Oral History of Leslie L. “Les” Vadász

Interviewed by:
Rosemary Remacle

Recorded: October 18, 2010
Mountain View, California

CHM Reference number: X5915.2011

Rosemary Remacle: My name is Rosemary Remacle and I’m sitting here with Les Vadász and we’re going to record his oral history today for the CHM archives. Les, you and I discussed this, but we’re not going to spend a lot of detail time covering some of the early years that are covered in quite a bit of detail in the interview between you and David Brock and Christophe Lecuyer done by the Chemical Heritage Foundation and in their archives. But let’s start with your version of how did you get to where you are today and what are you doing today? I’ll stop and ask some questions along the way, but that’s the general idea of what I’d like you to respond to.

Les Vadász: Well, maybe we can start with what I’m doing today other than this interview. <laughs>. I spend about two-thirds of my time in Sonoma, about forty-five miles north of San Francisco where we have a beautiful place with a vineyard and we are farmers. <laughs>. We grow grapes and sell them to winemakers. I am also involved in the local community, particularly the K through 12 school system up in Sonoma, and also in a variety of other areas of philanthropic interest. We also have a home down in Silicon Valley where our two sons, two grandkids and my wife’s mother live— we want to make sure that we don’t miss our grandchildren’s growing up—and about a third of our time we spend in the Valley. While I’m in the Valley, I also work with a few, very few startup companies where my experience may be of some help.

Remacle: How do you decide which startups that you’re going to work with?

Vadász: Oh, people come and ask me about a variety of things and obviously the conversation gets very fast to, “Well, would you be involved?” And I like to be involved just in a few cases, in stuff which is really high-risk, that it probably won’t work or may work eventually, but it’s not a cookie-cutter type of technology. Generally, it has to do with new technologies that are closer to my experience in the semiconductor business. I try not to get out of that area because, you know, many of us think that we are experts in everything once we had a few years of successful experience in some area. I try to restrict it to the area where I think I have some instincts.

Remacle: How did you choose the schools to get involved with? That’s kind of a step away from semiconductors?

Vadász: Well, here we get more into how did I get here. And if I look back to my career, if there was any deciding factor that allowed me to participate in this business, it was my education. I left Hungary as a refugee in 1956 and I landed in Canada where I was fortunate enough to be accepted at McGill. I got an engineering education there and everything else really originated from that. And so I am a very strong believer that education is a great equalizer and education is something that we need to support and build and build and I’m kind of fanatic about that.

Remacle: How did you get into engineering? Was there a person or persons that influenced you [in that direction]? Were you interested in those kinds of things all of your life? Who, what influenced your decision?

Vadász: Well, my parents were not college educated. In fact, I’m probably the first in my extended family to graduate from college. But there was always a value placed on professions. There was always

a reference to “he’s a lawyer”, “he’s a doctor”, “he’s an engineer”, and there was some reverence about these people. And for a little kid, that’s an influence. And when I was in high school, I went to a technical high school in Hungary and in fact I started first year of university before I left. And so I was in engineering school back in Hungary and it was obvious, logical, to me that I’ll continue in engineering. Now along the way, I shifted because I was focusing on mechanical engineering while I was in Hungary and I was focusing on electronics when I was at McGill.

Remacle: And what caused that shift from mechanical to electronics [engineering]?

Vadász: Oh, probably all the buzz about electronics and all the excitement and interest that I was reading more and more about, and learning more and more that major trend. And in fact, one of my professors was writing a book on semiconductors, so we were learning from the manuscript of his book on semiconductor technology. That’s how early that was in the age of semiconductors.

Remacle: And this was 1956?

Vadász: I started McGill in my second year, in 1957. I graduated in 1961. It was a five-year school.

Remacle: Your first job in business or position in business, was that at Transitron?

Vadász: Yes. That was at Transitron.

Remacle: And how did you get to Transitron from McGill?

Vadász: Because I couldn’t get a good job in Canada. That’s how simple it was. I was offered a sales engineer job by Northern Electric and that was the only job I was offered after graduation. And I didn’t know much, but I knew one thing; I did not want to be a sales engineer at that point in my career. I mean that just wasn’t what I felt I’m going to be good at. And so I was interviewed by Transitron amongst others from outside Canada, and they offered me a job. And they sponsored my papers and in the latter part of ’61, I immigrated to the United States.

Remacle: What was your first job at Transitron? What were you working on?

Vadász: I don’t know if you know the history of Transitron. The way I understand, it was formed by a scientist from Bell Labs, David Bakalar, who did some work at Bell Labs on diodes. And so they formed this company, which was very successful in diodes and also in securing a number of government contracts. And I started working on one of the government contracts relating to study of material properties, more specifically, lifetime in silicon and the doping of silicon with gold, and its effect on lifetime. This kind of stuff… very <laughs> arcane stuff today.

Remacle: The early customers for semiconductors were significantly military…?

Vadász: Yes.

Remacle: Was Transitron’s entire business built on military contracts or subcontracts?

Vadász: No, no, no. Transitron was not just military contractor, but it was a very heavy proportion of its business. I have no idea how much. I was one guy in the very small R&D facility. I did not really have that much knowledge of the total [picture]. All I know is that my project reported to Sandia Labs and I remember a number of trips to Sandia, and my first encounter with Mexican food. <laughs>.

Remacle: I was just thinking as you said that, that the difference between Hungary, Canada and New Mexico, particularly the Sandia part of New Mexico, is pretty dramatic.

Vadász: Very much so. My number one memory of that time was eating Mexican food which had cornmeal in it. And I just felt absolutely nauseous because I never in my life had cornmeal and there was some aroma with it that just did not agree with me. And for a long time I did not walk into another Mexican restaurant. Today I love it.

Remacle: It’s pretty good stuff I have to say. Did you feel like you were working on something that was really innovative at Transitron? Did you feel like you were doing leading-edge work or were you just doing what you’d trained to do?

Vadász: Well, it was in the R&D group, it was an R&D contract. We were really gathering knowledge that didn’t exist. So clearly I was thinking that, you know, I was working in a particularly leading-edge area. Now, I did not understand the commercial implications of that, but from the technology point of view, those were leading-edge studies, I thought.

Remacle: Why did you decide to leave Transitron and go clear across the United States to California?

Vadász: Well, I was at Transitron for almost three years, two and a half years or so. After a couple of years, I was getting pretty restless that I didn’t really feel that I was learning anything. And, you know, I was out of school less than three years. I mean I felt that, you know, I have many decades of career ahead of me. I really need to learn more and I need to be in a company where I can learn more. The other choice was just quitting the industry and going back to study. But for a variety of reasons, I <laughs> chose industry, economics being one of them. At that time, the pinnacle of technology activity, in my estimation, was at Fairchild R&D. I really wanted to go to Fairchild R&D. And I interviewed at a variety of places, half a dozen different places.

Remacle: Which ones?

