



Oral History of Andrew Heller

Interviewed by:
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Kapoor: This is to welcome Dr. Andrew Heller, Chairman, CEO of the Heller Associates and he's had a very distinguished career. Of course you're still very active. It is nice to have you here. On behalf of the Computer History Museum, my name is Uday Kapoor. I'm a volunteer here in the Computer History Oral Histories program. So welcome.

Heller: Thank you.

Kapoor: And what we like to do is start from your early life where you spent your early days and maybe in a few words if you can tell us.

Heller: A few words. I grew up in a very comfortable neighborhood in Scarsdale, New York. Got involved very early on with a bunch of entrepreneurial activities. The obvious one is running a newspaper route. The non-obvious one is running an entertainment service using Bell & Howell movie projection, sound movie projectors and putting together a team to do children's shows. The less obvious one's competing for engineering competitions by the time I was nine or ten, and got involved also in music when I was very young. So grew up in a very comfortable atmosphere. Went to Scarsdale High School. I actually got to sing with Liza Minnelli when I was young.

Kapoor: Oh, wow.

Heller: She had just come back from England and we had a chance to do things together. Went on and ended up at Columbia. I worked at Columbia and had two mentors there, actually three mentors there. Drs. Woo and Ting were there and I got to work on occasional weekends as an assistant for them and I had one of the great Lithuanian mathematicians who turned out to be a great mentor and a good friend, and then the one other person who really helped steer my life in that time of my life was a guy named Isidor Rabi who on his 90th birthday told me "Andrew, by the time you are 40 years old you must have at least seven careers or you'll be very bored."

<laughter>

Heller: So that's the early days.

Kapoor: Right. Right. So in the early days what-- you mentioned music. Did you do that very seriously? Were you learning, singing, or instruments?

Heller: I was singing. I play several instruments but I was serious about singing. When I was 14 I won the Junior Met Audition, the year that Mary Beth Peil won the Met Auditions and got to sing some things with her. While I was in college I was living like a king. Graduate students normally look at McDonald's as a step-up restaurant. I was eating at the four star restaurants in Manhattan in swap for doing a half hour, 40 minute session at the piano bar. So Four Seasons, Mrs. Brody's Restaurant, Paul Tautman's [ph?] Penthouse Club, Number One Fifth Avenue which is now an NYU dorm but then was a great hotel with dueling pianos downstairs, Dick Hankinson and Johnny DiMaio. So I would sing and get anything off the menu, anything from the bar I wanted, and I was in hog heaven. I never had the courage to tell any of the other students who I was working with how I was eating, and I'd on the weekends be able to sing. So I was earning a comfortable living singing while I was going through graduate school.

Kapoor: I see. So in terms of other hobbies, did you also play any sports? And of course, how did you get into science and engineering? That would be nice to know.

Heller: I'd always been involved in science and engineering. I'd done some things. I'd actually studied when I was quite young, the end of junior high, the beginning of high school the workings of saturable core reactors and using them in power supplies. Silicon controlled rectifiers had really just come out and applying the two technologies was novel and it was a very interesting thing because there weren't a lot of people out there working on that. And so, I was getting these wonderful, wonderful jobs in high school. So..

Kapoor: I see.

Heller: ...my interest in technology was always there and I can remember when I had a lab set up in the basement of my parent's house. They were pretty understanding. I had a big isolation transformer there so I wouldn't really destroy too much or myself, and then series loads so I could run various projects without having to worry too much about taking the whole house apart, and I had quite a lab set up and I remember when President Kennedy was shot I locked myself up in the lab for a day and a half or so and watched the proceedings on-- I didn't have a television at the time but I did have a tuner down there and watched them on a long retention green screen oscilloscope.

Kapoor: Wow.

Heller: And if you've ever watched TV on a long retention, it's kind of fuzzy. But yeah, we had a lot of fun and..

Kapoor: Mm-hm.

Heller: ...were set up to really just do fun things and..

Kapoor: Right.

Heller: ...I went on and my major was mathematics..

Kapoor: I see.

Heller: ...because I always found that to be a unifying thing that allowed me to do anything else I wanted. Not mathematics to become a math professor but mathematics to learn a style of thinking.

Kapoor: Mm-hm. So what level of mathematics did you go up to? As you said, you really like mathematics.

Heller: Let's see. For a while I was teaching partial differential equations. I spent one semester at Columbia working on indefinite integration with electric glass. I think that's about as far as it goes. I'm not sure. There's a lot more esoteric things that you could do in those days. Now there are but..

Kapoor: Right. So in terms of your college education, you mentioned Columbia.

Heller: Yeah.

Kapoor: What-- is that how you went into engineering and science?

Heller: Actually it was a girlfriend that got me into engineering. I was going out with a very, very attractive young lady for a while and going through graduate school. She left me for a Marine. So I decided it was time to go get a job at nights because I was really very unhappy, and I went off and found a job working in a computer room as an operator at nights and working at the university during the day. That lasted about four or five months until-- not even that, until I found-- this was very early in the days of 360 and I found a problem in the very first sort program they had, and I went up to the people who were running the standards group, the group that actually did the programming for their division and said "You've got a problem. We have this--" and the head of the group was somewhat skeptical about being able to repair this. So he gave me the six trays of cards and said "Why don't you see if you can fix it? I'm going on vacation for two weeks. Show me what you have when you get back." So I taught myself programming during that two weeks, redid the parts of the sort that were-- and these were all very, very low level parts, so they're sort of dealing with the hardware, and when he came back he said "What do you have?" And I said "Well, it's working fine. Would you like to see it?" He said "Sure. Maybe we can

put it on one of the machines and you can demo it." I said "Too late. It's already on all of the machines." <laughs> So, that's how I learned programming and the next week I was moved over into the systems group and no longer in operations, and then got through with college and went into daytime operations there.

Kapoor: Mm-hm. So, this is you entered IBM? Is that what you're talking about? Okay.

Heller: They're about the only people who would hire an oddball into the night shift position who was grieving from the lost love.

Kapoor: Yeah. Right. <laughs> So when did you join IBM as a full time employee?

Heller: In 1966.

Kapoor: Okay. So you were hired as a-- what was your position and..

Heller: I was hired originally as an operator.

