



## **Oral History of Szu-Chi Thomas Chang**

Interviewed by:  
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**Hsu:** Today is February 21<sup>st</sup>, 2018. I am Hansen Hsu, Curator at Center for Software History. And today we are here with Szu-Chi Chang. Is that correct? How do you pronounce your name in Chinese?

**Chang:** Zhang1 Shi4 Ji2. <Pinyin romanization, tones indicated by number>

**Hsu:** Zhang Shiji, okay. And also with your daughter, Rae. Rae Chang.

**Chang, Rae:** Yes.

**Hsu:** And so let's start at the beginning. Where and when were you born?

**Chang:** I was born in Ningbo, Zhejiang [province], China. The town actually very close to the famous city called Shanghai. But actually, most of my life in the kid's time is in Shanghai.

**Hsu:** And what year?

**Chang:** I was born in February 21<sup>st</sup>, 1934 in Ningbo, yeah.

**Hsu:** So today is your birthday!

**Chang:** Yeah. <laughter>

**Hsu:** So you grew up mostly in Shanghai.

**Chang:** Shanghai, yes.

**Hsu:** Uh huh. And this was during the years of the war with Japan, correct?

**Chang:** Yes, actually Japan, I think, occupy Shanghai at that time. Yeah. My father, he is a engineer on a English ship. That time was in India when, you know, Japan soldier occupy Shanghai. And then my father flew into Yunnan in China. And he somehow ask my mother to join him. But we try, but when we reach the Hankou, we couldn't cross the borderline. So my mother took me back into Shanghai. I have a [half-]sister, she's eight years older than me. My sister wasn't my mother's daughter. My father's previous marriage, and my sister[s] mother died later, and my father married my mother. So my mother took my sister and me living in Shanghai and she work as a laborer to support. And my little sister at home cook meal for whole family.

**Hsu:** Wow. And so how did-- so your mother was primar-- did she work? Or did she just--

**Chang:** Yeah, she work as a laborer, you know, in the where the pier and just laborer carry stuff from ship onboard, yeah.

**Hsu:** And so your father wasn't with you during that time. He couldn't--

**Chang:** My father's working [in] Yunnan way back in west of China. Midwest, I guess. And as an engineer in electrical company, I guess.

**Hsu:** And so you said he was working for the British.

**Chang:** Well at that time he worked for Chinese government.

**Hsu:** Oh, okay.

**Chang:** In Yunnan, yeah.

**Hsu:** For the Nationalist government.

**Chang:** Yeah, yeah, at that time Chiang Kai-shek is the leader, yeah.

**Hsu:** Right, right. How did your situation change as the War ended?

**Chang:** When War ended, my father go back to Shanghai and then we get together. And also he's-- because he used to work in steamship, so back to Shanghai after World War II, he work for government steamship. Later he become Chief Engineer.

**Hsu:** Hm. Wow. So I guess he had a pretty good position then.

**Chang:** Yeah, yeah. So after World War our family have a better life.

**Hsu:** How did your family manage to survive during the war?

**Chang:** It [was] difficult, because as a laborer, the wage is very low. Because my mother never went to school. You know, way back there, girls usually don't go to school at all. So she never have any education. So the only job she can take is the labor, you know? Using physical. I mean, after World War, my mother work just as a housewife. Yeah.

**Hsu:** And so then what happened after 1949?

**Chang:** In 1949, my father's steamship was ordered by Chiang Kai-shek to carry the armies from Shanghai to Hong Kong to Taiwan. And that time because my father is Chief Engineer, so he's allowed to take his family. At that time, my sister already married in Shanghai. So she stay in Shanghai. So my mother and me go with my father with the ship, went to Taiwan, yeah. That time I'm 15-years-old, yeah.

**Hsu:** Wow. Were you afraid? Was your family afraid of communist reprisals?

**Chang:** Well, at that time the reason my mother this time go with father, I think, because she experienced the World War II separated with father. So she was afraid of separate again. That's why this time she want to stay with father. Actually, I wasn't-- in the school, you know, all the schoolteacher favored communism. And they say that communism for the people. So even though I'm only 15, I don't know much, but I'm not afraid of communism. <laughs> Because [of] the teacher[s].

**Hsu:** Because the teachers made it sound like a good thing.

**Chang:** Yeah, yeah.

**Hsu:** Uh huh. <laughs> Did you want to stay? Or did you--

**Chang:** Well, as a kid, I have no, you know, I don't know choice. Whatever parents want me to do, I just follow, yeah.

**Hsu:** What was it like moving to Taiwan?

**Chang:** Because my father still is a Chief Engineer, so our life in Taiwan pretty good, yeah.

**Hsu:** So where did you live in Taiwan?

**Chang:** Taiwan? In Taipei.

**Hsu:** Taipei, okay.

**Chang:** Yeah, and we live in the dormitory provided by my father's company. It's a very good area, yeah.

**Hsu:** Hm. So what sorts of things were you interested in as a child?

**Chang:** I like to draw, okay? And I play soccer a lot.

**Hsu:** Oh, okay. Hm. Did you have any favorite subjects in school?

**Chang:** In the school, I attend high school. You know, in China is three years of middle high school, and then three years of higher high school. So I went to the first year of the upper high school. And there's a teacher, physics. He's very good teacher. And I was very, very interested in physics. I hate the linguistics.

**Hsu:** So you hated languages.

**Chang:** And even Chinese, I have to take a second year to make up, because I failed the first year. And also I hate the English. Because English at that time required to remember a lot of vocabulary. And I hate to memorize thing. I like physics. I want to analyze things, you know? So I'm good in math and physics and chemistry, but I'm very bad in linguist, like English, Chinese.

**Hsu:** So this was a teacher in the mainland before you--

**Chang:** Right, right. Yeah, yeah. No, that was in Taiwan, though.

**Hsu:** Oh, that was in Taiwan, though.

**Chang:** Yeah, in high school, yeah.

**Hsu:** Okay. Was it-- did you find it very different living in Taiwan than the mainland?

**Chang:** In the beginning, yes, because when we moved to Taiwan we are kind of suburban of the Taipei. And so neighbors are the field.

**Hsu:** The fields?

**Chang:** Yeah, the farmer plants things.

**Hsu:** The rice?

**Chang:** Rice. Yeah, mostly rice. But after couple years, then the more people come in then it become all the field build the houses, and not much different from Shanghai then.

**Hsu:** Oh, I see. <laughs>

**Chang:** Yeah, except the language we have, the local language we cannot communicate.

**Hsu:** Oh, because they spoke Taiwanese?

**Chang:** Yeah, Taiwanese is quite different from Shanghainese, yeah.

**Hsu:** Oh, right, because you're a native Shanghainese speaker.

**Chang:** Yeah, yeah, yeah.

**Hsu:** <laughs> So your native dialect is Shanghainese. Did you have trouble learning Mandarin, or did you already know Mandarin from before, from the Mainland?

**Chang:** Mandarin is actually I pick up Mandarin from my wife. When we marry in America.

**Hsu:** Oh, really?

**Chang:** Yeah. She's from-- she's also from Taiwan. But she get [to] Taiwan much earlier than me. Probably at least one year earlier than us, because my father-in-law is working, let's see, Hai Guan, Custom[s] House.

**Hsu:** Customs House, okay.

**Chang:** Yeah. So they move Taiwan a year earlier. And she speak Mandarin. Yeah.

**Hsu:** I see. So what province is she originally from?

**Chang:** Hebei.

**Hsu:** Hebei. Okay, hm. So let's see, so then you spoke only Shanghainese when you first moved to Taiwan, and then the locals only spoke Taiwanese, and you didn't know Mandarin, the national language, so how did you communicate with people?

**Chang:** Well, in the school, KMT government forced everyone supposed to speak Mandarin. No local language. That's how we learned the Mandarin, yeah. But even that, I speak very poor Mandarin, you know? After [I] marry my wife, I realized. <laughs>

**Hsu:** Hm. <laughs> Okay. So when-- so you went to college at National Taiwan University?

**Chang:** Right, right.

**Hsu:** Taida.

**Chang:** Because you know, I'm good in math and physics. So that time all the University have, unfortunately, [all the students wanted to] get into the National Taiwan University. It's the best university, okay? And I'm that time, the hardest department is EE. <laughter> So fortunately I go into the EE. And I graduate from there, yeah, in 1952.

**Hsu:** Okay.

**Chang:** Oh, no I go in 1952. Graduated in 1956.

**Hsu:** '56, right. So you chose electrical engineering because it was the hardest major?

**Chang:** Yeah, yeah.

**Hsu:** Not for any other reason, just because it was the hardest?

**Chang:** Well, one thing, maybe relate to my father. You know, because my father is a Chief of Engineering. Sometimes when I [was a] kid, when he get to Shanghai, he bring [me] onboard, you know,

just for visit, the ship. So I learned from my father that the ship using the propeller to move the ship in the water. And the propeller is kind of like electric fan, right? So because that, I'm interested in the fan. And that's why I want to go to electric engineering.

**Hsu:** Oh, okay. <laughs> Because the fan is being moved by an electric motor?

**Chang:** Yeah, yeah, yeah. Because I thought, because I learned from my father, the ship usually only, they're not going very fast. They only run one minute like 89 turn. And I learned that electric fan at home run thousand turn a minute. Man, I thought, "Wow! If 89 can move the ship, then if a thousand turn a minute, the ship will fly!" Well, at that time I thought that. That's why I want to go to electric so make major improvement on the ship. That's how I get into electricity.

**Hsu:** I see.

**Chang:** Engineer.

**Hsu:** So what was your specialty in electrical engineering?

**Chang:** Then that time the University in EE split into two group. One is electronics, one is electrical. And I choosing more modern one, called electronics, because that's more modern, I guess. But actually I wasn't realize electronic, nothing to do with the fan, which originally get me into EE.

**Hsu:** Right. Because you had wanted to do with electrical-mechanical things. And electronics is no moving parts.

**Chang:** Yeah. But after go to college, I realize I wanted to learn the electronics, because that's more modern one.

**Hsu:** I see. So did you-- were you exposed to computers in college at all? Were there any computers in Taiwan at the time?

**Chang:** No. At that time, college graduate has to serve national army. That time was a year-and-a-half. Right now [it is] only a few months, okay? But that time, in the beginnings, only one year. But for some reason, when we graduate they ask for a year-and-a-half. So that's the mandatory. So I go to army for six months basic training, and learn some repair the radar. That time American US supply airplane to National [Republic of China] Air Force. So National Air Force fly those plane. And there's a radar needed someone to maintenance. So since we are electronic engineer, so they training four months, two months of basic military training. And four months of this skill training, and for one year we served in the airport to service those airplane, American airplane.

**Hsu:** Hm. So that was very directly related to things that you had studied.

**Chang:** Right. Because it required a lot of equipment, which is maybe similar before pre-computer stuff.

**Hsu:** Hm. So then how did you decide to go to graduate school in the United States?

**Chang:** Well, at that time, Taiwan's economy is not very good. So a lot of college graduate, there are not much jobs available. But that time the national government encourage people go to abroad to study. There are a lot of people go to U.S. So actual half of a [my] class end up in U.S. <laughs>, to the graduate school. Most of us stay in U.S. afterward. So like my colle[ge] classmate, after the military service, I took a ship-- the reason at that time airplane fares very expensive. Besides, you have to go to Japan to go [fly] to U.S. But because my father working government steamship company, they do have a ship from Taiwan go to U.S., Los Angeles area. So I was onboard to go to U.S. And it take me one month.

**Hsu:** Wow.

**Chang:** <laughs> Very slow.

**Hsu:** Was your father working on the ship?

**Chang:** No.

**Hsu:** Oh, okay, a different one.

**Chang:** He work on some other ship. But--

**Hsu:** But he got you passage for free.

**Chang:** Yeah, yeah, because he work for the company. Also as <inaudible>, the chief engineer on that-- the steamship I take to the U.S. is my neighbor. <laughter> So he take care of me. <laughter>

**Hsu:** Oh, okay. Did your parents-- were they sad to see you leave? Were they sad to see you go, or were they encouraging for you to go to the U.S.?

**Chang:** My father encourage, because he feel I should learn more if there's a chance. Of course my mother hate me leave. But you know, in the family my father say, say-so. <laughter> And I want to go, because I see all of my classmates went to U.S.

**Hsu:** Hm. Had you already met your wife at this point? Or--

**Chang:** No.

**Hsu:** No, okay. So you met her in the U.S.

**Chang:** I went to-- I arrive U.S. in November, 1958 in Long Beach. And I go to school called Kansas State University in Manhattan, Kansas. And I take three semester and got a Master.



**Hsu:** Oh, wow!

**Chang:** Yeah.

**Hsu:** That's very fast!

**Chang:** Well, a year-and-a-half, that's what most people do. And I start working for RCA back in Camden, New Jersey, just across [from] the Philadelphia.

**Hsu:** Oh, wow.

**Chang:** Yeah.

**Hsu:** So it was-- so you got a Master's also in electrical engineering.

**Chang:** Yeah.

**Hsu:** Yeah. Why Kansas State?

**Chang:** Because one of my classmate is there. And because he's better student than me, so he got a scholarship in Kansas State. But I apply-- they didn't give to me, so I have to pay my own. But that's the only few school I know. You know? So I went there. But first semester I pay my own. But second semester on, I got a scholarship.

**Hsu:** I see.

**Chang:** Yeah.

**Hsu:** How did you pay for the first semester?

**Chang:** The first semester, I work. Or part-time, I work at [the] school. You know, as student, you can work in the school like cafeteria.

**Hsu:** Right.

**Chang:** Yeah.

**Hsu:** So were you still focused on electronics at this point?

**Chang:** Yeah. Yeah, I work electronics. But after graduate, I went to Philadelphia. The reason I went Philadelphia, because many of my Taiwan college classmate, they stay in Philadelphia studying [at] University of Pennsylvania. That was a very big, famous school.

**Hsu:** Right.

**Chang:** And during '59 in summer, I went to New York for summer job. I stop by and I stay in the apartment, and I like [the fact that] my classmate[s], so many of them in there. So I decided after graduate, I want to go to Philadelphia. But I didn't get a job in Philadelphia. I end up get a job in Camden, which is just across the river.

**Hsu:** Right.

**Chang:** Yeah, the reason I got a job is also very interesting. Because that time, even though I'm in U.S. for a year-and-a-half, my English is very, very poor still. <laughter> And when I talk, actually I learn later, okay, nobody can understand me, because I'm still speaking Chinese English, so-called. But the reason I got job is because the boss is Chinese. And he interview me in Chinese. And he look at my school record is very good in Kansas State. All AAAs, you know, all straight-A student. And so he like me. So he hire me. But my English is still very poor. That time when we have, sometime went through the-- RCA at that time wanted to go to computer business. So in building computer. And my group is build a CPU. Okay? When we test the machine, we have to do every testing log. So every engineer had to write down what you did, what you found. What bug you discover, and so forth. So every day I have to write the log. And the log, I learned later that only my boss can understand. <laughter> Some high engineer, they look high on this project. So they come to see log, they don't understand it at all. <laughter> But I didn't learn [that at] that time. Later on, I learn from my boss, saying "Your English is still no good."

**Hsu:** So was that your first exposure to computers was that project?

**Chang:** Right, that's the expose the computer. And we actually did build the computer, and then we also ship into a company. And we have to- because we-- project sort of kind of delayed a schedule. So we have to get engineer go on site to continue to testing the computer. So it's-- the computer is in New York. So I have to go to New York for several months to check out the computer, yeah.

**Hsu:** Oh, okay, so you were like a field-test engineer, kind of.

**Chang:** Yeah, yeah.

**Hsu:** Okay. Do you remember what model of computer that was? <laughs>

**Chang:** Way, way old RCA computer. <laughter>

**Hsu:** And how long were you at that job?

**Chang:** I work [there] three years.

**Hsu:** Three years. So that was from which year?

**Chang:** It's from 1960 until 1963.

**Hsu:** Until '63, okay. And then you decided to go get a Ph.D.?

**Chang:** Right. That time because U.S. want a lot of engineer. So the company sponsor me to get permanent residen[cy]. So in 1963, probably in springtime, I get permanent residence. So I decided I want [to be] like all my classmate, all my classmate go to college and wanted to have Ph.D., so I wanted Ph.D. as well. Then I choosing Illinois, because that time, you know, they're better University like MIT, or Caltech, or Illinois. You know, it's pretty, well, you know, famous, so I choosing Illinois.

**Hsu:** I see. Because it was one of the top schools.

**Chang:** Yeah.

**Hsu:** At Urbana-Champaign?

**Chang:** Urbana-Champaign, yes.

**Hsu:** Yeah.

**Chang:** So I went there, '63, September.

**Hsu:** September '63. So could you describe your time there? Was it enjoyable, was it fun? Hard work?

**Chang:** It's okay. You know, as long as it-- because it's computer science, so even though in the classes they have a difficult time, you know, when student-- professor discussing, most of the time, I couldn't follow. But since there's textbooks, I can study a textbook. So I still got good grade. I study computer related.

**Hsu:** Okay. So then by this time, your Ph.D. is firmly-- you're doing computer-related stuff. Computer design type of things.

**Chang:** Right, right, yeah.

**Hsu:** Okay. And so they had a program that was in electrical engineering that was focused on computers specifically?

**Chang:** It's-- that time, they don't have a computer science department yet. So it's in EE. But sometime they join with mathematic department, have different conception. Yeah. So I was one of those who joined the math and EE, in more theoretical computer subject, yeah.

**Hsu:** Okay. So now you weren't just learning the electron-- the hardware, you were also learning like the algorithms and those types of things as well.