Vadász: IBM, Sprague, Westinghouse, Fairchild. I think that’s basically it. And I got job offers from everybody, but there was no question in my mind that if I get a job offer from Fairchild, I will go to Fairchild. And in ’64, I ended up at Fairchild.

Remacle: Who interviewed you from Fairchild? Do you remember?

Vadász: Oh, God, the names. I mean clearly the name I remember is Pierre Lamond who also was at Transitron.

Remacle: I didn’t know that…

Vadász: And left before I left Transitron and went to Fairchild. That was one of the people who interviewed me. And I frankly don’t recall, you know? It’s been a hundred years ago… so it seems.

Remacle: So you went to Fairchild R&D then in 1964?

Vadász: ’64.

Remacle: And what was your first assignment there, who were you working for, what were you working on? Paint that picture a little bit.

Vadász: Well, I got involved in a group that was doing integrated circuits, logic circuits, a new family of integrated circuits called CTL.

Remacle: What does that stand for?

Vadász: Well, there is DTL, TTL. I mean obviously there has to be something. It’s one of the three letter acronyms referring to a way of putting together transistors to create the logic functions. And the head of that group was Bob Nevela. And we were doing a variety of gates, flip-flops and the like, planning to come out with a new family of integrated circuits.

Remacle: Had they framed the customer problem that you were working on? Was it “smaller, faster, cheaper”, was it “more reliable” or some combination of those?

Vadász: Hey, I had an assignment, here is a gate, we will do it this way. Now go and do it, develop it. And I really was not involved in the customer—well, the only time I was involved with the customer side was when visitors from companies came and we wanted to show what we have. I really had the job of developing the electrical characteristics, the layout, test the gate and characterize it, making it work. So I can’t..

Remacle: Was what you were doing particularly innovative?

Vadász: Well, it was supposed to be…

Remacle: What was your learning curve?

Vadász: Well, the number one learning curve was making integrated circuits. But I have to say that at that time, I looked at that job as, you know, it’s a good learning, but I was getting more and more interested in what MOS technology can do. I dabbled in MOS a little bit while I was at Transitron, just more from the point of view of trying to understand it. And in fact, my boss at Transitron and I published a paper on MOS.

Remacle: And your boss was?

Vadász: Well, on a day-to-day working level, it was David Root. The head of the small R&D group was David Navon.

<crew talk>

Vadász: And so, at the first opportunity I had at Fairchild, I got involved in MOS. And that came about when Fairchild organized a group called DIED, digital integrated electronic department under Bob Seeds.

Remacle: It had an unfortunate acronym.

Vadász: Yes.

Remacle: DIED.

Vadász: Yes.

Remacle: What was it about MOS that you found challenging, interesting? What caused your attraction to it?

Vadász: That it was really the number of transistors that you could put on a small piece of silicon to create bigger and bigger functions. You know, I did not at that time, understand what those bigger functions were going to be, but just the potential of doing that. And it was far beyond what I could see possible with the bipolar technology, which was, at that time, the mainstream business. And that potential kind of drove a number of lunatics like me who really thought that well, there’s the future of the business.

Remacle: And when you say the business, you mean the semiconductor…?

Vadász: Semiconductor business. And we really believed that, just because you can put so many transistors in a piece of silicon. We are talking about the economics of semiconductors; it really depends on just how many functions can you put on a piece of silicon. And from that point of view, the economics really played into MOS technology.

Remacle: Why did it take the market so long to broadly adopt MOS if that was the promise? Because there was a lot of back and forth between the bipolar people and the MOS people for several years…

Vadász: Well, the interesting thing was that MOS was not that interesting of a technology at the same level of complexity as the bipolar because it did not have the ability to drive other circuits at a fast enough rate. It was not fast enough because it was really bogged down by parasitic capacitances. And the parasitic capacitance may be from the package, it may be from the lines on the printer circuit board, the other packages that it had to connect to, but anyway, there were enough parasitic capacitances that if you applied MOS at the same complexity level as the bipolar, like three, five, ten, fifteen transistors on a chip, it wasn’t very interesting. Now, on the other hand, if you imagine that I’m going to package thousands of these, tens of thousands of these on a piece of silicon, then internally, on the silicon chip, those parasitic capacitances are many orders of magnitude smaller than they are outside the package. As a result, suddenly performance had to be looked at at a totally different way. The more functions you could put on silicon, the less you had to come out of the chip to do your total system, the more effective MOS become as a technology to use in our products. And we see the effect of that today.

Remacle: Very broad effect….

Vadász: Yes.

Remacle: Very broad in fact. When you were at Fairchild, were you getting a growing sense of the importance of the semiconductors to our world or were you still viewing it more from the engineering challenge point of view?

Vadász: Well, at Fairchild I learned a number of things. I learned more and more about the whole world of where these kind of products are used, particularly the computer industry. I also learned about the dynamics of organizations, the dynamics of large companies and I also learned a lot about the technology issues associated particularly with MOS. I learned that MOS much more from the theoretical conceptual point of view before I got to Fairchild. I learned that MOS has a mountain to climb, if you will, when I was at Fairchild because I learned some of the studies and some of the work that has gone on before me at Fairchild. These studies really established the foundation of what will make for a manufacturable technology.

Remacle: So were you exposed to the world outside of the R&D organization at Fairchild? It sounds like you were from some of the comments you just made. How did the R&D group work with the product or manufacturing groups? How did Fairchild structurally integrate those two functions?

Vadász: Well, when you were at Fairchild at that time, and you were in Fairchild R&D, you learned very rapidly that there was Fairchild R&D, and there was the R&D community at large.

Remacle: You mean [the R&D community] outside of Fairchild?

Vadász: Outside of Fairchild. Then there was the manufacturing and business organization of Fairchild. There was a big moat between the R&D organization and the manufacturing organization and I increasingly got the feeling that it’s very, very difficult to transfer anything from R&D into manufacturing. Generally it was looked at from the manufacturing side that “well, it’s not ready for primetime. We will have to reengineer it”. And they perhaps had some reasons for it too. It’s easy to create R&D organizations which are insulated from the market and it’s easy to create a manufacturing <laughs> organization which is insulated from new technology.

Remacle: So you were at Fairchild for four and a half years?

Vadász: Yes, about five years …yes, a little over four years actually.

Remacle: So what caused you to consider the possibility of leaving Fairchild and go to Intel besides your personal relationships with people like Andy Grove, etcetera?

Vadász: Well, I think I told this story to…

Remacle: David Brock?

Vadász: Dave. I was coming home from the funeral of my father in Montreal, and my wife was waiting for me at the airport with the news that Andy [Grove], Gordon [Moore] and Bob [Noyce] left Fairchild— I’m saying it in the wrong order— Bob, Gordon and Andy left Fairchild, and that they would like to talk to me. And obviously when they explained to me what was the purpose of the enterprise and having the opportunity to join people whom I respected—I felt that they not only had their head screwed on right, but they were really the leading thinkers, the leading technologists in the business— it took a few nanoseconds to decide.

Remacle: How closely did you work with them individually when you were at Fairchild?

Vadász: Not that closely. I mean I was leading the MOS section within DIED.

Remacle: Electronic devices?

Vadász: Yes, that’s right. Bob Seeds was the head of that group, and Andy was the assistant general manager of R&D and Gordon was the general manager or director of R&D. I think it got it all wrong.

Andy was assistant director and then Gordon was director of R&D. I worked with Andy on a paper before, or was it during? I think during that time…and then I worked with Gordon on a manufacturing/ R&D cooperative activity where some of the manufacturing and R&D guys and Gordon and I met periodically to see how can we, you know, bridge the divide that existed between the organizations. So I knew Gordon quite well from those meetings, I knew Andy quite well from my collaboration with him; I really did not know Bob very well.

Remacle: In that nanosecond that you made the consideration about whether you would leave Fairchild where you had been for a period of time and go to Intel that wasn't even a company yet really, how much concern did you have about risk or did you and Judy discuss “should I, shouldn't I”? You were still young and threw caution to the winds?

Vadász: Well, you know, I was pretty confident about my capabilities. I looked at the risk as, so what if it doesn't succeed? Is there a risk that I'm not going to be able to get a job? Hell, no. So what is the risk? That was it really. And so I never was considering the possibility that we would fail and I wouldn't be able to get a job. That was just not in the cards.

Remacle: So what was your first assignment or job responsibility there?

Vadász: I was setting up the MOS engineering organization.

Remacle: Intel was pretty much formed on the premise of MOS, right?

Vadász: Well, we were formed on the premise of memories, semiconductor memories and it was obvious from the beginning to many of us, to virtually all of us that MOS had this ability to..

<break in audio>

Remacle: We were talking about MOS and Intel and the decisions about MOS.

Vadász: Well, first I want to make sure that it's clear I didn't go to Intel with the notion that well, we'll do something. I mean I was very specific in my desire to do MOS, particularly silicon gate MOS technology and apply it to memory products. Now as things turned out, the very first product that Intel introduced was a bipolar memory, which obviously did not help my ego at that point, but that was the fact.

Remacle: Why was that? Was it ready to go to market faster?

Vadász: Well, no. An opportunity came to provide a very fast, small memory to, I believe Honeywell and we put together a team and when I say we, [I mean} Intel. It wasn't my side of the house <laughs>, okay? Intel put together a team and it was based on the technology history that the company had and

the good team that we put together. It was relatively simple to put together and so it was. At that point, we were still struggling to make silicon gate MOS work.

Remacle: In production?

Vadász: In production. I mean the technology development and production environment was one. We didn’t have really two organizations.

Remacle: That that an outgrowth of the team’s experience at Fairchild?

Vadász: It was clearly an outgrowth of our experience at Fairchild. We felt that the concept of a separate R&D and separate manufacturing/product development organization just did not work. And what we wanted to do is create an R&D and a manufacturing organization where the linkages were strong enough that, shall we say, they needed each other. So I spent a lot of time with the manufacturing folks while we were developing it. And we had a person who went with the product from R&D into manufacturing to become the product engineer, working in manufacturing but coming from R&D and continuously oiling that interface between our manufacturing activities and our development activities.

Remacle: Was it hard to find people on both sides of that divide—because they had come from other companies I presume where they were used to the R&D moat—to teach them to think and to work in this different way?

Vadász: Well, you know, it was hard to find good, competent engineers, but that was a different issue than people wanting to work in this kind of environment. No, I don’t remember that as being an issue. I think this is where management plays a very important role. If you put the right structure around talented people, they’ll do wonders. And I think that we had the right structure. I think that engineers felt that, you know. Those engineers developing the product, they felt that the success was measured by how successful is that going to be on the market, not what kind of a paper can I write about it. Now it may be that you write a paper about it, but having a successful, marketable product, that was really how we defined success.

Remacle: Your first job title at Intel was?

Vadász: Director of MOS Engineering.

Remacle: And you reported to Andy Grove.

Vadász: Yes.

Remacle: How did that relationship work? You had a personal relationship; your families were friends outside of Intel. What was your working relationship? That’s the part I’m interested in. How much of an imprint did Andy have on the organization?

Vadász: The working relationship was fairly tense. Don’t forget, you know, first of all, when you start a company, you put together a bunch of, hopefully talented, type A people, okay? Whether they came from the same organization, well that may help, but not all of us came from the same organization. But even if they came from the same organization, you know, there are some personalities, there is uncertainty about what we are doing, and that creates a little bit more high-strung environment, and well, you know, it creates a tense professional environment. I don’t think that mine was any different than anybody else’s, you know?

Remacle: Tense and intense both I would imagine.

Vadász: That’s right, yes, tense and intense, you know? And I think that people have to learn to separate their professional activities and their private activities, and I think that by and large we have done that. And there were many friendly relationships among many people within Intel, especially more noticeable at the early age when the company was small. Many of those friendships, you know, go on. And at the same time, you still had your professional environment and you have to make what you are working on successful.

Remacle: How did Intel’s approach to design and product development differ beyond this integration of R&D and manufacturing from the approaches of say Fairchild, TI and some of the east coast companies?

Vadász: I don’t quite know because I never worked at TI and some of those other companies, but I have a feeling that we were as a small company far more integrated in these activities than most established companies.

Remacle: So Intel had in the early years of the semiconductor industry which I would say that that’s where the industry still was when Intel was formed, would you agree with that? In other words, would you say Intel was born at a time that the industry was still in its formative years?

Vadász: Oh, very much so, very much so.

Remacle: So there was the east coast, the west coast and then this funny little company in Texas. Did you all give any attention to that [competitive environment] or were you just heads down, getting the job done?

Vadász: Well, semiconductor memories were a new opportunity. <*laughs*>. It was a zero billion dollar market. There was really very little if any memory business at the time when we were formed. So from that point of view, we were very early. However, if you look at the various participants in the industry, TI stood out as a premiere manufacturing house. You know, that was in integrated circuits, but they were

still the premiere manufacturer in our mind. And I think this probably comes from Gordon, who really felt that in the long run it will be TI who will be our competitor no matter what we do in semiconductors. And otherwise, you know, there were many smaller, less successful semiconductor companies.

Remacle: Did you have any sense, when I say you I mean you personally but by extension I guess the whole [Intel] team, any sense that the company could compete toe-to-toe with Fairchild and TI in as short a time as the company was able to?

Vadász: Well…

Remacle: I guess my question is did you guys succeed beyond your wildest dreams?

Vadász: Oh, I think we succeeded beyond our wildest dream through a variety of turns of events. I mean remember we started out as a memory company and we kind of learned very fast that even though it’s a new technology and it’s very exciting and all that, the business doesn’t grow to be a big business overnight. So a number of opportunities came along that I think we capitalized on very well.

Remacle: And those opportunities were…?

Vadász: One was the programmable read-only memory, and most importantly, the microprocessor. And those developments all really combined to really make for a very successful endeavor, much more successful than <*laughs*> all of us expected.

Remacle: The microprocessor development project was under your management?

Vadász: Yes.

Remacle: It’s been written about rather extensively so I don’t really want you to go into the details of it necessarily, but I would be interested in talking about the junction or the butting of heads around microprocessors versus memories. Here was a company [Intel] that was formed to do memories, MOS had pretty much gotten a foothold, Intel was doing well in memories. What were the internal discussions about “should we do this 4004”, although that wasn’t the name of it at the time, but that’s [what it became…].

Vadász: Well, first of all, it wasn’t really a butting of the heads, it was a situation that more and more Bob Noyce recognized that “gee, we are doing all this memory product but the market is not taking off like a hockey stick so what else could we do?” And I frankly, <*laughs*> the last thing I wanted to hear is “do something else” because, you know, I was busy doing one memory product after another after another. But when the CEO of the company comes and not only has an idea but brings a customer with that idea, it’s very hard to say “well, we shouldn’t look at this”, so this is how it happened. He [Noyce], through his business connections, knew the Busicom people in Japan and there was an opportunity to do a set of calculator chips for Busicom and so that’s how the whole thing started.

Remacle: How big was your organization at this time?

Vadász: I don’t know. It was definitely less than a dozen. And that was the problem. As we started to look at what the Busicom project was, it turns out that it required just too many chips, something like 16 different chips because it wasn’t one calculator, it was a variety of calculators that they wanted to do and I just didn’t have the staff. And that’s when Ted Hoff, who at that time was heading Application Research reporting to Bob and Gordon, came to me and said, “Hey, what if we do such and such?” which really made a lot of logical sense. Except again, I didn’t have the staff to do it and that’s when I hired Federico [Faggin] who, he and his team, did an absolutely superb job of developing what turned out to be the 4004 family. But, you know, Professor Burgelman at Stanford Business School has a saying, “many times it’s not about strategic planning, it’s about strategic recognition”. And we recognized the utility of that set of calculator chips was way beyond calculators. And so that was the next chapter, of trying to figure out okay, how could we make it more of a general purpose marketable device. It was relatively easy to agree with Busicom that we should be able to use the technology outside of the calculator application. It was much harder to figure out how do you market that product. I mean after all, it wasn’t powerful enough to be a computer of the definition of a PDP8 or bigger and the people who could use that kind of a small machine did not know how to do programming. And so I think that once we figured out that we have to really provide them development support, in effect build a computer, with the only purpose to help the customer develop their end product..

Remacle: These were what became the “blue boxes” then?

Vadász: That’s right. These eventually became the Development Systems. I think that was the most critical step in making it marketable worldwide. And that suddenly gave the means and the knowledge to people how to use microprocessors. And so that was a very important lesson: when you are on the leading edge, it’s very important to develop the product and technology, but it’s also very important to help the market use that product and technology. And I think that was one of the most important learning I had in my career.

Remacle: Why would you say one of the most important?

Vadász: Because, you know, when you are developing product, there is a naiveté, if you will, that can go on, and we were not immune to it, that well it’s obvious, you know, this is a great product, it’s obvious.

Remacle: “Build [a better] mousetrap and they will come”?

Vadász: Yes. “Go, use it.” Well, it’s not that simple. You go out there and you start looking at how much difficulties people have using your product, you come back with a different opinion on what you have to do in order for the customer to succeed. If the customer doesn’t succeed, you won’t succeed. But, you know, I was a young engineer; it was a good learning.

Remacle: You just referred to yourself as a “young engineer”. You got to Intel in 1969.

Vadász: ’68.

Remacle: ’68? What month?

Vadász: July. August 1, 1968 when we opened..

Remacle: You started out as the Director of Engineering. How did your responsibilities expand or change and evolve from when you started?

Vadász: Well, you know, I can’t tell you exactly what titles I had what year, but I can tell you that as the engineering activity grew and I eventually became VP of Engineering which included both MOS and bipolar. I felt increasingly the need to do something beyond engineering and I was more and more interested in the business aspect of technology. And I also became an advocate of “divisionalizing” or creating the various business sectors.

Remacle: And they were built around products and customers?

Vadász: That’s right. They were around certain product groups rather than just have a totally flat organization.

Remacle: So initially Intel had an engineering, a manufacturing, design, development.

Vadász: That’s right, sales and…

Remacle: A more function-based organization?

Vadász: Functional only. And so, as our business grew, [the need for] some restructuring was getting more and more obvious. And eventually we did that. We put the memories and the microprocessors and development tools into separate organizations. And frankly I don’t even remember what was where. But one thing I remember is that the microprocessor components and microprocessor systems, including development tools, were in one group where Bill Davidow was the head of that division, and I became the assistant general manager, and the memories were in another division.

Remacle: What were the management lessons that you learned aside from the couple that you’ve already mentioned, or the management problems, you wanted to address by moving out of pure engineering?

Vadász: Well, you may find this bizarre, but as you’re sitting on top of an engineering organization and you are less and less connected with each of the projects, they all have the same dynamics. A lot of effort at the beginning, then a huge amount of effort to design, then a phase of elation when you think it’s

working, then going back and really making it work, and then transferring it into the manufacturing organization. As these dynamics played out over and over and over again, it gets to be a bit of grind because you have less and less connection to some of the really exciting projects. And I wanted to really do something else and it was a great opportunity to pair up with Davidow who came into the organization from a totally different point of view. He was in a marketing organization and more of a system mind, computer system mind and I had a lot of opportunity for learning, to understand how to make that business work. Eventually, as the organization grew, we split the Systems business from the components business. I started to realize that, at that time in technology, it was not the component side of the business that was carrying the business, but <*laughs*> the system side. I kept going out to the field talking to the salesmen and they kept telling me how many development systems they sold and what great design wins we have, and then I kept asking, “Well, how many components are we selling?” And everybody was telling me, “Oh, it’s coming, it’s coming, it’s coming,” but we were just selling systems and very little components. At that time, really in the early phase of microprocessors, it was heavily system business.

Remacle: When did, collectively, the executive staff, when did you start using development system sales as a leading indicator to component sales?

Vadász: Right from the beginning when the group was formed, one of the key missions was to get a system sale. What I meant by that is that we wanted a design win, but the first element of that design win was that you sell a system, a development system. Maybe you also sell some board-level product which were early packaging of our components into module-level systems and served to accelerate the customer’s ability to use our technology. Basically, there were relatively little component sales.

Remacle: So when the organization was split between systems and components, Bill [Davidow] took the systems piece and you took the components?

Vadász: No, it wasn’t that way. We created a Division which had its own engineering and marketing activity and I was handling more the operations side, which means I started to work in the software and hardware development, system development area as well as the component development area, sort of expanded scope and also in the manufacturing of those systems. We had a separate manufacturing line for those systems. That was reporting to me. So that was the operational side and Bill took more the marketing side, for both systems and components.

Remacle: Okay. So at some point, you were General Manager of the Microprocessor Division or Group?

Vadász: Yes, Division at that time. And then, when we split it, I became General Manager of the Microprocessor Component Division. And that’s when I noticed the relatively modest components sales compared to the systems side.

Remacle: So the Microprocessor Division, can you talk about how that fit into Intel’s corporate structure at that time? And we’re now talking, what, about 1974, 75?

Vadász: Mid ‘70s somewhere. Around. Well, that division then, the Microcomputer Division which was both components and systems, development tools and modules, reported to Gordon and Andy. So did the memory…

Remacle: So at this time Gordon was Chairman and Andy was President?

Vadász: I don’t think so. I think Gordon was- well, you can look it up. I don’t know.

Remacle: But it was reporting to them.

Vadász: Gordon was CEO, I believe, and it was reporting to them. And then eventually we split the two. That was sort of the beginning of Intel’s System Group and then also it was the separation of microprocessor components from systems.

Remacle: I think we’re going to step sideways a little bit here and talk about the development of Intel’s microprocessor strategy over the span of the—how many years were you there—35?

Vadász: Thirty-five.

Remacle: From zero microprocessors to the dominant microprocessor supplier in the world and the dominant semiconductor company in the world.

Vadász: I don’t know that “dominant” is the right word to use.

Remacle: Well, I know the lawyers don’t like it, but certainly the most influential. Will you buy that?

Vadász: I would say that it had a serious influence. <*laughs*>

Remacle: It had a serious influence and serious revenues. And the microprocessor certainly contributed significantly to that. Can you talk about how Intel got from the 4004 to ultimately the Pentium—the short version? I know in the middle there was a lot of discussion about multiple [microprocessor] architectures and approaches and the 386 was kind of an accident?

Vadász: Well, it’s very complex and I’m not sure that I can really unpeel the onion in my mind totally, but there is no perfect architecture. It depends what you want to do. Like in anything else, there are fashions in architecture and fashions in technology. Certainly, the 4004 family has its origin in calculators.

Remacle: As an application?

Vadász: Yes, as an application and the whole architecture was architected in a way to do a good job of that. It was very easy to find that in a more general purpose world you want to have a different architecture. This was really driven more by our work at that time I think Computer Terminals? Datapoint. Datapoint or Computer- I think they are the same company I think it was called initially Computer Terminals. And so that really originated another microprocessor called the 8008, which very rapidly was expanded into a much more substantial device through the 8080. And that’s really has been kind of the origin of the whole Intel line.

Remacle: What about the excursion off into the 432?

Vadász: Yes, there were a number of excursions. I mean one of the very important early devices were the microcontrollers, the 8048, 8051 family. That really became the first really high-volume, programmable- very high-volume, programmable device because you could use that- it was very cost-effective and you could use that in controlling your dishwasher, your microwave oven, your gasoline pump and a variety of others, so it became a very effective device. And so that’s how the microcontroller line came. Then on the totally orthogonal end of the picture, we started one of those projects where companies say that well, if we had a blank piece of paper, what would we do? And that’s really the origin of what became eventually the 432 which initially was I think the 8800. And it went through many, many years. And I was a very strong advocate of that. And eventually I was the one who pulled the plug on it.

Remacle: What caused you to pull the plug finally?

Vadász: One too many problems. Yes, one too many problems.

Remacle: The straw that broke the camel’s back?

Vadász: Yes, that’s right.

Remacle: I do recall, I’m not sure that I’m right, that there was a SLRP [Intel’s Strategic Long Range planning process] meeting that I was sitting in on where Gordon looked at the assembled group and said, “Gentlemen, we can only afford one microprocessor architecture. Come back when you’ve got it figured out,” or some words to that effect. Do you remember that?

Vadász: No, I don’t. In fact, I think that the whole 8800 project started by Gordon with a memo which I think to the effect said “unfettered by the past, what would we do?” which I think was a very good question and perhaps the right question. And I have to say that even today I don’t know whether I pulled the plug on that project too late or too early. And you will never know. You’ll never know.

Remacle: So at what point did you and the rest of the executive staff really begin to understand what a bonanza that the microprocessor was and this approach to selling which embedded the concept of design wins in the company’s really total mindset that something was going to come of it, I mean

something big was going to come of it? Did it take the PC or did you start to get glimmerings before then?

Vadász: Well, I don’t want to put words in other people’s mouth because probably everybody that you ask on the executive staff will have a different picture on it. But the fact of the matter is that in the business area where the company started, semiconductor memories, we were not winning. And so..

Remacle: And this would have been in the late ‘70s?

Vadász: Early ‘80s. And I think Andy became the strongest advocate that “okay, we may not know what”—and again, I’m paraphrasing and he would probably be much better saying what he meant—but “we may not know what the microprocessor future is, but we know what our memory future is”. And so he was a very strong advocate of just pulling the plug on our dynamic RAM, the mainstream of the memory business.

Remacle: And at that time, was that [Ron] Whittier’s responsibility?

Vadász: Yes. Now there were many and, you know, somewhat legitimate arguments of why you want to keep it. The most legitimate among the arguments that I could see was that you need volume products to ramp new technology. The counterargument to that were many and again, very logical. The one is “hey, microcontrollers, we’re getting very high volume”. Second, the memory technology was beginning to kind of inch away from the mainstream logic technology and became less and less of a logical ramping vehicle as well. But, you know, when your history is memories and the whole company is formed on memories, it’s not logic necessarily that drives your thinking, it’s emotions. And emotionally, it was very hard for the company to basically say “okay, we’re going to walk from this business.” And we did.

Remacle: I remember when I joined Intel that Jack Carston taught an Intel culture class and one of the things that was part of that, one of the hallmarks of that class was “Intel learns from its mistakes, we’ve walked away from memories”. Do you think Intel was unique in its ability to walk away from businesses that they felt weren’t good businesses and in the vernacular learned to “eat their children” as they evolved product lines over the years?

Vadász: I think Intel was not unique being able to walk away from business. I think when you have technologists who have much more connection to the products they make versus just looking at it as, you know, numbers on a spreadsheet, technologists perhaps have a harder time walking away from it, but I frankly never felt that we were that unique.

Remacle: Okay. I just mentioned Intel Culture. That’s certainly gotten a lot of attention over the years. Talk a little bit about how that developed and how it got to be so systematic at Intel because I think that was somewhat unique at the time.

Vadász: Well, "Intel Culture" as a term I think originated with Andy. And Andy was a very strong believer in culture. He believed that, you know, you can't write down everything on a piece of paper. Not everything can be defined by rules and regulations. You really have to have people who are enough on the same mindset and [with the same] feeling of [what's] right and wrong so that when they have to make a decision, you can have confidence that their decision would be along the line of what you would do. And that's culture. And so he believed very much, especially as the company was growing, that we have to formalize it to at least make sure that people understand that A, culture is important, and B, what are the values that we feel are important for success. And so I think that all these elements really originated with him. A, he had a very strong feeling how an organization should work, very straightforward, facing up to issues, and B, he felt that we ought to articulate that so we all understand it. We can debate it, but at least we understand it. And I think that that was nurtured very heavily over the years. I have no idea what's [going on] with it now.

Remacle: I have to say that that was one of the things that…after my tenure at Intel I walked away with a lot of the Intel culture which is with me still today. I still write memos that have ARs [Action Required] in them and I really do believe that I have not run across another company that is so systematic about those kinds of things.

Vadász: Yes.

Remacle: Let's jump ahead to your role in forming [Intel's] Strategic Staff. First of all, let's just ask what was the charter or mission of Strategic Staff and why was it added to the structure of the company when it was?

Vadász: Well, again, as we had these divisions, I had this notion that "gee, what if there would be strategic planning somewhere on the same line as at the beginning of the company?" You know, you had the group that was pretty competent in what we were doing at the beginning. We sort of did our own little planning of, you know, the next step and the next step. "Well, why don't we apply this very same philosophy to these groups [business divisions and Groups]? Let them do it." And so I was very excited about the concept of "well, how could we implement this sort of innovation machinery replicated over and over and over again with the various business groups?" Well, it didn't turn out that way, I have to say, because over time it became more of a bureaucratic exercise. And while I believe..

Remacle: When you say "bureaucratic", what do you mean?

Vadász: The Division Managers delegated the planning down in the organization and there were a lot of [overhead projector] slides generally, but then they reviewed it and it went back and forth, but they didn't own it. They didn't struggle with the creation of a strategy the same way as at the beginning of the company struggled with the creation of the beginning strategies. And the first time I realized that was when I went on my first sabbatical and I had an opportunity to discuss my experiences at Harvard Business School and they really just nitpicked and pulled it apart and I didn't know whether I was coming or going.

Remacle: And this was what timeframe?

Vadász: Early ‘80s I think. Early ‘80s. And so we changed again where planning again started with the CEO, who really had to think through, you know, what direction the company should be going and then assigning the development of various strategies to the various business groups. And so in effect, what was a bottoms-up, not very effective process, became a tops-down, bottoms-up process which - I think - is being used today. But certainly, my original concept that well let’s go bottoms-up didn’t work very well.

Remacle: I recall Ram Sharan coming in. What impact did he have, if any, on the ultimate thinking about strategic planning at the company?

Vadász: Well, he had a very useful contribution. I still remember it. And basically it can be summarized as: “look back to the last five years, look down the road in the next five years, look at the differences and ask yourself what am I going to do about it?” And that’s a very good concept. It’s very much applicable to virtually everything you do in business life.

Remacle: Personal life too…

Vadász: Maybe with personal life.

Remacle: Except I don’t have a strategic plan for mine. <*laughs*> You were part of an iconic executive staff at Intel. A couple of things. As you’ve already pointed out, you’re type A, very self-confident, very direct people. How did you all keep from like snatching each other by the throat once in a while? And then part B of that question is how did you all stay together for so long? I mean I don’t know that there are any other examples of a company that start with zero revenues and the same team that started them there ends up there 20 years later, or even longer than that in some of the cases, yours certainly.

Vadász: Well, Andy once told me something which I think is very much representative of how we live that life inside a corporate world. He said, “You are not paid to like the person, you’re paid to work with the person.” And so, you know, whenever things get, let’s say a little tense, you remember that. That’s the way corporations should work. And I think it was <laughs> very wise..

Remacle: Do you think you all internalized that?

Vadász: I did. And from the fact that <laughs> there were so many others who stuck around, I assume that others did too. You know, and as you get a little more mature, you’re probably able to handle some of these things a little bit better. And every organization..

Remacle: You get a little more breathing space because the company’s successful.

Vadász: Yes. Every organization has its, you know, issues. There is no perfect organization.

Remacle: Because there are no perfect people.

Vadász: Well, I haven’t found anybody like me yet. <*laughs*> And what are you going to do? Are you going to run from place to place to place to place to place? That makes no sense.

Remacle: What do you think were the major accomplishments in Strategic Staff?

Vadász: Well, basically two things. One is struggling and eventually developing a way of looking at your future and developing a sort of a regular review of where you’re going, and when you do that you basically have the ability to course correct.

Remacle: How did you keep that from reverting to the bureaucratic “oh, it’s SLRP time now, we have to create a slide set”?

Vadász: Oh, I’m sure that some of that exists, but as long as the top management of the company is properly engaged, it is their job to make sure that the process focuses on the strategic issues of the company. And I don’t know how is it done now, but, I mean when I retired seven years ago or so, you could argue that maybe it could be more efficient, but it accomplished its purpose. It forced the top management to look at the world around them and develop some thought process of where to go.

Remacle: From Strategic Staff, you went to head up the Systems Group for what, about four or five years?

Vadász: Around that time, yes.

Remacle: Why did Intel think it needed a Systems Group?

Vadász: Well, let me answer why Intel needed systems activities.

Remacle: Okay.

Vadász: How you group it is another story and that’s really not the important part. If you look at it, our first system product at Intel was really big memory boxes. Now imagine at the time when we made those big memory boxes it was filled with dynamic random access memories. There was no dynamic random access memory business. We had a chip which was not the easiest chip in the world to use. It was a very difficult chip. You know, it is typical of first-generation product, it was a relatively marginal technology, but it got the momentum going. So how do you create a market? Well, part of the way to create a market is to reduce your customer’s job of making it work in the system by creating the systems and selling it as a box. And that indeed sort of accelerated the flow of that technology to the market which then benefited our components business.

Remacle: What were the key systems products Intel sold or [which were] the most successful [ones]?

Vadász: Oh, I don’t even remember, but they were kind of big, like five by six by five feet.

Remacle: The board business, was that part of the systems activities?

Vadász: That was really Bill Jordan’s system group that came from Honeywell and it was at the very early phase of dynamic RAM development. Now you could argue that eventually that role is taken on by our customers and that kind of a business is not needed to be inside Intel, but it certainly helps at a very early stage of new technology to…

Remacle: Incubating?

Vadász: Or to smooth the flow of that technology to the market. Now we’ve already talked about the microprocessor. There was every reason in the world to enable potential customers to use our component products and the only way to do that was to create a system product that they could use. Now over time, there can be issues where, you know, the products- your main business being a component business, the system product may overlap with the business of some of your customers and that’s where the issues come and that’s where the frictions come. But as long as you use your system capability to smooth your ability to have the market absorb new technology, it’s a perfectly legitimate thing to do. And many semiconductor companies, most semiconductor companies, couldn’t have done that. That’s I think was the major differentiator for Intel.

Remacle: Why do you think Intel could do it and other semiconductor companies didn’t or couldn’t?

Vadász: Well, you know, it’s because we needed to. Let’s put it this way. We needed to. We had leading-edge products where we needed to do something to create the market for it.

Remacle: Then from there, from the Systems Group, you went on to form Intel Capital. There seems to be like a theme here: that if something new needed to be started or something important [need to be done], Les got to do it.

Vadász: Well, I always like to position myself in this intersection of new technology and new business. And Intel Capital really didn’t start out to be Intel Capital. Intel Capital started out as a corporate business development activity. And let me first talk about investments and corporations, okay?

Remacle: Okay.

Vadász: The fact that a corporation invests in another corporation, that’s no news. It’s not even much of a news when they invest in private equity, startup type of companies. You know, there have been a number of companies in the Valley and I assume all over the country that made investments in new technology companies. Sometimes these investments happen as well… let’s create a strategic investment group in our finance organization and let’s make investment in businesses that are in the strategic space of our company. These things generally didn’t work out very well for the [invested]

companies primarily because the investors were not really in a venture capital environment, they were in a corporate environment, and second, they really didn’t have much of a tie with the business units and so what was strategic was really very loosely strategic. Intel had a different problem. An Intel Group, may have invested in a company because there was a piece of technology they needed, and the company needed money to be able to deliver that piece of technology. It was really in support of Intel’s business. And as each of the groups inside a company made these investments, as you can imagine, it can easily get to be a relatively chaotic situation.

Remacle: A lot of moving parts…

Vadász: Not only that you are investing into a hodgepodge of very localized activities, but also there is no commonality in how you do the deals. And so, really at the worst, you can expose the company to undesirable liabilities; at best, you’ll gain a very successful supporter of your business. But it got messy. And so we started with “okay, how do we sort things out so that A, we are able to make investment and B, we’re going to make it really strategic?” And the way to make it strategic is to link the activity into the business that you are in. And one of the first things we did, we defined what’s success. Like for example, delivering a product to you may be a momentary success, but if the company is not a viable entity that you are investing in, they’re not going to help you in the long run. So basically we have established right from the beginning that you really have to look at companies with the potential of succeeding. Not just the companies that can deliver a piece of technology for you. That right away forced you into a different kind of thinking that existed . And so then you have to really look at how you’re going to do all this. You have to really do it by trying to put yourself in the shoes of the entrepreneur rather than in the shoes of the big company knowing very well what the needs of the…

Remacle: How hard was that to do?

Vadász: Well, at that stage of my career, I didn’t have any difficulty with it and I looked at my role as making sure that the whole organization we were creating was going to have this as a major [guiding] principle. You really have to look at the success of that entity. Not only your success because you may have a momentary success, but in the long run, if you need the help of this company’s technology, you really have to look at it as a successful entity. It’s a very important measure of success.

Remacle: So do you think this was the major differentiation between the way Intel approached corporate investment versus what you saw throughout- I’m pretty familiar with the Japanese [companies’] approach, but the Japanese [companies] and big companies like Nokia and so forth, how would you differentiate [their approach from Intel’s]?

Vadász: Well, this was an important element, but by no means the only thing. It was just as important to look at how you organize this. If you organize it as a totally separate entity within a company, your linkage with the operating divisions is going to be minimal.

Remacle: So this is the Fairchild R&D lesson learned over and over again?

Vadász: That’s right. That’s right. So, you know, I didn’t care whether the people reported, to me or reported into the business unit. I didn’t care that our legal people were part of the legal organization or our finance people were part of the finance organization, they were my organization. And some people reported directly to me, some people reported directly to the other organization, but any time when we reviewed a business deal, we expected the business organization to speak up why do they want it. And so having those people linked or be part of their organization one way or another created a hybrid. That’s very hard to do and many companies cannot deal with those kind of things.

Remacle: What role did the MBO [Management By Objectives} system play in that linkage, at keeping that linkage alive do you think?

Vadász: Well, MBO became a supportive system in virtually anything we did, but the most important thing was that you had, in effect, matrices that an individual reported into two organizations. And it required a certain organizational maturity to be able to handle that and individual maturity to be able to handle that. And I think that we were very successful at that.

Remacle: I think again from my experience, the matrix management and the MBO system were two things that were pretty unique because Intel did them, I thought pretty darn well, given how big the organization ultimately got. And they seemed to be the glue that really held things together I think.

Vadász: Certainly it became an effective way to align the organization, align the various parts of the organization. But I can’t emphasize enough the importance of this hybrid organization structure.

Remacle: Is there anything else that you think contributed to the success where others kind of stumbled around?

Vadász: Well, hmm. I think the easy part was—which probably everybody could do—was sort of get outside and engage with the venture community and try to be a part of the venture community. We were able to help the companies on the operation side quite a bit. We created get-togethers, meetings, exposed the company’s product and technology to potential customers, we invited some of our customers. That was very effective. We provided some of the startups with basic HR 101, Finance 101, things that not necessarily in the vernacular of a startup company. People started to look at Intel as a value-add in a deal, and I think all these elements step by step added to the total.

Remacle: What were the lessons that Intel learned over the years and that you personally learned over the years about fostering “intrapreneurship” inside the company, pluses and minuses both?

Vadász: Well, at variety of times I kind of nurtured activities of one kind or another, new business ideas, new technologies inside a company. And, I think more often than not, they did not result in big successes. I think we were not immune to the difficulties of big companies creating something new and capitalizing on it. And at times I still think about how does a company- what does a company need to do? What does a big, successful company need to do to successfully incubate major new things? Now that

doesn’t mean that in Intel’s line of business we couldn’t create new technologies. Intel has been very successful in our line of business. But you get outside of that and we have had our difficulties.

Remacle: You sat at the top of one of the most successful companies in the world, arguably, and certainly one of America’s most important corporations for a long, long time. What do you think were the company’s greatest non-revenue accomplishments and what were the biggest lessons learned in those 35ish years?

Vadász: Oh, that’s a big question.

Remacle: I know.

Vadász: Greatest non-revenue accomplishment… Well, probably the fact that we were able to build a successful, high technology company of the size with the kind of market impact from nothing. That has to be a lesson for all entrepreneurs that, you know…

Remacle: It’s possible.

Vadász: It’s possible and you have to go through the figuring out phase. There is no blueprint, you know, but there are certain major human attributes that play an important role like working hard, facing your issues head on, and those are all lessons, but there are no blueprints. You have to go through this.

Remacle: What you’re just saying reminded me in the early mid ‘80s things were pretty tough at Intel. Nobody could see that they were going to become- at least I don’t think anybody then could see what the company was going to become or what it has become. IBM had to come in and lend the company some money. Were you all just solving the problems one after another at that point?

Vadász: These were all problems of the day, you know? We didn’t stand by the Kool-Aid machine and talk about “gee, what a great thing we are doing today or tomorrow?” [It was] just, solve the problem, look ahead, see where you want to go, keep solving it the best way you can.

Remacle: What in your career has been the most exciting, rewarding, satisfying thing that you took on?

Vadász: Well, actually the latter phase of my career at Intel, the Intel Capital office was surprisingly, very exciting. In a way, it combined virtually all of the learnings and at the same time kept my finger in technology. And in fact, I find that I expanded my technology view of the world to a broader area than I had before that. At the same time, I was able to use all my experiences of what does it take to build companies and run a complex, a very complex organization, in a worldwide setting and that was pretty exciting.

Remacle: Almost the same question but from a slightly different vector is what do you consider not Intel’s, but your personal largest accomplishment or the accomplishment that you’re most proud of?

Vadász: Well, virtually all the foundation of today’s electronic business has come from that little department that I assembled back in…

Remacle: You’re referring to the MOS [engineering team]…?

Vadász: From the MOS [technology] to the memories, to the microprocessors, to EPROM. That’s the foundation of the business today. And, you know, it’s a big business now. What is it, 200 to 300 billion dollar business?

Remacle: Unbelievable.

Vadász: And that’s just at the component level. But I still find myself looking more forward than back. But I do look back more frequently now than in the past because in the past I never looked back. I have a very bad sense of history. But sometimes [now], I do look back.

Remacle: Do you now, did you consider, yourself an entrepreneur?

Vadász: Oh, absolutely.

Remacle: And why?

Vadász: I like to make new things work and make a business out of it. That’s a very challenging intellectual exercise these days.

Remacle: Why did you decide to retire when you did?

Vadász: Oh, I was in the business at that time for 42 years. I really felt the urge to do other things. I mean I still keep my finger in it a little bit. I wish I could have done what I am doing now with all the flexibility of time that I have now, 10 years earlier. I felt very confident at the time that I wouldn’t be bored, but probably there was something in my gut who said” well, are you sure?” So I got myself involved in a number of things and right now sometimes I feel I have to retire again. <*laughs*>

Remacle: Retire from retirement?

Vadász: Yes, that’s right. <*laughs*>

Remacle: If you could change or redo something in your career, what would that be?

Vadász: Hell, I don’t know. I don’t play “what if” games. I don’t know. I don’t know.

Remacle: Talking about the next generation and thinking about some of the things you’re doing, if you could distill one piece of advice to young entrepreneurs or young engineers, what would that advice be?

Vadász: I think engineering is increasingly a multidisciplinary profession. Semiconductor [industry] right from the beginning was a multidisciplinary profession. You really not only had to understand the application of the technology whether it was computers or any other kind of products that the technology was applied for, such as radios, but also in the creation of the device, it was a multidisciplinary process from physics to chemical engineering, material engineering, on and on. I think this is becoming more and more today. I mean if you look at medicine, I think that some of the technologies that we worked with in the semiconductor industry, some of the capabilities we created in the semiconductor industry are increasingly applicable. And you look at all the application of the devices, the products that we created have their own technology disciplines. And so I think it’s very important to remember that if you want to be an engineer in the future, you have to look at a breadth of disciplines and be at least conversant in it to be able to relate your own profession to the other areas.

Remacle: In the years that I’ve been associated with high-tech companies, it seems like there is better and better—and maybe it’s because the consumers are more directly connected to many of the products that the companies develop—but it seems like there’s a better and better recognition— certainly probably Apple is sitting at the top of that peak— of really understanding and delivering products that are user-friendly. That term has gotten way overused, but the concept is still applicable. Would you agree with that?

Vadász: Oh yes, I mean people don’t care how the bits and bytes and work. People care what it does for me and how easy it is for me to use it. But, you know, it’s wonderful that we can have all the technology to focus on that issue. When you are at the very early phase in a technology, you don’t have enough pieces to to make it easy to use or make it really high impact. It has to start somewhere. We are now at a point where we can make a product easier to use by throwing another hundred thousand transistors at the problem. So be it. Nothing to it. And we had to get here.

Remacle: Switching gears almost entirely, what role does history play in—going back to your school kid commitment—how important is history and most specifically, the history of the computing and semiconductor industries and the capturing of it, do you think?

Vadász: I don’t know that. I have the feeling that it’s very important if it educates. If history is nothing more than just “there is this, then there was that, then there was that”, that’s not very educational.

Remacle: You can look that up on the internet today.

Vadász: Yes, that’s right. So I think the challenges is to make history a tool of education. And that’s not easy. And I hope you guys [at the Computer History Museum] do that here.

Remacle: We are. We even have hired a Director of Education. We’ve got some questions that we’d like to be able to use some of your responses potentially for the [“Revolution” Exhibition] Exit Theater that I showed you when we walked downstairs. So what do you think the next big challenge is for the technology industry and the technology industry covers a lot of territory, but what do you think the big challenges are?

Vadász: Well, I think the big challenge for the US technology industry is to stay the US technology industry. And that’s an economic challenge because I have a feeling that the more the business moves from the US to other parts of the world, the innovation will follow. And that’s very much disconcerting.

Now as far as on the technology front itself, you have, obviously, the use of all of the technologies, all the capabilities that were developed during the past decades in the semiconductor industry can be used in other areas. Particularly, I’m thinking of medicine. I think that there is a tremendous symbiotic relationship between the way we see parts of medicine evolving and what the semiconductor industry has been doing with microminiaturization. As far as silicon itself, you know, maybe I’m a stick in the mud but ido not believe that silicon will be replaced anytime soon and certainly not in my lifetime as the mainstream of the business. However, I see many of the new technologies coming along augmenting silicon to be able to work with smaller dimensions.

Remacle: So driven by diverse applications…?

Vadász: Basically Moore’s Law is going to be more and more realized with silicon technology augmented by other technologies like what we refer to as nanotechnology and the like. And that I see is the next phase. And beyond that, I don’t know.

Remacle: One other question. What else should I have asked you that I did not?

Vadász: You know, going back again to some of our discussions on that panel [MOS, July 13, 2010], I think one of these days in the annals of history the silicon gate story will be a very important one and the serendipity associated with it and its whole impact on personal computing, personal communication is going to be told.

Remacle: Specifically, what did the silicon gate technology enable that you’re referring to?

Vadász: Well, in my mind, silicon gate technology enabled MOS to be a viable manufacturing technology and MOS technology enabled all the personal computing that we have today. And to me, that’s really at the 20 thousand feet level of the story.

Remacle: If silicon’s not going to be replaced, might MOS as a process technology be replaced or augmented?

Vadász: Oh, it will be augmented.

Remacle: But not substantially replaced?

Vadász: No, it’s still a field effect device. But the point is we still would have computers without personal computing, but it would be a different world. We still would have communication, but it would be a different world. And that is such a huge societal impact.

Remacle: That’s where I was going. It was something between a comment and a question. It is so pervasive today and that pervasiveness would not have been possible without silicon?

Vadász: Absolutely not.

Remacle: Without integrated circuits.

Vadász: Yes. And that is beyond technology. That’s much more, of course, technology is interesting only in the context of the impact it has on our lives.

END OF INTERVIEW