Kapoor: Operator? I see.

Heller: As I said, that lasted a few months.

Kapoor: Right. Right. So then of course you advanced fairly to a very high level as a fellow, as I read. So maybe..

Heller: I was made a fellow in the company I think because they had two choices. I was getting very involved in all of the labs not only critiquing what they were doing but coming up with alternatives, and it was either fire me or make me a fellow, but they couldn't justify my going around to all the different labs working on projects. Of course the first very large project I worked on was a project I worked on with John Cock. I think you know the name.

Kapoor: Yes.

Heller: And several of Jack Bertram's [ph?] team from the old Menlo Park super computer project that was going on there, and we were designing a one board machine built on very high speed, bipolar

technology, a water cooled one board machine. That was the very first RISC processor. It preceded Berkley discovering RISC by about five years. It was late '66, early '67.

Kapoor: Right. So maybe you can tell me a little more about your career at IBM, how you progressed.

Heller: Well IBM was funny. When I had redone some low level machine, error corrections codes, and this was after I'd been there about nine months, 10 months, and a number of our customers had heard about it. So I was going down and working with customers out of the standards group in White Plains, and then one of the people who'd heard about it was one of the people at JC Whitney, the venture fund, and they came and offered me a great job and I would not have left IBM had not it not been for the fact that I was on the task force. Do you know what a Token Technical Person is, a TTP?

Kapoor: Mm-hm.

Heller: I was the TTP and I had pointed out in the task force-- so what was being done which was going to cost a couple of hundred million dollars, which in 1960 was real money, wasn't going to work, number one and number two, they were going to spend a lot of money to do something that couldn't be applied to our own customers, and I thought I'd really made an impact and about three weeks after the task force I found out that everything I had inputted was deleted from the final report. And so, when Jock Whitney came and offered me a position at a new startup, it really seemed appealing. Somehow one of my friends found out what I was doing and told one of her friends who was a corporate officer and I got a call about a week before I was going to resign, and the call that I got was "Hello, Heller? Are you Heller?" "Yes, sir." "This is Vin. Be in my office Friday at four o'clock." Vin Learson who was then president of IBM. I didn't know who Vin was and I went to my boss and said "Somebody named Vin has asked me to go to Armonk [ph?] Friday at four o'clock. Should I do it?" I thought he was going to have a stroke and he said "Yes, you should do it." Well I found out that was to be for a 15 minute exit interview. My 15 minute exit interview ran until around 9:30 that night.

Kapoor: Wow.

Heller: And I was asked then to go accompany him on his sailing boat in races in the next weekend. Had a good time but the next weekend after that this fellow named Jack Bertram who'd been running the big super computer program for IBM here in Menlo shows up, says "Vin asked me to talk to you," and I understood afterwards he wasn't thinking about hiring me. He was just thinking about doing what the boss had asked. Well he came in to look at some of the work I'd been doing on the whole approach to making systems that could withstand various types of serious hardware failure and he again, he came in to do an hour, an hour and a half with me. We ended up driving him home at around, what, five or six o'clock at night, Maryanne? And that was Saturday. Monday I was called to his office. He said "All I can do right now is double your salary but will you come work for me? I'll make it up to you and make sure

you get taken care of." So I moved up to research as the only non-research employee at research, was put into computer science. Over time had a lot of fun up there, met wonderful, wonderful people up there, and began a career that really got involved with all of the operating divisions and looking at how to design software to do extremely fast searches, indexing and how to design hardware. I did have a lot of patents in hardware. It never occurred to me that there was really a difference other than the tools used to describe them. So I was kind of an oddball, got involved in a lot of fun things and a lot of the labs would sometimes call up and ask me to look at something, then be sorry they asked me because I'd come up with about 20 changes. It was once said to me "We can't have you in Poughkeepsie [ph?] more than one or two days a month because in two afternoons you can give us enough work for a year."

<laughter>

Heller: So, but it was fun. I mean we had great interactions. There were great people and we could fight in a way that wasn't personal. You fought like hell and then went out and drank together that night. I did that around the labs, including in San Jose and in Boulder, Poughkeepsie, Endicott, Burlington, Fishkill. We got involved in a lot of disagreements that turned out to be more fun than anything else as we started to push things forward. We were making huge, huge strides at that time, both in software and in hardware.

Kapoor: Mm-hm.

Heller: And these were all pretty basic things. And then as I said, IBM reached a point where it was fire me or make me a fellow, so they made me a fellow.

Kapoor: So the division in Menlo Park, as you mentioned, was it called Advanced Computing Systems?

Heller: Yeah, ACS.

Kapoor: ACS. You know, it so happened that I had an offer from them when I was graduating from University of Washington.

Heller: So you must've met Dauber and Dave Hellman [ph?].

Kapoor: Actually they wanted to have me come and work here. I was interviewed on campus, and so they made me an offer to come work at ACS. Those were the Vietnam War Days and the draft. So everybody advised me that maybe stay out of the thing. I was not a US-- not a permanent resident yet. So I made a decision not to go but I just wanted to confirm that it was ACS.

Heller: That program had some amazing, amazing people..

Kapoor: I see.

Heller: ..in it.

Kapoor: I would have had a really interesting career if I had joined, yeah, but I didn't join at that time. So but you stayed in New York even though you were part of ACS? Is that..

Heller: I never was part of ACS.

Kapoor: Oh, okay.

Heller: They were just breaking up ACS at..

Kapoor: I see.

Heller: ...when I was joining Bertram, but all the people from ACS, not all but a lot of the people had moved back to Yorktown Research.

Kapoor: I see.

Heller: So I got to work with them and it was a good portion of the team, and then I met other members of the team who were out here over time and worked with them. My very first project was out here on the west coast over in the laboratory down in Los Gatos which I guess was built by Johnson & Johnson. I don't know who it was sold to.

Kapoor: I see. Okay.

Heller: It was a snake pit, a place where you could attract rattlesnakes.

Kapoor: <laughs> So I read also that you served as a member of the executive committee on technology.

Heller: Another TTP, yeah.

Kapoor: Yeah. <laughs>

Heller: I was their Token Technical Person here who tried to bring reality to what management wanted to do.

Kapoor: Right. A technical review board..

Heller: Yeah.

Kapoor: ...who said "Overseeing the long term technology commitments where the company had crossed the operating units," and as a general manager of the independent business unit you were responsible for UNIX.

Heller: Well, I was asked to go run a group that had done the very first RISC computer that was sold by IBM, which was way after the project we did in Los Gatos, and I agreed to do it. I went down. We had the IBM version of UNIX. AIX was there and we got to upgrade it and I ran both the software and the hardware group as..

Kapoor: Okay.

Heller: ...corporate vice president and president of the independent business unit. That was fun. We had a wonderful, wonderful team. We were able to ignore-- because we're an independent business unit we're able to ignore a lot of the things that were going on in the rest of IBM. We were able to deal with the different types of communication structures that were being used in the industry that were not IBM token ring necessarily.

Kapoor: Mm-hm.

Heller: Seldom IBM token ring, which got us into some trouble with the new chairman, John Akers, because he thought we should always be using only IBM architecture. I explained to him that our project, our goal as an independent business unit was to compete against Sun and Apollo and DEC and not to try to compete against IBM.

Kapoor: Right.

Heller: It was a difficult discussion.

Kapoor: Right. So the RISC RS6000 workstation, all that you were involved?

Heller: All the way through. If you look at the RISC chip set which is still being developed..

Kapoor: Yes.

Heller: ...Watson is based on the RS6000 chipset.

Kapoor: Yes. Very interesting. So a lot of the, as you said, the power PC, SB2, they're all direct descendants of those..

Heller: The power PC was a descendant from the one chip, single chip version. We had brought members of the team who were working on it in Burlington down to Austin to our team there, and it was very interesting to watch what happened with that chip, and then several other members of the team when I left IBM, several of them went to places like Silicon Graphics and Sun, but that was an amazing, amazing team. We built our own tools for verification of our physical designs and found out over time that everyone at IBM who was doing CMOS design was using our tools instead of using the standard tools. It took us about a year to finally get the fab to agree that our tools were considered standard, not customer-owned tools.

Kapoor: So besides EDA tools, design tools, were you also involved with say packaging issues or..

Heller: Very much involved in..

Kapoor: ...technology..

Heller: ...packaging issues.

Kapoor: ...all kinds of technologies? Right?

Heller: Yeah. We were at that time just at one micron CMOS. We used-- because of the way the IBM line was setup we were able to use a mix of CMOS and NMOS to drive some critical areas, and it was doable on their line without any real problems. The system was rather interesting. It was a RISC system

where we implemented a pretty aggressive multiply capability so that we could do more scientific operations, but it really still was a step and repeat.

Kapoor: Mm-hm.

Heller: Just done not a single bit at a time but multiple bits at a time. We did a lot of things with out of order execution. It was a very, very advanced design but what was equally important was we also had compilers under my division so that we were able to make optimizing compilers built around the structure of the computer. And so, you can get performance gains that were really significant.

Kapoor: Right.

Heller: Code motion based upon the structure of all of the pipelines in a computer and some of the other ways that we did execution allowed us to get more than one thing done per cycle in some cases.

Kapoor: Right. Right. Anything else you'd like to talk about during your time at IBM that you can think of?

Heller: No, except to say in those days IBM was a very interesting company. You could try something and fail and still survive and be there to fight another day. The people I met there were among the-- certainly among the most dedicated people I know but also became long term, lifetime friends no matter where they went, and that was a time probably one of the-- that was a Camelot time for IBM which I think ended really when John Akers came in and didn't understand that it wasn't the patents in a drawer that were important. It was the people's ideas that were important. It wasn't the installed base that was important. It was the customers that were important, and just that very slight difference changed the way he dealt with the engineers and scientists enough to start to break the culture, and it had been a very wonderful culture. It was a family culture. People gave it 110% because they knew the company was there to protect them no matter, and that made it a very different environment than it evolved to.

Kapoor: Right. Thank you. So after leaving IBM you joined the venture capital firm Kleiner, Perkins, Caufield and Byers, and can you tell us about that transition?

Heller: The transition was interesting. John Doerr had been trying to get me to come over to Sun and after a number of discussions I concluded it would not be fair to my team for me to take a job, even a senior position job at Sun. So John changed his strategy and asked me if I would come to work at KP, and my conditions were pretty simple. I wanted to be able to keep doing some of the consulting that I was doing. So I quit-- when I quit IBM the first thing they tried to do was stop me from quitting by threatening a large suit against me. Larry Sonsini from Wilson Sonsini pro bono came in and explained to

IBM what a right to work suit would look like given that they already had explained in their letter to me all of the different things I was impacting. So IBM instead of filing a lawsuit agreed to hire me as a consultant for their mainframe activities and I was free to do anything other than mainframes, which was fine. It wasn't something I was terribly interested in spending a lot more time on. My believe was and was pretty well-substantiated that CMOS machines would overtake and become the standard anyway and we were going to be with multiprocessors way before the end of the century. So I went to Kleiner and my very first week at Kleiner we went down to the release 3.0 or _____ conference where I was given a teddy bear that year for the Teddy Award, and got to ride around with John and Will Hearst and what's his name? Stu Alsop and a bunch of people like that, Mitch Kapor. In fact, I went back up to Silicon Valley in Mitch Kapor's Falcon. I got a chance to really meet some people that I had met with casually but as an IBMer was kind of protected from spending a lot of time with.

Kapoor: Right.

Heller: I had a lot of fun at Kleiner and I was consulting for a couple of other companies but mostly spending my time at Kleiner. Helped start companies like Rambus which Kleiner didn't want to do originally, and S3. As I said I was on their..

Kapoor: Right.

Heller: ...founding board, but basically half a dozen companies. Then I wanted to go do my own 64-bit microprocessor, and this was in '91 because nobody was doing it. It was obvious that that had to be the next step, especially for workstations.

Kapoor: Mm-hm.

Heller: It wasn't as clear that you'd have to do it for mainstream computing for a period of time, but as databases got larger and as the computational capabilities became more intense you needed 64 first for computational and then for addressing ultra-large databases which were going to come. It was just a matter of time. So I started a company that was guided to a large extent by Bernie Lacroute. The company was called HaL which stood for Heller and LaCroute but we never told anybody that.

Kapoor: I see.

Heller: And Bernie was asked by Kleiner to stay on at Kleiner and not to come on. So he stayed as a friend and advisor but never came on the company.

Kapoor: I see.

Heller: And we built that company in Campbell. We built a software arm down in Austin because my heart was still partially in Austin. Developed the first 64-bit microprocessors about 10 years before Intel had the Titanium. Christ, I knew most of the architecture guys who were working for Intel. They had come out of IBM also. We originally offered the proposal to take the RS6000 chipset and do a 64-bit microprocessor to IBM and they laughed and said "It's not needed. We've got a very fast microprocessor now. Thank you. The one that you developed." <laughs>

Kapoor: <laughs> So you also consulted with Xerox I understand?

Heller: Yes. Bill Lowe had become one of the officers at Xerox and..

Kapoor: I see.

Heller: ...knew me from IBM and asked if I would come up and start working with them. They actually had the very first SPARC based multifunction printer and they didn't bring it out because the business community there said "That's not what we're in," but they'd done a SPARC based fax, printer, ..

Kapoor: Yes.

Heller: ...scan.

Kapoor: Yes. I interviewed John Shoemaker who was a Xerox..

Heller: Yes.

Kapoor: ...engineer.

Heller: He was <inaudible>.

Kapoor: He was hired by Sun. So..

Heller: And I was very sad that they..

Kapoor: Yeah.

Heller: They had some really good technology. They had some very good technical people. They had-- in the technical community they had people who had the vision to see where the market and where the technology was leading the market. In the marketing community they had people who looked backwards to film and that was very sad because there was just some huge potential there.

Kapoor: Right. So it's interesting that I also knew John Doerr. He-- I was at Intel when I joined Cypress and we were trying to decide on the best tools. So he and I used to drive around looking at the best tools to design the RISC processor with Sun.

Heller: Yeah.

Kapoor: Because he was on the board of Cypress and Sun.

Heller: I know Cypress well. In fact, I think Cypress still has the only CEO who has a full automatic uzi.

Kapoor: <laughs> TJ Rogers has since retired, of course but the other..

Heller: Now, is John spending any time here in the Valley or is he spending full time out in Colorado?

Kapoor: John Doerr?

Heller: Yeah.

Kapoor: You know, I don't know. I have met him recently when we had the Intel reunion, actually the memorial service for Andy Grove. I met him at that time, but-- so I don't know.

Heller: You want a Grove story?

Kapoor: <laughs> Okay.

Heller: Do you remember when the 432 was being done?

Kapoor: Yes, at Intel.

Heller: The architect for that was a good friend and he sent me a 432 t-shirt which I wore into an IBM board meeting. It was not well-received, but I went back and I was at a dinner party that Grove was at and I said "You guys don't understand what you have your hands on. Embedding the basics of the operating system will be the direction you will go throughout time as we move forward. Don't give up on this thing." Well, a couple of weeks go by and I get a letter from Intel addressed to me at IBM and-- or it was addressed to me at Kleiner I think, but it had to be IBM. Excuse me for rambling a little bit.

Kapoor: No problem.

Heller: It was IBM, and the letter had on it one word. "Bullshit," with the signature of "A".

<laughter>

Heller: Well a couple of weeks went by and I was at a dinner party that Grove was at and he looked at me and he said "Did you get my letter?"

<laughter>

Heller: That's when I knew who the letter was from.

<laughter>

Kapoor: Right. Right.

Heller: Now Justin Rattner was another great, great, great thinker.

Kapoor: Yes.

Heller: He was an out of the box thinker there at the time. I don't think he was ever properly appreciated.

Kapoor: I worked at Intel with Rattner for like four years.

Heller: So were you there when they did the super computer?

Kapoor: I was there in the late 80s, '83 to '86 back when..

Heller: Okay.

Kapoor: But I was involved with the graphics chip in Santa Cruz, and then of course I knew Bernie Lacroute since we did all his-- so I didn't realize that he was part of HaL. <laughs>

Heller: He was involved in the creation of HaL and then never came in once we got the company actually started.

Kapoor: Okay. So..

Heller: You know he's growing wine now?

Kapoor: Yes, yes.

Heller: Growing grapes.

Kapoor: Yeah, up in Oregon? Yes. So, and HaL computer, I guess there was some association with Fujitsu. Did that happen later or..

Heller: No, that was actually-- when IBM turned us down Bernie was still working with me and we were working through the idea of doing the full system, the chipset, the hardware, and the software for 64-bit UNIX, and Bernie had worked with Fujitsu in the past and brought me in front of Sekizawa where we presented the whole..

Kapoor: Yes.

Heller: ...vision. He got very, very interested and started to work with us and I said "Let me build a team. Give me some seed money. Let me build a team so we can show you where we're really going," and they opened a bank account and they would put money in and we would take money out and we started to build the team. Well when they decided they definitely wanted to go forward, at that time they had several million dollars invested and had no paperwork. If we'd walked we would've walked with their money, but we went forward and did a handshake agreement to go forward with the company and sell

them half of the company for a very large amount of money. It was probably the largest first round in the history of Silicon Valley at that time, but it took us a long time to paper it, to do the documentation. So they kept sending money and we kept working and building the team. We were at about 300, 350 people by the time we actually signed the documents, but we were also about \$25 million into the program <laughs> by the time we finally signed the documents.

Kapoor: Right. So that was located here in the Valley?

Heller: HaL was down in Campbell for the hardware team, and the basic operating system team, all the tools and documentation were being done out of Austin.

Kapoor: Okay. So how did the company do and why was it sold to Fujitsu and when?

Heller: The company was well along the way. We'd gotten into some disagreements that over the operating system and ultimately over the software. There was a question of whether to stay with what Sun was doing or whether to go with UNIX System Labs and we'd become the developer for 64-bit for UNIX System Labs and actually had it running and ran into a fight between Fujitsu who wanted the Sun version and was our funder and owned 50% of the company, and the team who wanted to go and be the USL providers, and at that point we reached a point where I just-- I didn't want to keep going in that fight. It was not-- it just was becoming too much of a burden for the team to have these two pulls. The system was done. Fujitsu bought it. They had the right to buy it. They bought it for a large amount of money and made most of the original team millionaires, and used it in systems that they delivered through ICL and through Fujitsu around the world for a number of years.

Kapoor: I see.

Heller: And they've kept the team on. They still have the microprocessor team here in Campbell. I don't think they kept the software team because most of the software people that I talked to are out of HaL just working in other companies. So I think the software team has dissolved.

Kapoor: I see. Okay. Thank you. So then you transitioned from Kleiner Perkins to Heller Associates, or how did that happen?

Heller: I started Heller Associates when I left IBM as a consulting firm.

Kapoor: Okay.

Heller: That's where..

Kapoor: Right.

Heller: ...the Xerox and..

Kapoor: Sure.

Heller: ...some of those other companies-- I just kept it on when I left HaL and one of the reasons I left HaL is my son was turning five and was going to go into kindergarten. We had him at Harker. Harker's smallest class was 25 kids. My son was just graphic and extremely bright but extremely ADHD, and in a class of 25 he would not have survived.

Kapoor: Right.

Heller: We found a small school down here down in Austin where he'd be in a class of six, and he excelled. We moved down to Austin, and that again was one of the reasons why we decided to leave. It was a good move for us. It was a good move for my son. Unfortunately as I think I told you..

Kapoor: Yeah.

Heller: ...he passed away a few weeks ago.

Kapoor: So, after you left, maybe transitioned out of Kleiner Perkins and more up your own activities, I guess I..

Heller: I still remained working on boards for Kleiner Perkins for..

Kapoor: Okay.

Heller: ...a number of years.

Kapoor: Okay. Okay. So association with ClearCube for example, was that on Heller or from Kleiner Perkins?

Heller: That one's from Heller Associates.

Kapoor: Okay.

Heller: ClearCube Smart Technologies which we..

Kapoor: Blade Technology later.

Heller: Well, yeah. ClearCube was a Blade Technology. One of the things it had in it was-- well it doesn't matter. Smart Technologies was bought by, what is it called, I Squared, the company in Dallas.

Kapoor: Right.

Heller: They bought that at a time when we were trying to go through another venture round. They offered to buy the company at a significant markup to what we were going to get on the venture round. And they kept most of the people. I started a company down here in Palo Alto with John Mayes that ended up getting sold to Cisco at, again, a very nice step up. And the team went, I don't-- one of the things about being chairman when I work with these startups is part of my condition is I don't go if the company gets sold or acquired. And I did a number of other companies that have been fun and successful and interesting.

Kapoor: So, I see a lot of the companies that you have been, in the beginning, have been part of, and as you said, that you don't continue after the IPO, or--

Heller: No, at that time, there was no advantage to me being on a public board. My set of skills is in working with the technology with trying to find marketing channels and with working with the people. By the time you're a public company, you've got enough of that. And the public company needs a different set of skills anyway. It wasn't something I wanted to do.

Kapoor: So, were there any specific technical areas that you were interested in?

Heller: There are several. One of them, obviously, has been, for a number of years, in remote computing and remote technologies applied to medicine. I was on the board of a little company called Vinamatics [ph?] that was the very first company to do large scale telemedicine. That company got sold to Medtronic, but it wasn't sold until after we had gotten many of the big health providers in Texas to start utilizing our software and equipment. One of the big reasons turned out to be a very-- a reason we'd never thought about. We were originally doing it because it was a fun market because you could look at

it-- everyone thought you do telemedicine to reach an Indian tribe in Arizona. Well, that was true. It was also true that you could bring clinicians who were specialists into places like urban cities, Harlem. You're never going to attract the greatest and best clinicians into Harlem. But you could get them to work telemedically with extreme cases down there, do all of the pre and post procedure in a locality with local doctors and have them only come to meet with the clinicians for just prior to a surgery or whatever, a procedure, and during the procedure, and then be able to still deliver that level of technical skill to people who could not normally get it. And so, it was as important to urban areas as it was to remote areas. And we'd worked through and gotten both the hardware and software working and sold it to many, many of the providers in Texas. The governor of Texas, who became a President later on, Governor Bush, helped push through legislation that forced the insurance companies to pay for telemedicine. And that, of course, became-- that legislation became the base for the national policy that was put in place after he became President. The surprising reason that a lot of the providers wanted it was a lot of the big providers had contracts with major corporations. And what they found was one of their biggest expense items was, if a person was injured on a Friday, they would not go and talk to the onsite staff because they didn't want to be bothered and not be able to go on their weekends or whatever. When we put the telemedicine systems in place, they would go and go on the day that it occurred because they could be diagnosed instantly, not shifted around and sent around. Otherwise, they were waiting until Monday or Tuesday. And if something really bad had happened over the weekend, by the time they went in Monday or Tuesday, it could be very serious and very expensive to cure. And so, companies like Scott and White purchased our hardware and software to put into places like IBM for that reason. And we'd not anticipated that as a significant benefit. But of course, places like Stanford use telemedicine now. They used to service-- still service northern California in certain critical areas like pediatric oncology, pediatric pulmonary medicine. And everything pretty much north of San Francisco they do. And they used to send their clinicians around. When they got telemedicine, instead of having their clinicians go spend a day driving up and a day working with patients and a day driving back and then having patients come down for procedures and then have to come down for pre and post and spend five hours coming down from Garberville, California or Redding, they were able to meet with local doctors, save the patients huge amounts of wear and tear and get a huge number of additional hours for the clinicians. So, they become very fond of it. And we see that now everywhere. Stanford started a telemedicine program in Saudi Arabia in Riyadh for children.

Kapoor: Very interesting.

Heller: So, that was one of the areas of interest. Another area of interest has obviously been in transactional security. I've been working on high-end transaction systems for many years including companies that did hardware-assisted transaction processing and indexing. I'd been involved with transaction processing since the IMS days, which was 1966, 1967, and developed a lot of the indexing technology that you can reference in the books coming out of Stanford on computer science. They referenced a lot of the indexing techniques and technologies that I had worked on or patented. So, I'd always been interested in transaction processing and, over time, became much more concerned about the security and securitization of transactional processing as well as the protection of databases. So, I shifted away from super high-performance transaction processing where I'd been involved for years and started to shift more and more into security and privacy issues. I had told our attorney general, who is

now our governor in Texas, when he took his job as attorney general, I said, "Before you leave this office, you will spend more time on computer fraud, computer theft, and transactional capabilities than you will on anything else in your office." And I was right. So, that's where I'm spending a lot of time even today, going to multi-path and going to not-- people don't understand the Internet itself is a very insecure place to be. You don't want to send real data down there. You want to send other things. And going multi-pathing so you can do dynamic encoding and things like that really makes a big difference, and not sending, whether it's a credit card or anything else where the numerics are important, not sending that down but sending encrypted forms that are dynamically encrypted that only take part of the information down one path and part down another. Those are the types of things we're going to have to evolved to.

Kapoor: Yes, so can you say something about the homeland security you've been involved with?

Heller: I work as a consultant for them. Mike McCall is a good friend. He's head of the homeland security committee for the congress. And I work with a number of the organizations inside the government that are looking at that. Homeland security, people keep thinking of it in a rather limited way. Homeland security included working on ways to protect some of the critical functions in government from an EMP pulse, a mass coronal ejection, that we were anticipating during a high solar flare period from around 2008 through last year. And so, we'd gotten a lot of work done with state governments and city governments on protecting critical assets, computing assets, everything from building Faraday cages to building sacrificial electro-optic interfaces to their critical computational capability that had to be back up for emergency services. Everything from flood control and dam control-- which dam control, believe it or not, is online. You can get literally get to and open the floodgates of major facilities from online, to traffic control, all of these systems were exposed. And so, the idea was to keep emergency services, emergency communications, all of that, in protected areas, build the structures. And working with those institutions has been-- was a major portion of what we were doing for homeland security as well as the more obvious transactional capability and database protection.

Kapoor: Right, very interesting. So, those are very, very innovative areas I believe. Any other areas that come to mind?

Heller: Right now?

Kapoor: Yes.

Heller: Right now, one of the areas that I'm spending a lot of time in is I've reinvigorated my singing.

Kapoor: Ah, of course, we'll come back to that.

Heller: Okay.

Kapoor: But in terms of the techn--

Heller: In terms of the technical stuff, I'm working with some companies that have been a lot of fun. I'm doing some stuff with drones for new applications that basically can reduce the cost of certain types of functions by an order of magnitude as well as increase the scheduling, the actual intervals-- decrease the intervals to a much shorter time to protect against damage from certain things. That, working with software to provide certain types of services that are now being done through intermediaries and eliminating the intermediation and doing everything automatically in real time to significantly improve the benefits of various types of things in medicine and staffing and types of just general operational things that are being used by companies today that are being done semi-statically with manual intermediation and really automating those.

Kapoor: So, what are your views about cognitive computing and currently in the data analytics and big data, in that whole domain, any of your thoughts in those areas? IBM is, of course, selling big--

Heller: I've gone and visited my grandchild several times. As you know, Watson is based on the chipset that was developed for the RS6000 and continues to evolve down in Austin. I think that two or three things have been discovered. And all of them play into where technology will lead us naturally. One is that along with big computing, big data is opening up areas of not just solution but innovation of understanding that could never been done before we had big data that was rapidly available. We used to think in megabytes or then in gigabytes. Very few people, until the last ten years, thought in terms of terabytes. And on the cognitive systems, we're talking about petabytes. Ten years ago, a fifty-petabyte machine was prohibitively expensive. And the architecture wasn't there. Today, a fifty-petabyte machine can be done, is being done in various locations for things like Watson. In five years, we'll see a hundred, hundred and fifty petabyte machines, which can be used in a way that allows the computers not just to do reactive modeling but to answer huge amounts of what if or correlative studies. If you think about some of the diseases we have, we have no databases on things like trisomes, which affects eight hundred thousand people in the United States alone and comes in various forms. We know it has some types of commonality with other diseases, accelerated amyloidosis. So, getting to big data is going to be one of the critical areas that will be naturally fed by our ability to make larger and larger storage devices and larger and larger memories. And that's going to change a lot of the way we do things, a lot of the way we look at AI, a lot of the way we look at cognitive processing. Once we can eliminate the data constraints, the ability to integrate everything from structured data that really is built around an inferential structure based on a particular point of view, based on a particular protocol, allows us to do things we could never do if we were limited just to one view alone.

Kapoor: Very nice. So, I've seen a list of companies that you've been-- you have mentored or started or have advised on. It's amazing. How do you find the time? How do you-- how many companies are you currently serving, for example?

Heller: I'm currently working with several companies. Some of them take a lot of time. Some of them are done more as service to help people I know who want to start up companies or have an idea that I think is useful. Some of them are just companies that are doing something that I view as being a social benefit. One of the companies I've been advising deals with clothing to be worn post-surgery that's much more comfortable and designed to be able to make life easier for post-surgical patients, simple area, looking at embedding new types of sensor technology into that that can be used for home medical remote medicine, things that allow us to do things that let the patient get home more rapidly. But those are things I do just for fun. And there's always-- it turns out, if you're doing something fun, there's always enough time.

Kapoor: Of course.

Heller: And there's never enough time. But there's never enough time no matter what you do.

Kapoor: That's right. Of course. So, now let's talk about your other passion which is music. As you mentioned, you started with the drive in the very beginning of your life, and now you're-- you've been doing a lot of-- can you tell us more about your involvement, Tommy Dorsey, and other artists--

Heller: Well, for the last ten years-- my wife, ten or twelve years ago, gave me a Christmas present. I opened up this package. And in it was a cover of a CD that said, "Andrew Heller Sings." And I looked at her. And I said, "Did you record me in the shower?" She said, "No. You don't sing in the shower anymore. I want you to sing. I want to have something to you remember you by since you're an alpha personality and are probably going to kill yourself through something stupid. And I want to have a memory." So, I thought she was kidding at first. And I realized she had actually put money aside in a shoebox for years, found a producer who was a Grammy-nominated producer who was willing to take on doing a very simple album, which we did. And I told her, if she could sell two hundred copies or more, I would go do a second album. She exceeded her requirement. The second album we did was a Christmas album that had gotten worldwide acclaim. While we were cutting the Christmas album, we started work on a country album because there were just a number of old country-western songs that I thought were really part of the American heritage, things like "El Paso," which went to the top of the charts for nineteen weeks when I sang it.

Kapoor: Wow.

Heller: So, we were doing pretty well in terms of getting penetration into radio and other things. And I was beginning to enjoy performing. I performed at universities. I performed at performing arts centers. Last

year, I went off and did a short mini-tour with the Tommy Dorsey Orchestra. I've just finished cutting my second album with the Nelson Riddle Orchestra with Chris Riddle helping us doing Sinatra songs that were originally orchestrated by-- arranged by Billy May and by Nelson Riddle and bringing back that original big sound. It's hard to record big sound today because most of the studios are designed for small groups. And if they have to get a big group, what they do is they divide it up and then electronically put it together. You get all of the music that way. What you don't get is the interactions in the room. And although we mic every instrument so we can bring up or bring down an instrument, we also mic the entire room, which changes the whole dynamic. And on the new stuff, we're going to vinyl because we can actually master very differently and bring in all of the full range of the music and do something that you can't do on a CD because of the sampling rate. You have to compress both-- on the spectral image, you have to compress. And you also have to compress on your dynamic image. Remember, a CD doesn't really like a hundred and twenty DB range, which is what the human voice has. You just can't do it. So, you're running compressors on sound. You're trying to fit into the spectrum of FM radio because your CDs have to be playable. You're trying to fit into MP3, MP4, NACH, so that you can be put on iTunes and other things. But with an orchestra and with the types of arrangements we're doing now, having a thirty-piece orchestra is something you can really have fun with if you're willing to go and present it in a way that allows you to really hear the difference. It's a different experience. And so, we're bringing out our new stuff. We're bringing it out iTunes and MP3 or MP4, but we're also bringing it out on vinyl, which really opens up.

Kapoor: Right. So, besides the orchestras that you're associated with, do you have a group, your own group?

Heller: It depends on where I am. I usually have a few people from Austin that go wherever I go, but we pick up local artists. So, when I'm in New York, when I was at Hofstra and doing things up in New York, we picked up local musicians from New York City, did one quick rehearsal with them. Professional musicians, if you have the arrangements fully done, are pretty quick at picking things up. The only thing you really need is a conductor who knows enough about you to watch you because I'm watching the audience. I'm singing a story, and I'm watching the audience. And I'm going to move the music around as I watch the audience. And I need a conductor who, number one, knows that I'm going to do that but, number two, knows he plays the music. He may slow it down or speed it up because of me, but he knows I'm not going to be necessarily on the beat that he's on. I'm going to come in early, late, do the phrasing in a way that tells the story. And I learned that from who I think was probably the greatest person at telling stories with a beautiful voice. And that was Frank Sinatra, which is why we did the two albums as tributes to him. And I don't-- I'm not an impersonator, which is why our music is doing well. We go places where they don't want an impersonator. My view is if I'm going to listen to an impersonator, I'd rather just listen to the original because it's always going to be better. But when we did a tribute to Sinatra, we took the music that he had made famous and did it our way, which is why the first album was called "Sinatra My Way." We've also done some inspirational music. I was asked to do some by a number of friends. One was a particularly poignant request from a friend who you know who lost his son, Dave. And he asked me to do a —song, a specific song for his son, which we did. And we did an entire inspirational album around that. Well, the album got great reception. So, we did a second inspirational album. And I was one

of the final nominees for entertainer of the year by the Inspirational Country Music Awards. So, we've been touring [ph?] around with basically the American songbook, Broadway, the songs that really are Americana. I don't do rap. I only do upbeat stuff. The desire I have when I sing is to be able to watch an audience and see their eyes light up, and see their passive expressions go to smiles, hear them stamp their feet as they are listening, and know that we've reached them. We did a show in northern California for a town that had been decimated by the events of 2008, but more importantly decimated by the administration's decision to stop most of the logging in the national forests. And this is in an area where eighty percent of the county is national forest. To make and exacerbate that problem, their mill had burned down in the town which employed a large number of people in the town. I got a call from the mayor, "Would you please come up and do a show. We can't afford you." That was his exact words. I said, "Tell me more." And he told me about what was going on. I said, "I'll come up, but I won't bring the band because I can't volunteer them to work for nothing. But I'll come up under three conditions. One, I get eighty percent of the house." So, the second was I controlled the advertising and the prices. And the third was I was not going to bring the band. I would sing to tracks augmented by one or two local people that I would pay. Of course, they agreed to that. But the mayor's first comment was, "Well, people here are really broke. They're not going to be able to pay for your tickets." I said, "I'll set the price on the tickets. And I'll take that risk." He told me they had built a performing arts center. And I figured okay, they went out. They did a bond. They got a contractor to come in and an architecture firm. I get up there. And they had built a performing arts center. But he meant they had built, not had a bond issue. They had built it. It was a huge Quonset hut style building from the outside. You walked in and the lobby was basically modern Quonset hut. And then you walked through these doors and walked into an area that was dark. All of the hallway walls were carpeted. The hallway was carpeted. If you walked up to the stage house, it was a very large, nicely modern well-lit stage house. And if you looked back up, you saw a very steeply angled audience that held about four hundred people where each one of the seats was hand done in Mexico with leather. So, I went in to do that show. I was supposed to do two forty-five minute segments. The first segment ended up running a little over an hour and the second about an hour and a half because people wouldn't stop. They wanted more. That's when you know you've reached them. That's when you feel good. You get so much back as a performer. So, that's why I like doing it. I like doing upbeat stuff, things that make people happier. I really don't understand performers who want to do negative songs, whether it's rap or just dark music. I'm not even a fan of some of certain things that Wagner did because I find it's too dark. I like doing things where music can reach people. It reaches people in a different way than anything else. It reach-- we have our brain, and we have our soul. Music reaches the soul more than the brain. And it's something very special because you can make a difference in people's lives. So, we've been recording. We continue recording. I don't know how much longer we'll do that. But I'm scheduled to do another charity show next month in April. We're raising money for high school performers to help high school musical theater. We have a program that works with a number of central Texas high schools, helps both the schools with monetary assistance for the schools who don't have enough in their budgets to be able to have these programs and works with the kids, scholarships for the kids that they can take wherever they go. So, that's one show that we'll be doing. We're bringing out the album. So, there will be a number of shows associated with that both on television and-- and it keeps me-- when I have spare time, that's what I do. And it's fun.

Kapoor: So, I noticed that in your technical contributions and also in the musical world, a lot of social consciousness and helping raise the spirit and raise the-- you know, do things for society.

Heller: Yeah, we were very lucky. My wife and I have worked hard. I mean when I was at IBM, and HAL, and Kleiner Perkins, and since, I used to like working basically seven days a week and eighteen to twenty hours a day. And it wasn't until about eight years ago that I decided I no longer wanted to take-- or ten years ago, I no longer wanted to take an active management role and pulled back to working only part-time, working sixty, seventy, eighty hours a week. It occurred to us that we had been very lucky. And we'd been-- we'd made money, not Bill Gates style money, but plenty of money. And so, we were able to contribute, and have over all the years that we've been in Austin, which is almost thirty years now, able to contribute to things like education at the university, hospitals that take in any patient no matter what. Engineering, of course, is part of education, but music and the arts, not just through the university, but through the opera, the symphony, medical facilities, including raising money and starting the seed money, but raising money for special instrumentation at some of the hospitals. We did a five-hour show at our-- we have a house downtown, two blocks from the capitol of Texas, on the main drag. And we did a party down there for people to introduce the city and a number of my friends to one of the first IMRIs that was going to come to Texas. I think it was the seventh or eighth in the world. We went to Dell Medical Center, which is a children's hospital, the only platinum children's hospital, by the way, in the United States. The show lasted five hours. We did two hours of music. We brought in people like Ray Benson and acts from the university, local acts from people who aren't known nationally, then stopped. They did a one hour presentation on the IMRI and had one of the kids who-- we had the head of neurosurgery there. And he presented. We had all four television networks there. And they-- each one of them ran a section in their nightly news, which made people aware that we were raising this money. We needed to raise six million dollars. We raised a significant amount from that party directly and then indirectly from the people who saw stuff. We were able to get the instrument.

Kapoor: Wow.

Heller: So, it was stuff like that that's fun. And we contribute to things like that. When they needed money to do a new wing at the hospital, which is a Catholic hospital that, as I said, takes anyone. We contributed the foundation grant for the new wing. And when a children's hospital needed a bone marrow transplant wing, we did the anchor donation for that. When our performing arts center was being built, we gave a significant amount of money there. We try to do things that affect the community in a positive way or affect our children in a positive way. Mary Ann and I are very concerned that we have to go spend the time, number one, to incentivize kids to learn more, especially in arts and science. But also, we believe very strongly that we have to reward the kids who really have a work ethic and have demonstrated it as well as a skill level. And so, we're doing things like endowments and other things to both help students who are already in universities but to also help younger students find their way when they've already demonstrated that they're willing to put the effort in and have some skills. Those will be our leaders. Those are the kids that we're betting our country on and our futures on.

Kapoor: That is really fantastic what you're--

Heller: And as I said, we've been lucky enough that we can afford to do it. We don't need that much money to eat. We have all of our toys, all the essential toys.

Kapoor: I see a lot of people having foundations and starting philanthropic--

Heller: Yeah, we have a foundation also.

Kapoor: And I'm sure you have. But I think what's really special is that you are engaged, that you're actually contributing to the passion.

Heller: Yeah, we sit on the board of this-- my wife sits on the board of the symphony. I sit on the board of the opera. We're on the advisory board for the musical school, the Butler Music school at the University of Texas. I'm actively involved with natural sciences on everything from the computational computer science organization to the physics organization and high energy physics. We sit on the-- both of us sit on the board of the college of fine arts. But we're just involved in a lot of things. She's on the board of Seton Hospital development group. And so, we try to get our time in as much as we can on these things. And we do our fun things too and sit on boards like-- we have airplanes. So, we sit on boards of the airport, local airport, which is owned by the pilots.

Kapoor: This is fantastic. So, we were talking earlier about the new work ethic and how the new students and the current students how they're behaving in terms of entitlements and things like that. So, just wanted to ask you, since we are probably some the same generation of development and work ethic that we were engaged in, and we have some sort of a commonality in what we felt--

Heller: You do realize there's only one-year difference in our ages.

Kapoor: Yes. So, any advice, any recommendations to the current generation and future generations from your side as to how should one view life, and what should we be doing?

Heller: There's a few things. One, don't force but encourage your kids. Two, get them off high-stream, high-velocity video, and have them do more things that require them to do some thinking. If they're not doing that, they're not developing the parts of the brain that will help them in the future, whether it's having some norm in their own brain that's not coming from a war game or something else. But having some norm that allows them to build expectations in what they're going to see as they turn around a corner or what they're going to hear when they talk to a friend of theirs. When you have kids that can't

even talk to one another but walk down the street texting one another, we have a serious problem in-- developmental problem that is going to inhibit the curiosity in our kids. And inhibiting their curiosity basically takes all of the potential brain power they have and leaves it unfocused.

Kapoor: Yes.

Heller: And don't forget the arts, music, great literature. Show our kids what the human mind is capable of. We send our kids through high school and college and maybe graduate school and then tell them okay, go reach for the stars. And what they've been exposed to is not what the limits of the mind are. They've been exposed basically to standardized teaching and to regurgitation education. But they haven't seen what Shakespeare could do in writing the greatest psychological documents in history and doing them all in iambic pentameter. They haven't heard a great opera where the acting and the singing are done together to tell a story. They just-- they haven't seen the mathematics of some of the great thinkers. And without that, when you say, "Reach for the stars," they look at you and say, "Is the star-- is that the thing at the end of the driveway with the light on it? Is that a star?" We have to get our kids exposed to the greatness of the human mind not the lowest levels of our society. We're taking things like music, and instead of exposing children to what can be done with harmony, melody, and rhythm, we're allowing them to go off into seeing the most primitive rhythm with the exclusion of harmony and melody. And they're seeing things that are so primitive and so simple, they're not able to understand what the human mind is capable of actually doing. So, they don't set their own expectations high. And as parents, we need to be able to help them be exposed to those things. They can make their own decisions when they're older. But our responsibility is not to let them tell us what they want to be exposed to as children but expose them to the best and greatest things they can see. And that's my only advice.

Kapoor: Thank you. Thank you so much.

END OF THE INTERVIEW