**Chang:** Right. Yeah, yeah.

**Hsu:** Okay, wow. Yeah, so you had a very broad computer education.

**Chang:** Right.

**Hsu:** Huh, wow. And so did you find it-- you didn't find it very difficult?

**Chang:** Not very difficult. <laughter>

**Hsu:** So what other sort of areas, what sorts of classes did they have?

**Chang:** I'm not really remember. Yeah.

**Hsu:** Okay. So this is-- you say you joined-- you went to school in-- to graduate school, Ph.D. in 1963?

**Chang:** Well, I finish in February of 1967. February. And that's the-- so I actually graduated officially in June of '67. Because it's between, you know, the school year. However, because I finish everything in February. So I join company called Bell Lab, AT&T Bell Lab. I work over there. You know, start from February.

**Hsu:** February, okay.

**Chang:** Until Sep-- August '69.

**Hsu:** '69, right, okay. And how did you get that position?

**Chang:** Well, because they, you know, those big company, they go to school, you know, before you graduate they go to [your] school, then interview [you]. And I got the job that way.

**Hsu:** Oh, okay, right. So you had good grades, you were a top student so they snatched you up.

**Chang:** I guess so.

**Hsu:** What was your Ph.D. dissertation focused on?

**Chang:** It's a theory about self-diagnostic. I don't remember the actually the title. But it relates, you know, you try to self-diagnose the computer. But in theoretically.

**Hsu:** So you had a lot of experience in computer design or computer architecture?

**Chang:** Well, the computer design, way back in RCA.

**Hsu:** OK. So you'd already had that experience.

**Chang:** Oh, yeah.

**Hsu:** Right, yeah. Could I also ask how much attention were you paying to U.S. politics and also international politics during this time?

**Chang:** Well, at that time, at that time, I mainly tried to have a family, tried to stay-- have a better life. So I'm not too much watch out for international news. I did it sometime during the school in Illinois. I subscribe two magazine. One is *Time* and one is *Newsweek*. So every week, I read those magazines. So from there, I learned something, international thing. But most of the time, I just read article and not doing anything.

**Hsu:** Right. So what were your thoughts about things like the Cold War, or the Vietnam War or the Kennedy assassination? Did you have any reactions to those?

**Chang:** Well, sometime in *Time Magazine* article about China, okay? Of course, I do remember one year, physics, the doctor in China operate hand, and they connected some nerve, so the patient can using his hand. There's article present in world physics meeting. And I read that, I feel great! I feel proud of Chinese. You know, they achieve such thing. But other, I don't have too much remember. But mainly at that time, I try to establish a family and I met my wife in February '67, just before I leave Illinois, I met my wife.

**Hsu:** At Illinois?

**Chang:** At Illinois. She just arrived in Illinois. You know, in Chinese student we always welcome a party to welcome new student arrive. So the party, I wasn't plan to attend the party. However, the party's organizer used to be my roommate. So because I'm leaving Illinois, so I had to see him about something I'm leaving-- I don't remember the detail. So I go to there, and I saw my future wife there! When I saw her, I have a love in the first sight. <laughter> So I stay in the party and I sit next to her, talk to her, try to get information from her. Her name, her relative, all that. It turns out she go to Illinois because her sister-in-law is graduate student in the Chinese Literature Department. And [s]he teaching Chinese for the Americans. So [s]he need a assistant, teaching assistant. So take her from Taiwan to be as teaching assistant. And also teaching as she can go to graduate school, you know, to study for the Master. So that's how [s]he get into Illinois. So I found out. But I knew her brother-in-law, okay? So in the party, I met her. Later I write a letter to her, and then try to establish our relationship.

**Hsu:** <laughs> So you were trying to woo her while you-- long-distance after you graduated? After you joined Bell Labs?

**Chang:** Yeah, because I working in the AT&T, Bell Lab. So the phone call is free.

**Hsu:** Ah! <laughter>

**Chang:** So I every day I call her long-distance. That time, it's very expensive for long-distance call. <laughter> But I take advantage of the company.

**Hsu:** Right. So you-- so you were working for Bell Labs in New Jersey, correct?

**Chang:** Yeah, Murray Hill.

**Hsu:** Murray Hill, yeah. And so I guess you were working on computer stuff there, too.

**Chang:** That time the semiconductor haven't starting yet. There's no integrated circuit. And we had joined them-- they are thinking about build a computer, so they can make fabric-- you know, at that time, computer is very big. You know, one computer may be like a refrigerator-- ten or twenty refrigerator's size. So they are thinking build a small computer. