuff. I'm not going to put you on the assembly line. I'll get you a job as a technician in the engineering department." So, my entry was into the videofile R&D department, As I said, digital was first coming in and Ampex was a bunch of analog engineers. They were all in their ’40s, ’50s, and ’60s with swizzle sticks and pocket protectors, the digital was coming in and they would say to the young people "Here's the manual. Figure this out.” Ampex had a long history of this. Ray Dolby, when he was in high school, used to bicycle over to Ampex and work there before he went off and founded Dolby Labs. Steve Allen used to bicycle over there. So, Ampex really just turned things over to young people and really encouraged them. The senior people, their felt a part of their job was to teach the profession of engineering, what it was to do quality work and to be responsible. But the technology, the young people could figure it out.

Hsu: And what year did you start at Ampex?

Mayer: That was around '66 and Ampex had got a program for a large document retrieval system and so, by a series of defaults, I became the project manager for this large project for Ampex and by coincidence, I worked with Bob Miner and a fellow that came in just after I left and that was Larry Ellison, who both picked up this document retrieval system. They started a company based on some of what they were doing at Ampex… ORACLE.

Hsu: Interesting. So, that was the main project that you were working on at the time?

Mayer: Exactly. It was, at the time, a large project that tied 12 police stations in the LA area and you could do remote fingerprinting of suspects. The images were sent into a centralized database. You could do matching of the Henry codes of the fingerprints and send the information back out to the local police stations before the people were released or booked.

Hsu: So, this was all done using video technology?

Mayer: It was primarily video because it was an analog technology but kept a digital time track and digital track on the videotape recorder so we could access individual frames. So, each video frame was a fingerprint.

Hsu: Interesting. So, you mentioned several people that you met at Ampex. You mentioned Larry Ellison, Al Alcorn. So, talk about meeting all the people that you met at Ampex.

Mayer: Well, Larry came in just after I left. I'm not sure of this, the exact things, because Bob Miner was still there. We were starting to put in larger databases for searching the videotape recorders based on the time codes and I think Larry came in. IBM had just developed, I think, the SQL database languages. So, Larry really, along with Bob Miner, took the lead on that. This was just after Al, Nolan and I left. Larry and Bob worked on the SQL data base at AMPEX and went off to start Oracle. I think Oracle-- I heard that ORACLE was the name of the project at Ampex: Object Relational Something Database for Law Enforcement. So, that's how the Oracle name came out. I haven't been able to verify that in history. So, if you run into Oracle people, I'd be curious.

Hsu: So, talk about meeting Nolan, Al Alcorn, and Ted Dabney at Ampex.

Mayer: During lunch times, we would all play games. We'd play Go, pinochle, Kriegspiel, chess, and any other possible games. So, there was a small group of us, maybe half a dozen, that played the games. Nolan was really the number one games player. I was a bit of a games player. My main contribution during those days was Nolan wanted to do an implementation of the MIT game Computer Space as a G-job at home. I had some extra IC chips from the Los Angeles Sheriff's Department project. So, I got him some parts for his project. Originally, he was going to do this using a small minicomputer and Larry Bryan was going to be a programmer for it, and he was going to do Computer Space, but the economics of that didn't work out. So, Nolan did Computer Space as essentially doing a hardware random logic of the game and he did that during the off hours. His goal was put the game on location as a revenue generating arcade piece that could be produced in volume. There were a group of us that were following his technical and later business progress. We had respect for Nolan as the tops in our group as a game player but we didn’t envision a commercial market for electronic games.

Hsu: Interesting. Al Alcorn, you met him around the same time?

Mayer: Yes, I believe that he was at Berkeley, and they had a work-study program. So, he was spending time at Ampex doing the work-study. I don't think Al ever went back to finish up at Berkeley. He just fell in love with what he was doing at Ampex. Nolan, being Nolan, came in there as an engineer. This was his first job in engineering and he had been at Ampex for six months and he went to his boss and said "As a career move, now that I've done engineering, should I move into marketing?" That was typical Nolan.

Hsu: And then you also met Larry Emmons at Ampex?

Mayer: Yes, Larry was more on the analog side, the cameras and monitors. We both didn't enjoy living in the [Silicon] Valley. So, there was a company called Grass Valley Group up in the hills of Grass Valley California that was doing video technology. Grass Valley was rural in the low Sierra mountains. There was a spinoff company called Arvin. Instead of having the Silicon Valley commute and a tract home, I could get 20 acres of land and build a small house. So, from a quality of life standpoint, I went to Larry and said "Look, this Arvin company is completely whacko, but let's go there, up into the hills of California, and we could survive doing some consulting and start our own company.” I went up to Grass Valley with Larry, and we started our G job of doing a read-write video disc using videotape technology. We were surviving doing small engineering contracts while we developed our product. I came to see Nolan to see

what he was doing-- by this time, Nolan had already left Ampex to do Computer Space with Nutting Associates, and he had already started the second company, which was Syzygy with Al. Nolan said "Schmuck, what are you trying to do this hard stuff for? First of all, it's hard, and second of all, even if you've got it working, no one's going to care." In a moment of brilliance, I said his business plan was better than my business plan. So, I ripped up my plan and that moment of insight and brilliance was matched with an equally ridiculous moment because he said "You could either work for a 5% commission or a salary of $25,000 a year," and $25,000 a year sounded like an awful lot of money. So Larry and I agreed to make our company part of Atari and work for $25,000 a year. So, he gave us first a couple of projects to work on. One was called Radio Controlled Pong so that you could be in a bar and sitting at a bar and control a Pong game that was sitting above the bar and then I did a really bad game called Gotcha, but Nolan and Al stuck with us and offered us a full-time job and the concept was that Al, really great engineer, but he was right next to the factory and this factory kept saying "Feed me, feed me, feed me." We wanted to have an R&D arm that was a couple of hours' distance ride so we could still work with the factory, but we weren't spending all our time being eaten up by factory problems. So, we became the advanced development arm for Atari and reported first through Al.

Hsu: Okay. So, where exactly is Grass Valley located?

Mayer: If you draw a line between Sacramento and Reno, it's about a third of the way up there. It's in the low foothills of the Sierras and it's in the gold country at about 3,000-foot elevation.

Hsu: Wow. Nice. Did you know or interact with Steve Jobs or Steve Wozniak at any point?

Mayer: Sorry. Yeah. Al will give you the amazing stories of Steve coming in and how he got hired to work on Breakout and all the other games. So, Al's the keeper of that story. But occasionally, the two Steve's and I would meet in the lab and talk after hours. Since I had brought in the 6502 microprocessor to Atari and Woz was in love with that and things like that. So, we got to know each other during that period of time. Where I really got to know Steve Jobs was after-- when I went to New York. Atari was bought out by Warner, I started the central research facility for Warner Communications. Steve Jobs had come to New York City to roll out desktop print publishing. He invited me to the roll-out. I saw the opportunity for desktop video publishing. So, he and I spent a lot of time talking about that. Atari was about ready to completely crater in. So, I arranged to spin out my lab from Warner as a startup and move it out to Silicon Valley and Steve Jobs had arranged to give me a contract to do desktop video publishing for Apple. While my whole lab was in a U-Haul truck coming out, Steve had been just kicked out of Apple. We arrived in California with my company in a moving van to that news. During that time, Steve and I talked about whether I wanted to be part of the founding members of NeXT Computer. But I was committed to doing desktop video publishing. So, I passed on that. But we maintained really good connections during the NeXT Computer days and also when he was buying Pixar. I was there with him on that because I was looking to buy oundDroid at the same time to be part of my desktop video project. Later on, when Steve went back to Apple, he asked me if I wanted to first help him on Final Cut Pro and then whether I wanted to be chief engineer of Apple. I knew enough about Steve that he would just eat me up. I'm too much of a pussycat for him. So, I said "As much as I like what you're doing, that wasn't going to work out." My last contact with Steve was in 2002, a screaming match. I tried getting him to do a telephone, and he said

"Over my dead body, Apple will never do a telephone." But that was classic Steve in the sense that I had this image of what it might be. But Steve had the sharpest Occam's razor of anybody. Unless he could grok every part of it, if everything wasn't ready to happen, and if he couldn't see the whole thing, why spend one microsecond of your time thinking about stuff until it was ready to happen? I didn't have the human interface worked out yet because the multi-touch hadn't been worked out. So, mine was going to be-- the idea was to use voice as the interface. Also the carriers weren't very good at that point. Apple was just introducing AirPort [WiFi]. So, it was going to be a thin client off of your Apple computer on your desktop and it would be a portable phone that you could use around your home or around your office. But it wasn't something hooked up through cellular because cellular just didn't have the chops at that time for it.

Hsu: Wow, fascinating. Yeah, that jumped a little bit farther ahead than I expected. Let's go back to the ’70s. So, talk about how did the VCS project come about?

Mayer: Atari was based on location-based entertainment, coin-op machines. Al realized that the intersection of semiconductor technology allowed [one] to take Pong and do a custom chip. In those days, doing a custom chip was an incredible amount of grief. You had to mainly print out the floor plan of the chip and there was no real CAD/CAM. You had to just check things out and it was really hard. So, he did the first consumer version of Pong that was successful at home and then we had another couple of games that were coming out, Stunt Cycle and others, and he had to do a custom chip for that too. Each one of those custom chips was just a lot of work. It wasn't scalable. I had seen the HP calculators, the 35 and the 45. Inside the HP 35 and the 45 were the same silicon. They would just change the ROM to say whether it was going to be a business or an engineering calculator. So, my original idea was you could just change the ROM, an internal ROM, and this could be one game versus another game. So, the initial concept was not with interchangeable cartridges. That only happened a couple of weeks into the project where we said "Okay, let's put the cartridge connector on the outside." The hard thing of the project was you had to hit a price point at retail. Pong at Sears had set a price point of $189. So, if we were going to do the VCS, what can you do for $189 and that might sound [like] a lot of money, but if you take $189 and you say Sears is going to get the top $70 of it and then you have to allow for profit of Atari and shipping and this and this and that, then the microprocessor could only be about $10 and the graphics chip could be only about $8. So, that was the budget. So, we had a paper design of what this might look like, but there was no computer chip that could meet our performance and our price standpoint. In order to do the chip also from a graphics standpoint-- normally, frame buffers were sized to store a complete picture containing all the information. The amount of memory is the number of picture elements for each line times the number of lines vertically. We couldn't afford all that memory. The VCS, including all the memory for graphics, all the memory for the computer stack, all the memory, working memory for the games was a total of 128 bytes because we were in such a tight cost constraint. My co-inventor of the VCS, Ron Milner — he did primarily the sound part of it while I did the video part of it — went to a Wescon show. MOS Technology and Chuck Peddle came out with the [6502] chip. It just barely hit the price points and the performance points that we were looking for in the white paper. He was selling the chips by the barrel full. I didn't realize he only had one barrel of chips in the whole world.

Hsu: This is the 6502?

Mayer: This is the 6502. So, Ron and I quickly came back, got one of the chips, and over six weeks we built the prototype of the VCS. We showed it to Al and Nolan and I programmed maybe the first half-dozen benchmark games to show the range of what could be done on the system. Then Al was going to take over the project. One of the great inventions of Atari at that time was that there's always a problem of "How do you move a project out from advanced development into engineering?" because there was always "Star Wars" followed by "The Empire Strikes Back." So, we brought in a technician, a young engineer, Joe Decuir, and he came up to speed on the project. We shipped the basic design with Joe Decuir, who had grokked the essence of the project. Al put together a wonderful integrated circuit design team. He also worked with MOS Technology to find second sources of the chips. He first tried seeing whether we could use one of the main sources of chips. So, Intel wouldn't do it for the price point or the performance point and Motorola wouldn't do it. So, we were only had MOS Technology. So, Al arranged for multiple sources and did all the back work to turn it into a product. One of my favorite cartoons was in The New Yorker. It's two beavers at the foot of Hoover Dam said "Well, I didn't actually build it, but I had the original concept." So, the idea is-- and we really had that at Atari-- is no one person could build it. It was handing the baton over to the next people. Handing the baton over to Al, you knew he was going to take it and do an incredible job with it.

Hsu: Wow. Could you talk a little bit about the design of the Stella chip?

Mayer: So, the idea was that-- it was how you could cut the cost down. We couldn't afford memory. So, the idea is we were going to invest with the fastest microprocessor we could possibly do and then lock it tightly to the TV screen. So, if you think of the world now in supply chains, if you wanted to have a large warehouse, that would cost you a lot of money to have store the inventory. Keeping up with the a TV set that kept saying "I need lots and lots of information very fast," you either had a lot of memory where you could store all of that information that the TV needed to display, what we did is we locked the microprocessor to the scan rate of the TV so that the microprocessor during the horizontal retrace could figure out what needed to be displayed on the next line. So, it only had to keep one line of information. So, the amount of memory instead of being a two-dimensional matrix, which uses up lots of storage pretty quickly, it was only a one-dimensional problem. But it had to be a microprocessor that could figure out from a gameplay standpoint and a graphics standpoint, everything that needs to be displayed in those 50 microseconds. We had pioneered the idea of line buffers in our arcade games. So, one of the advantages of Atari is that we had location-based entertainment, where we could prove out technology at a different price point and also, more importantly, we could try out game concepts and people paid a quarter to fill out our questionnaire of whether it was a good game or not. You just count the quarters and say "This is a good game." So, we were already up to speed with the technology. So, it's how you can match that technology to hit that incredibly tight price point.

Hsu: Okay. So, that chip, what became the TIA, that was primarily designed by...

Mayer: I did the video part of it and Ron did the audio part of it and we implemented it with off the shelf logic chips. Then we could give the medium-scale integration the equivalent of maybe a chip that would have maybe four gates in it or a four-bit counter and we would then send that to Joe Decuir and Jay Miner who would then turn that into a transistor implementation and then to a chip layout implementation of that.

The advantage of the whole project was by just incredible serendipity; we didn't have the time and the money to over-design it. So, it was such a minimalist design that it played not only the games we knew about, but even four years later, it could do the games that were coming along like Space Invaders. If we had had a larger budget, we would have over-designed it, and it wouldn't have been nearly as flexible. But the idea of having a fast microprocessor tied to the TV screen, no operating system, nothing else, it allowed the future programmers to work with essentially microcode and do their magic. Okay. The Stella chip was a custom layout chip. I think it had-- Al could probably give the exact number-- but it was the equivalent of maybe 70,000 gates. The RAM that we had external to the chip was 128 bytes of RAM that was divided sort of half for the computer stack and half of it to do the gameplay and the graphics creation. The memory cartridge, it had a read-only memory, but the memory cartridges could be either 2K bytes or 4K bytes along the way, which was the state of the art. The chip costs were set by the number of pins as well as the number of gates that it had. So, we were incredibly limited to how many address lines, how many data lines. So, we were fighting the technology, fighting for every cent that we could do to hit this price point.

Hsu: Right. So, how much did the chip and the RAM cost at the time?

Mayer: The microprocessor, I think, originally was a little more expensive. I think it might have been $12 and then it had to get down to $8. I think the TIA was maybe $8. So, I think we had about a $16 budget for all the silicon.

Hsu: And 128 bytes of RAM, how much did that cost?

Mayer: That was built in to the-- there was a chip that came with the MOS Technology that included I/O ports and a few other things. So, we had the choice of either having more RAM or less RAM. The one thing that limited us more than anything else was the cartridge connector. We never brought out more address lines to the cartridge connector. So, it really wasn't that expandable because our idea was it was only going to do a couple of-- a small series of games. It was going to last in the marketplace for a couple of years and then we would go on to the next thing. The longevity of the VCS was a complete surprise to us. A lot of the success to that was not because of Atari being great. It was Atari being lucky. So, the first part of the success of this was that Atari was always short of money. We built the company collecting quarters and using that to pay our distributors for parts. When it came time to do consumer, Sears provided us the original money so that we could do the consumer Pong, but to do the VCS required more money and our business model was always to be bought up by Disney, but Disney never wanted to buy us out. When we had the VCS prototype, the people at Warner-- because they had Warner Movies, Warner Records, and stuff like that-- that was hitting their sweet spot. They could understand record players and records. So, they saw what this might be and that's when they got interested and that's why they bought Atari. They gave us the money to scale up doing the first production. But also, they were also smart about licensing deals. So, until Space Invaders and games like that, all the games that we put out on location and for the consumer were all games that were designed by Atari and the Atari engineers. But now that Japan was bringing out amazing games with an entirely different sensibility, they were opening up whole new segments to the game-playing industry because of the Japanese sense of fun and graphics and things like that. The Warner people understood that they could cut a deal with the Japanese

manufacturers for the home rights to these games because we had the only platform that could play those home games. Because, for the key early days, we had the only programmable platform, we were able to get the licenses for Space Invaders and all these great Japanese games that came afterwards. So, it was a change of movement from being our own internal technology company to being a company that took advantage of Warner's understanding of markets and advertising. So, the games that we knew and the industry we knew could get us the first couple of hundred thousand VCS sales, but it was Warner coming in and the luck of that that took us into being a world phenomenon. Atari became the fastest-growing company in the world at that time. We had name recognition second only to Coca-Cola and I think 80% of the ROMs in the world were going into our products. It was just an incredible ride.

Hsu: Wow. Talk about how-- why was Sears such an important distributor?

Mayer: People now don't appreciate it, but Sears in those days, if you were to wrap Amazon, Walmart, and the internet and put them all together, that's what Sears was. The Sears catalog that they mailed out, which was about 1500 pages, was the shopping catalog of the times. About half of all Sears' sales were through the catalog. They were the premier distributor. So, it's hard to imagine what influence they had. You could buy from Sears, not only the Craftsman tools, you could buy whole homes that were kit built. You could buy ducks and they would mail them out to you. It was the whole world in shopping.

Hsu: Wow. Yeah. It's difficult to imagine these days.

Mayer: Yeah. Then for Sears, for them to put us on their catalog and on the back page of the Christmas catalog to go out-- there was no consumer electronics like we know it here. They essentially created that kind of catalog and because of them and because of Atari, we moved consumers and software to the Silicon Valley. So, that's one of the reasons why Atari became not only successful, but we created a benchmark for the venture capital community and the spinoff communities to open up software companies that could go direct to consumer. So, when you think of all the internet companies that came out of the Valley and the VC companies, they wouldn't invest in companies like ours in the days when Atari started. They would invest in Intel. It was engineers in black ties and white shirts or bio-tech companies. It was hard technology companies. So, a consumer company, an entertainment company, was just so out of their strike zone.

Hsu: But I understand that there was an investment from Don Valentine at Sequoia?

Mayer: Yeah. Don, he took the risk with us. He got us some investments early on, relatively small in the couple of million-dollar range. But he helped keep us going along the way. Nolan and Al can talk more to that. As a side note Al and Nolan introduced Jobs and Wozniak to Don; and also, Al introduced the two Steves to Synertek for the 6502 processor source for the Apple products. So, we, primarily through Al and a bit through Nolan, helped Apple get started through those contacts. But it was alien stuff to the Valley at those times. It was a strange culture match. I wasn't there at the meetings. but as Al tells it, the Sears people came out to see just what they were going-- they were going to write a contract for a couple hundred thousand of these VCS-- of these consumer Pongs to this strange company. So, they came out to visit the company to do their due diligence. So, they came out at eight o'clock in the morning to visit the

factory and what do you see at eight o'clock in the morning in Silicon Valley? Either empty parking lots or people, programmers that were there from the night before. Ten o'clock, the people from the factory and the front office people started wandering in and it was just a strange mix because the Sears people were in the suits and the Atari people were in the blue jeans. As Al and Nolan tell the story that they agreed to the Sears people to come back that night and by the time they came back that night, the Sears people had bought blue jeans and the Atari people had bought Sears suits. But it was a Sears, at that time, that was willing to take the risk. The unsung hero of this whole story was a buyer at Sears named Tom Quinn, who's recently passed on. He staked his whole career on this Silicon Valley company that had virtually nothing and for him to commit for a purchase order for a couple hundred thousand consumer Pongs, to commit the Sears back page of the Christmas catalog, to arrange for a line of financing for Atari, because we couldn't build those couple hundred thousand units based on our financing. He was one of the great heroes of the story.

Hsu: Okay. So, I wanted to hear more about designing the Combat game.

Mayer: So, the original white paper that I did of what the VCS had to do, it had to play Pong, the four-player called Quadra Pong. It had to do a tank game, where two tanks could go around shooting at each other through a maze, and a flying game. Our concept of thinking of what a Sears ad might look like, it had to do 50 games in the first cartridge. They were all mind-numbingly similar with small changes in the graphics, but we had an idea of what the ad was supposed to be-- 50 games for $189. So, I did the first cartridge to just see how far you could do it. So, each game could only be maybe 50 or 100 bytes different from the next game and so, it was all about quantity and not quality. I think that when I sent the cartridge down, they recoded the cartridge, but it was really a proof of concept of what the game could do. It was straight out of the chute. We had no idea at the time that a clever programmer could have it play chess, for instance. The idea of 128 bytes for everything to play chess-- it wasn't a good game of chess. It was more of like the dog playing chess and people said "That's amazing, the dog plays chess," and you just said "It's not so amazing, it always loses." But we wanted to explore, at least to give-- as we sent the unit down to Sunnyvale for programming to see what it might do and to see their imagination of what was possible.

Hsu: So, you mentioned Sunnyvale. So, was that where the main Atari campus was?

Mayer: Exactly.

Hsu: Okay. So, I wanted to ask about how was the Grass Valley R&D Center-- how was it managed or how was it organized, and then how was the relationship between Grass Valley and Sunnyvale or the larger company?

Mayer: We were mostly around 10 to 11 people. My partner, Larry Emmons, who [together] we founded Cyan Engineering, he did primarily the administrative. He was also a superb analog engineer. We started out mostly as equals, but because his expertise was more in the analog side and the world was going digital, he took over a lot of the administrative stuff. I thank him for that. There was one other engineer, Ron Milner. He and I would do primarily the digital things. Then we had a couple of technicians for

building the prototypes. We had somebody that was pretty good with sound and somebody that was pretty good with graphics and we had a layout printed circuit board designer. So, that was Grass Valley. We reported in first through Al Alcorn and later on through Steve Bristow. Once a month, either Larry or I would fly down because Larry and I both had airplanes and we would fly down to visit the company or Al, who also had an airplane, would fly up to Grass Valley. Once every couple of months, we would all meet together and kick around ideas. Nolan was more the game idea and businessperson. He was also the rooter for new things. We would come up with ideas for games and Nolan would say yes or no. By this time, Al, who was a superb engineer, just had this factory and his engineering team to feed. So, he really didn't have much time to do hard engineering for himself, but his love was chip design. So, when the opportunity came to do a custom chip, the first custom chip for the company, he took that on as a project. But mostly, we would build a prototype or a model, a wire-wrapped model, we would send it down to Al's team, who would do the final engineering on it and put it into production. So, our job was to come up with new game designs, but mostly to push the architecture and to incorporate new technologies. So, we did the first driving game and the first driving game had a ROM memory in it. So, that was new to Atari and we were able to solve the vehicle dynamics equations using a model of using additions that Howard Gardner used in Scientific American for solving differential equations by just doing successive adds. Ron did the first gun shooting game with an optical gun. So, we would try bringing in new technology. When the first microprocessors were coming out, the Intel 4004, you couldn't keep up with a video game. So, we modified a Bally pinball machine and showed how we could replace electro-mechanical technology for doing pinball machines and that became the basis for Atari getting into the pinball business. When the Motorola microprocessor came out, we did the first arcade game using that technology.

Hsu: Wow. Something that I forgot to ask about earlier is were you aware of the Fairchild Channel F while you were working on the VCS or were these independent?

Mayer: That was completely independent. I didn't hear of the Channel F until the Consumer Electronics Show where we introduced the VCS. The only thing I knew of, while we were designing the VCS, was the Magnavox Odyssey, which was an analog device that had limited capability. The very first video game that I know of, Winky Dink. Do you know about Winky Dink?

Hsu: No.

Mayer: It was in the 1950s, early 60's. You put cellophane over the tube of your TV. There was a live action and cartoon TV show, and it could say "Can you help Winky Dink?" So, you take your marker pen on the cellophane and mark it on the screen of your TV. The kids, when they couldn't find the cellophane, would just mark it on the front of the TV. So, the Fairchild-- I only became aware of that later on, I think, when the patent issues started becoming an issue. So, I don't know whether Al knew about the Fairchild or not. Al is the greatest engineering manager I've ever seen, knew how to protect us and just say "Go ahead and design," and he would give us enough information so we knew what we needed to know and how it would fit into the company and not so much information that would slow us down from doing the inventing.

Hsu: Earlier, you mentioned the games coming from Japan, like Space Invaders. Could you talk about how Atari responded to the competition from Japan?

Mayer: So, two things. One, Atari had its own DNA. So, the games that we did tended to be driving games: driving on the ground, flying through space, things like that, and soft shooting games. We tend not to do violent games, but that was in our DNA. The Japanese, I think partially because of their history of anime and things like this, particularly Nintendo that had been doing cards for 80 years or 100 years, had a much better sense of fantasy games and role-playing games. So, Atari never competed at the location base with those kinds of games. When it came time that these games became super popular, that Manny Gerard, who was the president of Warner, actually licensed the games for the home market, and that turned into a really tough conversation with Sunnyvale engineers. The Sunnyvale engineers are saying "You're spending the money for these outside engineers and these games," and Manny said "If you gave me those games, I wouldn't have to do it." So, it was a really tough, tough time for it and it exacerbated the split between Sunnyvale and the engineers there and the Warner people in New York. There was a strong cultural difference between the two. Manny and Al tried bridging that difference, but it was really hard and by this time, Nolan had left to enjoy the richly earned rewards of Warner buying Atari. So, he was out having a good time and starting some other companies. So, we lost the keystone of our cultural DNA, which was Nolan. Al did as much as he possibly could to hold things together as I, Steve Bristow and others, did— We tried as much as I could also, but without Nolan there-- and Atari was moved from a niche company doing some location-based entertainment and doing a little bit of consumer, into a really significant company that was doing billions of dollars a year in business. I think more than half of Warner's bottom line came from Atari. So, it was no longer business as usual of a bunch of young engineers having a good time. The days of: “it didn't work, so what?” were gone. Then also there was a major shift where "What was the value added?" From an engineering company, the Atari DNA was the value added was the Atari engineers, the Atari creativity, the Atari game developers, and now the value added was licensing games from around the world and marketing and we were bringing in people, product managers, and so, it was a very tough cultural shift.

Hsu: I just wanted to clarify-- what do you mean by location-based games?

Mayer: These are arcade games. So, they would go into supermarkets, bars, 7-Elevens, Greyhound bus depots, and they were-- you put a quarter in them and they were controlled by local zoning, where you could locate the games and that was the start of our company and allowed us to pioneer new games and new technologies at a $1,000 to $3,000 price point and with different expectations and we could see what worked and didn't work and then we could then take the best of those games-- so, those were like the movie theaters and the multiplex theaters and then based on that, they could then go into the home with the VCS.

Hsu: So, yeah, we were talking about the changes to the company after the Warner acquisition. Is there anything else you would like to expand on that? Maybe discuss the leadership style of Ray Kassar, the new CEO?

Mayer: So, Ray came in-- he came from a marketing background. He was selling cotton and linen shirts. He understood marketing, and he could take a product that was well-established and take it to the next level and the next level beyond. But neither Ray nor Manny Gerard had the experience of technology changing. When was the last time that technology changed in the movie business, in the record business? It didn't happen that often. Nolan was surprised by the VCS. He thought it would only last three years and then Atari would replace it. It lasted longer than that because of the Japanese games. When Nolan left, Al and I tried explaining to Ray and to Manny that technology changes. You go through generations. A 7-year-old is not the same as a 14-year-old or the same as a 21-year-old. A 3-year-old semiconductor technology is starting to get long in the tooth. But Ray and Manny brought in all these people from Procter & Gamble. When was the last time that Crest changed a formulation? Their idea of a major change in an industry is Palmolive going from a 42 share to a 44 share. So, for them to understand that it could go from 100% to zero or to actually negative, we had quarters where our gross revenue was actually negative because more stuff was coming back than we were shipping. They didn't understand that the world could change that much. But Nolan, Al, and myself, we understood these things. But neither Al nor I had the skills how to communicate that to the Warner people. Atari was just so successful. Why listen these Cassandras saying everything is going to change? Al and I could look in the labs and you could see what was going to happen. You look in the labs and you know what's going to happen two years from now. We'd been around long enough to also know when the salespeople renegotiate their sales contracts, you know something's happening in retail: because the salespeople are smart. They're not smart on semiconductor design, but they know what's happening in retail. But it was hard for Warner to understand this. They saw this as a product that would just keep going on and on and on. They had never gone through what it was like to introduce a whole new cycle, a whole new platform. Nolan came back to try connecting with Warner, but Atari was a very different company by that point. So, he didn't have the creds anymore to establish the original DNA. So, those of us that had been around from the beginning tried holding to the old Atari, but it was not going to be an easy battle.

Hsu: So, I understood that you got a new title under Warner?

Mayer: A bunch of titles. I still kept my title at Atari as a senior VP and things like that and tried helping out the divisions there, but I started a central resource facility for all of Warner. Warner was doing records, movies, and other media and entertainment companies. The idea of the lab was based on the RCA and the CBS model of labs. I had this idea that I could come to New York and come there with the Atari magic and change all these operating divisions. I didn't understand that while I thought I was going to be an asset to all these other Warner divisions, they saw me as a cost center. So, from my standpoint, it was really great because I got a chance to meet with the Warner publishing people and to understand book publishing from the 1400s, the movie people, the record people, and I got a sense of video games as a new publishing and a new storytelling medium and the first one that had really come out since the early 1900s. Print, really change in ther mid-1400s, and started really coming into its age in the 1500s. Movies and records, started in the 1870s, and came of age in the 1930s. You look at "Steamboat Willie" in the 1930s. The Disney people that discovered everything Atari rediscovered about storytelling with animation. So, I started seeing how what we were doing was rediscovering-- it's always about a good story well told. The tools are different, the technologies are different, and… there's the famous quote "We form the tools and then the tools form us." So, having the opportunity to be a tool builder for these new platforms was

great and I could see the new stories that could be told. But Atari was just churning money like mad. The hardest thing in the world is to convince people that the world's going to change and to start building new platforms and trying new things when there was so much coming in supporting the old stuff. The E.T. cartridge came about because Steve Ross wanted to get Steven Spielberg to start doing more movies with Warner. So, he cut a deal with Spielberg to do E.T. and without any sense that the heart of that movie was emotional connection. What we could do with the technology at that time didn't match what the movie was about. There was also a Christmas coming up and there wasn't enough time to do a good game development. So, the cartridge was bad. I had-- when I was back in New York with the lab, I did consumer testing on the E.T. and you could tell it was going to be a really bad cartridge. But people don't want to hear that it's really bad because they knew that because of the marketing clout, Warner could sell umpteen million cartridges. They had done the same thing with Pac-Man, which was an okay game. It was a good game, but with only an okay implementation. So, they said "Don't worry, based on our marketing, we could sell them." But we had lost the DNA, which was Atari, which was our connection with the games player, the trust with the games player and yes, we could make money, but you don't destroy one of the great consumer brands of all time.

Hsu: I want to go back and talk about the 8-bit home computers, the 400 and 800. So, talk about how did that project start?

Mayer: It started-- I was going to do the follow-on for the VCS and it was going to be hitting the $180 price point and had a little bit of computer kinds of things, but it was mostly a games player that was going to be cartridge compatible with the VCS and then Apple started coming out. Nolan had passed on getting a share of Atari buying a part of Apple. So, Al and Nolan came up to Grass Valley. I showed them the basic architecture and I said "Do you want this to be more of a computer or do you want this to be more of a home game?" Two different price points, two different technologies, and stuff like that and they made the mistake and I allowed them to make the mistake, which was to say yes to both. So, it was compromised from both standpoints. As a home game, it was compromised because home electronics had to match a very tough FCC requirement for radiation and things like that. You couldn't do a home computer with plug-in boards and stuff hanging out of it and still meet the FCC requirement. Al had worked hard to have the VCS pass the FCC requirements. So, we had to make this unit so it wasn't expandable and also, it had to have an external battery charger eliminator. It couldn't have a power supply in and it couldn't have plug-in boards for expansion and it had to go on to the home TV. So, the home TV limits you to 40 characters if it's coming in through the RF port. For a home computer, you want it to have 80 characters across. Apple didn't worry about any of those things. They didn't have to hit a consumer games price point. They put in a really good power supply. They said "The heck with the FCC," and they just went ahead and did it. So, as a home computer, Atari wasn't expandable. It didn't do the 80 characters. You had all these battery eliminators, chargers around them, and things like that. So, it was a really good implementation but severely limited by the constraints. As a video game replacement for the VCS, it didn't hit the $189 price point. It didn't hit it because it had all these extra things and also, our manufacturing engineering people got kind of lazy at this standpoint. When we did the VCS, we fought for every penny. By the time we were doing the home computer "Okay, let's just go out and source a keyboard for $20," instead of working hard and what Commodore did was they were able to find a keyboard for like $6 or $8 that was perfectly adequate. So, we lost the hunger to hit the price points. We

had lost the hunger to define who the customer was and so, we had a compromised customer. It was also a change in the regulatory days. Richard Nixon came in as president and the ideas of the FCC shutting people down for radiation disappeared. The days of doing patent protection, which was considered antitrust in the days of the VCS-- we had the choice when we were doing the video game and the home computer of putting in security like Nintendo has so only licensed cartridges could play on our device. During the pre-Nixon days, that was considered restraint of trade. So, we never did that. But we could have done it. So, we didn't understand that the world was changing from a regulatory standpoint. So, we had a compromised product from both standpoints. Good people working on it, but whenever you're working on a product, you have to know who your customer is and one of the great things of Steve Jobs, he had, again, the sharpest Occam's razor of anybody. It was in or out. You put it in, did it right, or it didn't exist. You didn't try loading stuff in and so, they were good implementations, but they lacked the sharpness of knowing who the customer was and being very targeted.

Hsu: Okay. So, we're talking about the 400 and 800. So, was it the same team that worked on the home computers as the VCS?

Mayer: Pretty much, yes. The team got a little bit larger, but it really was essentially the same team.

Hsu: Okay. So, you and Ron Milner...

Mayer: Yes. We did primarily the graphics section. Joe Decuir and Jay Miner did a lot of the I/O and some of the systems engineering and then also saw to doing the chips.

Hsu: Okay. You said that the home computers were kind of an evolution of the VCS architecture. Is that correct?

Mayer: I tried keeping the core of the VCS and then expanding it because I wanted to have it so the old cartridges could still play on it. So, I increased the clock speed, but in a way that was a multiple of the previous clock speed and kept some of the player objects and things like that so that it was possible to do backfilling of the cartridges, that it could be cartridge compatible and from a programming standpoint, it would match a lot of the programmers. So, it was an easy transition over into the new technologies.

Hsu: Okay. Could you talk about the differences between the two models, the 400 and the 800?

Mayer: Essentially, there's only two big differences. One had a full stroke keyboard versus a membrane keyboard and one had more memory and an extra expansion cartridge, but inside, they were virtually identical.

Hsu: You were talking about how they were maybe a compromised design, but how successful in the market were they?

Mayer: They were moderately successful, but they really were eaten up by coming from three different directions. The Apple [II], because it was fully expandable and so, the secret and the magic of the Apple

was you could drop in those cards and make it anything you wanted. You wanted it to be a MIDI controller, you wanted it 80 characters, you wanted more RAM-- it was all there and Woz did a really good job on that and then Radio Shack with their TRS-80, and Commodore with their VIC-20. The VIC-20 was all about cost. It was, I think, a couple hundred dollars. They said it's a learner computer. It turns out when people were buying a computer in those days, they didn't know what it was for. So, the only differentiation between a computer was two things-- did it have a full-stroke keyboard and how much memory it had. It's like the equivalent of this camera is better than that camera because it has more pixels. So, during the early days "How much RAM and did it have a full-stroke keyboard?" Apple, because it was from Woz's DNA, was expandable and from the hobbyist standpoint, they just hit the sweet spot for that growing forward.

Hsu: I heard that there was an attempt to create an add-on to the VCS to turn it into a computer.

Mayer: Yeah. There was a couple of things. So, there was a couple of companies that were doing it. So, it was a cartridge that had additional memory and a stripped-down BASIC cartridge. That was one of my negotiations early on with Bill Gates was to get their BASIC-- either for our home computer or for the VCS. The idea [that] there was just going to be a learning device for teaching about games. I was doing one other thing that I wish that Atari hadn't exploded at the time because it was going to be just fun. Fischertechnik-- I don't know if you know them. They're like Legos, but the German form of the Legos and I was negotiating a contract with them of doing a construction set of tying the VCS to the Legos and it would have been just plain fun to do.

Hsu: So, in my research, I discovered there were a number of other attempts to turn consoles into home computers as well, like the Imagination Machine was one of them.

Mayer: Intellivision...

Hsu: They planned to make the Intellivision one.

Mayer: Yeah. So, Bally had gone the furthest along the way. But again, it was a strange fit. There was a market if you could get it for $200, which Commodore and the VIC-20 did. But the key there was bypassing the TV set and going-- the RF modulator and getting 80 characters on the screen. So, that really defined what a computer was, along with a full-stroke keyboard and anything that was compromised there, it just didn't fit. From a marketing standpoint, Radio Shack did a pretty good job because they had their own distribution channel. They had their own market segment.

Atari also had this ambivalence of…were you going to be hurting your game segment and your game marketing by calling it a computer? So, it was a tough market segmentation. If we had started a very different company that was financed and with a clarity of vision, that would have been much, much better.

Hsu: Well, that's interesting because the VCS itself has the word “computer” in the name, right? So, what was the origin of that?

Mayer: I have no idea. Good question. Maybe Al could tell you that.

Hsu: Okay.

Mayer: We thought that it was the idea that having the interchangeable cartridges. So, I think it was the idea that the computer and the system sort of came together, the idea that people understood that you could repurpose it and it could be something different based on the software.

Hsu: I see. Did Nolan disagree at any point with making the home computer or was he supportive of it?

Mayer: He was a bit distracted by that point. He was there and that-- because of both the confusion and the amount of money available with the Warner stuff and all the other things-- and we were riding a high that we could do anything we want with the name. So, again, we had lost that hunger for refining a product and being certain of where it was going and what the key value adds were. I think by that time, Nolan just wanted something to go opposite Apple without thinking what it was going to be.

Hsu: I see. Did you have any involvement in the Atari's later consoles or later computers?

Mayer: There was just a little bit, but they were mostly repackages. Steve Bristow tried doing another one with different architecture and I looked at trying to change the 400 and 800 around a bit, but in my lab in New York, I was starting to work on a next-generation business computer using a 32-bit processsor. I started conversations with DEC computer because they had the VAX on a chip. I wanted to see whether I could get that because it would step us into software. That's where I met Gwen and Gordon Bell and got my first introduction to the Computer History Museum back on the East Coast before it moved out here. DEC was having their own identity problems of "Are they a computer or not? Are they a personal computer or not?" I don't know if you've met Avram Miller. He was working on the DEC's personal computer. It's very hard for a company to go against their DNA. They tried doing it, but it requires incredible leadership and a driver to go against their core DNA.

Hsu: I read that you were also involved in the beginnings of Chuck E. Cheese?

Mayer: Yes. Chuck E. Cheese came out of Atari. Nolan always wanted for Atari to be bought by Disney, but Disney never wanted to buy us. But Nolan really wanted to have Disneyland parks. So, he came up with the idea of having mini amusement parks in shopping centers. This had a couple of advantages. First of all, the coin-op market wasn’t growing as fast. There was a limit to the number of coin-op locations because zoning was pretty restrictive. But if you could put it into food service, you could put pinball machines and video games. Nolan also was a great secular philosopher. One of his aphorisms-- the parents decide when the kids go out for dinner and the kids decide where. Have you ever been to Bear Country Jamboree? Because Chuck E. Cheese is like a mini-Bear Country Jamboree at Disneyland. So, Grass Valley did the animation, the animatronics for it. There was another company that built the

characters and then we did the pneumatics and the programming and the control. At Nolan's place, we had an off-site and they were coming up with names for-- Super Cheese had already been taken. I remember the meeting coming up with the name Chuck E. Cheese because Super Cheese had been taken. Other people at the meeting may have different memories, but I had the cadence of Joey Lee Lewis, for whatever reason, and that became Chuck E. Cheese. We did it. Nolan being typical Nolan, one of the corporate spokespersons being an eight-foot-high talking rat. It was one of the number one pick-up places in San Jose on Saturday mornings because single fathers would have the kids for the day on Saturday morning. So, they would take them to Chuck E. Cheese and if that's where the single fathers went, that's where the single mothers would go. It was a strange scene and it was just wonderful and Nolan's idea was to take a high margin business, which was video games, with a low margin business, which was food, and marry the two together and have something for the whole family.

Hsu: Okay. So, we've already started to discuss your moving to New York and starting Warner's Labs. Could you talk about how that came about and then some of the major projects that you worked on there?

Mayer: So, I first went back to New York because Sesame Street Children's Television Workshop was doing something called Sesame Place and it was going to be amusement parks for kids. But they were mostly learning parks and I was sort of the patron saint for weird projects at Atari. So, they said "Go back there and see what the fit was." I went back there and I said: “I'd like to do a central research facility and see if we could bring some of the Atari magic to the other Warner divisions." So, I started working with Warner Cable, Warner Records, Warner Publishing, to see what the fits might be, and I also started a research facility for Atari back there, where we were doing some games and also some consumer testing. We were just getting going, but it was very hard and it required a different set of skills which I didn't have, of how you interface a corporate resource to operational divisions. I was really spoiled by having Al and Nolan. I could come, just invent stuff, Nolan and Al say "Great, we'll productize it.” I didn't have to develop the skills of how you move a project over and work within a corporation. So, it wasn't a good fit. I could see what needed to happen, but it was a very different model of how you sell across divisions at a corporate level. For me, it was fantastic, because I learned about the history of books, I learned about the history of movies, I could see where the tools were going, and it was a fantastic playground. But Atari was starting to peak and go down by that point. So, we didn't see the fruition of stuff that we might have been able to do. But I did see the importance of video games in the history of the 500-year history of storytelling and what they could do. We had, through Alan Kay, who was working at Atari, a relationship with Nick Negroponte and some of the other people, to see where storytelling could go in the future.

Hsu: Right. So, like the idea that video games are a medium, that was starting to become part of your consciousness?

Mayer: Exactly. For me a couple of things that came out from the association with Negroponte, one was the introduction to Marshall McLuhan and understanding that this skin barrier here isn't as finite. The central nervous system just doesn’t stop at the skin. First, it's going to be audio and visual with remote broadcast of television and radio that brings the average world to you, but it's going to be so many other things that are going to penetrate that barrier. Then there was Sherry Turkle, who did the wonderful book, "*Hamlet on the Holodeck*," to look at the taxonomy for storytelling along the way that was just great and

then there was Father McCulkin, I think his name was, and he wrote about and came up with the wonderful aphorism that we create the stories-- we form the tools and the tools form us. My whole life, whether it was at Atari or at Ampex or when I was doing TV, it was about tool building. And now, I work in museum designs taking what I have learned in game design and applying it, appropriately I hope, to museum design. It's building the tools for the real storytellers and then you just turn it over to them. After Atari, I got very enamored with the ideas of both Spielberg when he did the Shoah project, where everybody has a right to tell their story no matter how inarticulate they are. So, that's what got me interested in desktop video publishing. And also, Coppola, who had the idea, where he outfitted this trailer with all the tools for video/movie production so that a single person could do a project by themselves. It was sort of like what MIDI did for music production and desktop print publishing for the print industry. We wanted to have people that were storytellers to have all the tools of video storytelling. Coppola said you think of doing theatrical release movies as the auteur, but it was really a director with a bullhorn and 40 union people holding an 80-foot-long paintbrush and saying "Put the purple over there." He wanted to have tools where people could tell all their stories with personal tools and collaborate, not because they had to, but because they wanted to. So, I started working on tools for the video industry analogues to what had been done for desktop publishing and desktop audio.

Hsu: So, before we move on to Digital F/X, I wanted to sort of wrap up the story of Atari and I guess I wanted to discuss the effect of the 1983 video game crash, how it affected Warner, how it affected the company, Atari, and maybe where you were. What are sort of the ripple effects?

Mayer: So, by late '83, '84, I could see what was happening, and it was going to be too hard to change the ship. So, I actually organized a meeting with Morita-san from Sony to see whether Atari and Sony could come together, because it was just too hard to change the then culture of Atari. So, you could see this starting to happen along the way and the projects I started doing were outside of Atari, but seeing whether I could help some of the other divisions of Warner. So, I started doing things with Warner Interactive and stuff like that because I couldn't change Atari. Then in '85, we were working on this new project at the labs for video. We could see that everything was going to collapse. So, I said to the Warner people rather than writing off all the stuff that I was doing "Let me just do the spinoff of this. It was going to cost you n dollars to shut down the lab. Give me that money, and in return I will give Warner a percentage of a new company that I would start." I took the video project to Silicon Valley, and got money from Kleiner Perkins as the lead. The company was Digital F/X and did go on to win an Emmy for helping start the field of desktop video.

Also, during the Warner days, I met a 17 year-old Bobby Kotick. The collapse of Atari took down several independent game publishers. One was Activision that had renamed itself as Mediagenic. So I went on the board of Bobby's company and we bought Mediagenic out of bankruptcy, took it down to, I think, two people, and started rebuilding it from there. The only title we had at that time, I think, was Leisure Suit Larry. So, Bobby, with a little bit of help from me, but it was mostly Bobby and Howard, we rebuilt Activision one step at a time, renamed it from Mediagenic back to Activision because there was a strong love of that name and support. We just rebuilt it one title after another. I stayed on the board until it got to a fairly good size and then left the board. Bobby just kept building it and did a great job. It was an easy job in the one sense. Our business plan was to follow Electronic Arts. Electronic Arts was the

McDonald's-- so, if they built on one corner, we would build on the other corner. They could get Madden Football. So, we would get more fringe sports. For $25,000 we signed with Tony Hawk's Skateboard. We followed EA and got a chance to participate in the rebuilding of the industry. The other part of the rebuilding of the industry was Nintendo. Nintendo with the NES came to Atari to see if we would license their console. Their console had a lot of similarities to what I wanted to do with the 400/800, both price point, amount of memory, moving objects, and things like this, and tightly tied to what gamers wanted. So, I think the NES was what we wanted the 400 to be as a gaming machine. What Nintendo did in two other areas were fantastic. One was they made it a closed system, so they could maintain the quality. By the time when Atari was collapsing, everybody was making cartridges, and there was just a whole bunch of junk titles out there. Nintendo said "It's a closed system. We don't care about the legal issues about being a closed system and the antitrust ramifications. Let's just do the games right. They did a great job on the console as they didn't have any ambivalence of was it a game system or a computer system. They just did a fantastic job with games like Mario and then the Wii controller. They deserve all the credit they can get.

Hsu: Yeah. So, we were talking about your connection to where the game industry went. Did you ever reconnect back with Atari at all or the later iterations of Atari?

Mayer: When Jack Tramiel bought Atari, he asked whether I could go on the board or not of the new Atari. It wasn't a good fit for me, but I got a chance to get to know Jack better. I did a little bit of advising with him on the Jaguar, but not much.

Hsu: Okay. So, let's go back to Digital F/X. So, you mentioned it spun out and after the spin out, just talk about what sorts of projects did you do? What sorts of companies did you work with?

Mayer: For Digital F/X?

Hsu: Yeah, for Digital F/X.

Mayer: So, I got funding through Kleiner Perkins and my lead on that, the board lead was Vinod Khosla. It was his first company after Sun. I had the dream board and the dream investors. So, John Warnock was on the board. Through John, we tried doing some accelerators for Photoshop. On the board also was Mickey Schulhof, who was the head of Sony, and Marty Payson, who was the head of Warner. And we had a who's who of VCs-- Mitch Kapor was an investor. Intel was also an investor. So, this was a dream team. What I didn't realize was I had this 10,000-horsepower engine of investors and a quarter inch drive shaft: the company’s development team. What I learned as the head of the company is that these VCs have a portfolio of 100 companies. As a head of this company, I had a portfolio of one company. The VC’s model was designed to go ahead and drive this to the maximum because they were looking at return on partner's time. They were dialing the dial up to 11 and it takes a really strong president-- well, I was actually chairman of the board-- to say "No, this is what we can do," because you have all these great people. So, we tried doing a little too much and we kept going for the world's most demanding customers because the idea is, if you worked at the very top level, you would build your company name and then you could filter it down to the less demanding customers. So, we discovered the

world's most demanding customers. And they demanded things. Our very first customer was-- they were going into post [production] for "Star Trek: The Next Generation." We were still coding the machine and they were getting ready for post. We had a good machine, and we achieved at the highest level of production. What we hadn't expected was a trade war between Japan and the US and that killed us from a couple of standpoints. We projected memory cost to go down. Because of the trade war, memory costs were actually going up. Also, Sony wanted to put the ax into the heart of Ampex, which was still making analog videotape recorders. We had assumed the whole video industry was going to go from analog to digital. Sony wanted to bring out another couple of generations of analog tape recorders to drive Ampex into the ground. Then the other thing that happened during that time was the savings and loan crisis. Our bank was Silicon Valley Bank at the time and the auditors came into Silicon Valley Bank and started pulling the credit lines and everything like that. So, we were in a multi-level squeeze and we couldn't survive our way through that. We took the technology and placed it with Aldus and Adobe. So, the technology as a desktop technology lived on. We got an Emmy for our work in pioneering desktop publishing. So, that was gratifying along the way. And I did some consulting with the technology as it worked its way through Adobe and Aldus. And then later on, that's one of the things that brought me back working with Apple, because Steve Jobs had brought in from Macromedia Final Cut Pro. So, I helped work with that and then later on, became more involved with Apple on their other video projects.

Hsu: Okay. So, could you explain exactly what the technology was, number one, and also, number two, what the products were, what the business model was?

Mayer: So, Digital F/X, the products, at the high-end product, the goal was to-- at the highest level was real-time video manipulation. So, you could consider it a single-polygon 3D device that could map real-time video onto the polygon in real time. So, you could rotate it. You can morph it and then you could also bring in background layers for foreground and compositing of images. So, you can manipulate real images in real time and now, you do this on your iPhone, on your Macintosh. This was 40 years ago and 35 years ago and the most we could handle is one, two, or three images and this device sold for $60,000 and it also brought in all the elements of video production. It had editing. It had a paint system. It had a titling system. It had graphics. It had everything else. So, the idea was a workstation for real-time video and that was at the high-end. Then we brought out a lower-cost version of that that didn't have the full real-time digital graphics to sell for the couple of thousand dollar range for analog editing to hook up with your VHS and your Betamax tape recorders and your industrial level tape recorders. It was a product line from the very high-end D1 digital editing, industrial level down to a consumer vesion for the videographer doing weddings.

Hsu: Okay. So, you were selling the hardware and the software together as a turnkey system?

Mayer: Exactly. It was a bundle and then we also had a pre-visualization software-only version of it. So, you could do some editing and some manipulating and some storyboarding, but it was really oriented for pre-visualization.

Hsu: Okay. But you weren't actually developing effects for-- like you mentioned "Star Trek: The Next Generation." You weren't actually producing the effects for them, you were just selling the systems to another effects house?

Mayer: Our equipment was bought by the post houses and it would replace their Grass Valley switcher, their Ampex ADO editor, their Quantel paint system, the Chyron titling system. So, it was all brought into one box with one database that you could edit. The effects were done using our hardware and software.

Hsu: Okay. So, then timing-wise-- so, then Digital F/X closed in what year?

Mayer: That's a good question-- in the early 90s, early or mid-90s. So, there was a period of roll-up. Around the valley there were weaker video companies and so, what happened was the VCs said "Take on these other companies." So, there was one company that was doing audio work, the equivalent of both editorial and Foley work and long-form editing. So, we brought them in and some others and we were trying to do the roll-up, but the video industry was going through a tough time, and the capital industry during that time was a tough time. So, it was right on the edge that we were a couple of years before the Mac was powerful enough do all this stuff. It was also the last stages of the analog and the early ages of all the stuff you could do on the Macintosh. The idea was we were going to bridge the space between the analog special purpose video devices and the future Macintosh world. So, with startups it's great if you're on the razor's edge to make sure you're behind the edge instead of in front of the razor's edge.

Hsu: So, then you continued to consult in the years after that or what did you do after that?

Mayer: Well, there's a couple of things. I did consulting for Intel and for Apple and then my love was pro bono working on museums. So, if you think of a video game, it's a theater. It's a theater that has lighting, it has sound, it has where the audience can sit, and you put in the content is the actors and the writers. So, it's a black box theater that you could now make it into anything you want. If you think of a good museum, it's a theater for storytelling. You're standing in front of this object that was created by somebody 3,000 years ago, and it has a story to tell. So how do you take that object-- and there was a museum critic that said "Museums, that's where objects go to die." So, this is how you can now take the storytelling that we learned in video games and take the real object and let people understand that that object was created in a time and place by somebody and that has a story to tell and how to do it with respect for the scholarship behind that story,because there are curators and things like that. So, you have to completely respect the object, but you have to allow people into the object using the skills that we learned in video games. Now, I got into that not because I was great at story telling. If you're in a museum, your first concern is how do you raise money? I came from the video game [industry] in Silicon Valley, so, they said "This guy must have lots of money." So, people from Silicon Valley get invited into all sorts of places, and we pretend to know what we're talking about and the museums pretend to listen. But that starts a dialogue that's interesting if the Silicon Valley people come to it with the humility saying: "These people on the museumside have an expertise, and these stories are absolutely wonderful," and if the museum people are willing to look at that transition as museums being not only the collection of artifacts, but are places for public gathering and where the interaction with the public becomes absolutely key. If both sides recognize the value of the other, then wonderful things can happen. It's not an easy thing to negotiate

because in museums, their main asset is history. In Silicon Valley, our main liability is history. Silicon [Valley]typically wishes that history would just go away, so we can invent a new thing without having to worry about backwards compatibility. But when we can have the kind of dialog between the old and new, just like Adobe did with the centuries old technology of typography, great things can happen.

Hsu: I also understand that you've taught courses at universities.

Mayer : I was an adjunct teacher and also an advisor to several educational institutions. The work fell into two broad groups: students that might be interested in working with or creating startups and institutions that may not be quite as open to the challenges of a new digital world.

Hsu: You've also testified before Congress and other government agencies?

Mayer: A couple of times, yes. So, part of it was very early on regarding some technical issues of solar and heat pumps. In the ’70s and the early ’80s, Congress was trying to figure out what to do with this new digital technology, how they could support the technology, what's the role of copyright law, and things like this. So, what is the role in Congress? Also, congressmen love to stand in front of Silicon Valley people and say "We're embracing the future." So, it was great theater. So, sometimes we'd go there and talk a little about what we needed, and it was really encouraging support for education of the arts and the digital and bringing the two together and also, there was a change in the regulatory framework coming out of the Nixon-Reagan days of what's the role of patents, what's the role of copyright, and things of that nature and then there was a group of people looking to see what's the role of teaching of technology in computers in brick-and-mortar education. So, sometimes you'd get invited in for those discussions.

Hsu: Right. So, you were on the California State Task Force for Education?

Mayer: Yes. Computers were coming in. “What are schools going to teach? Are they going to teach the ability to just teach the ability to type, to program or what? How does this all play out? What does California need to do to remain competitive… etc.” and things. It was absolutely amazing for me because the textbook people were in the room, the Teachers Union were in the room-- everybody was in the room and everybody had a vested interest. You realize how hard the discussion is because everybody was-- not everybody, but most of the people were well-meaning, but coming at it from their area and by the time everybody threw in their two cents worth, it became an overly constrained problem and not much was going to happen. At the end of the day, there wasn't going to be funds for teacher training and support to really do a good job. So, that all disappeared, but I did see one project that Apple did called the Vivarium and it was just beyond beautiful to see what a well-financed and well-supported and teachers that had come up from the MACOS model of constructiveness learning can do. Several Montessori schools have also found ways to incorporate technology appropriately. So, I would encourage any of the people that are looking at what technology should do now, and particularly AI and stuff like that, to look at these programs that were driven by teachers that really understood classrooms.

I have mostly. focused on informal education at museums, zoos etc. It is an easier testbed for ideas.

Hsu: Oh, wow. The Vivarium was, that was an Alan Kay project.

Mayer: It was an Alan Kay project. They put all that technology in and I'll use the F-word-- it was that kind of disaster and it was to the credit of Apple, to Alan Kay, to the teachers and the supervisors saying "All this technology doesn't work. What does work?" and they went back and re-engineered it and they found out what good teachers with good technologists and enough time and enough respect for everybody could do and it was really spectacular.

Hsu: So, you were mentioning patents before. I take it you have a number of patents in computing and multimedia. Could you discuss those?

Mayer: Some of those were because I didn't know what was happening at Xerox PARC. So, we were reinventing a few of the things at PARC. Atari did not aggressively go after patents because, as I said, back in the days of Nixon in the ’60s, if you asserted your patents, you would get into antitrust issues. So, Ron and I would do some patents whenever we needed a new appliance because Atari would give us $1,000 for every new patent. If Ron and I were co-inventors, that would be $500 a patent. So, after tax, that would allow us to buy a new major appliance. So, you could go back and see what Atari could have-- the intellectual property portfolio that it could have had along the way. So, my patents were mostly a few in the system and moving objects around, but it's only a fraction of what we could have done.

Hsu: Okay. So, these were all patents related to the VCS or the 800?

Mayer: And the home computer and for the coin-op games.

Hsu: Okay.

Mayer: It was interesting to see how patents moved from what was in the late ’60s to by the ’80s, how important they could be.

Hsu: Right. Situate Atari in the technology and cultural landscape of the ’70s. You mentioned Apple grew out of Atari. We have like Intel, Microsoft, the microprocessor, Berkeley and the counterculture-- what are all these components-- let me rephrase that. How did the culture of Atari arise out of the mixture of all these influences in the environment?

Mayer: It starts and it gets almost to the finish line with Nolan. Nolan was our Mick Jagger. He put the band together and was our front man. He understood games, but Atari was the metagame. We all knew we were going to fail. So, we always had our plan B and C. We had multiple companies. So, no two companies were on credit hold at the same time and Nolan created that sense of having fun about doing this. There's no fear of failure. We had a trophy for the biggest mess up ever and that trophy went from person to person. So, if you had good failures that was a great thing. So, that culture was really important. So, Nolan set that culture of fun. We were working in an entertainment industry. We were people that liked and respected each other and our game players. If we messed up, people weren’t going to die. Al took the culture of Ampex, which was the culture of hard engineering and engineers knowing the

customer, because at Ampex, we knew the customer. Al early on set up a coin op route for the engineers at Atari, not to make money to compete with our customers, but so that the engineers understood what our coin op customers needed. So, if you were emptying a coin box at two o'clock in the morning at a Greyhound bus depot with all these quarters rolling all over the ground, you would change the design of the coin box for the next time. So, Nolan and Al were the two cornerstones for setting the culture. Al's biggest job was-- he had a secretary and his secretary would let Al know whenever Nolan wanted to go into the labs, because Al could then run to the labs to intercept Nolan. If Nolan went into the lab alone, he would generate so much enthusiasm and change every single project and nothing would ever get done. So, Al's job was to keep the projects moving ahead and moving the technology ahead. So, the two of them were absolutely key. So, that introduced a different model for companies and company management, for Don Valentine and the VCs that followed Don Valentine. There was that sense of excitement of knowing the customer. Particularly for Woz, it was building something that somebody in the Homebrew [Computer] Club could see and understand and that Woz could be really proud of and that was the culture at Apple and a lot of that came out of Atari. Then the consumer oriented companies that came after us with At Home and Yahoo, it blended bringing the consumer in. That started bringing in the Warner culture with marketing, advertising. So, that became the benchmark for At Home and some of the other consumer companies and consumer-facing companies after that and not to minimize the fact that when Atari was making money, that invigorated the VC community. They saw the numbers and they started making the money. First, it was-- Electronic Arts was the first independent software company to take money and they were doing games for the computer. And then Activision. So, it changed the whole ecology of the Valley and it started rippling. The kids at UC and Stanford and the engineering school and the business school saw the model of that's who they wanted to be. So, you start seeing that effect downstream. So, Stanford did a better job of changing the curriculum and started providing courses to feed the students' interest. So, I think Stanford did a really good job of following what happened at Atari and Apple, and creating the food chain, the big end of the funnel for the kids coming in.

Hsu: So, what other thoughts do you have about the legacy of the Atari VCS, the 8-bit home computers, and Atari's role in the video game and PC industries?

Mayer: So, I think there's a couple of important legacies. The one that's by far the most gratifying is kids coming up to you saying they were dorks, they were whatever, they'd never seen a computer, and things like that and that allowed them to study it, enter their careers, and they're in the industry now. So, that's by far the most important legacy. The other thing is I hadn't realized it until you start looking back at the video games at 50 years and you probably already know the market. If you take the print industry, the film industry, and the music industry, and combine all those three industries, and then double that, that's the size of the video game industry. We were privileged to help create a new form of storytelling. The last equivalent form was the 1920s. So, to be part of that and to see that as a new form of storytelling and then to watch what people are doing now and what they will do in the future as game technology continues to evolve to tell more stories in richer ways. The video games industry has brought new tools to the goals of both entertainment and education: to engage the audience’s imagination. When you go into a museum and you look at an exhibit and you say "Why is the neck of the giraffe that long?" and it's the Jesuit model. Once you've got them to ask a question, you've got them for life. So, now, video games are now with the new tools for storytelling, AI, and all these other things, that there's new ways of engaging

people to ask questions and to tell their stories in the context of video games or interactive movies or some blend of any of those.

Hsu: Thank you. Okay. One final question-- if you had to give one word of advice to a young person today, what would it be?

Mayer: Actually, my one word is try-- to try everything, to be open to all sorts of things, and the world will tell you what excites you, where your place in the world's going to be, and how you're going to create value, but to try as many things as possible and with as many people as possible.

END OF THE INTERVIEW

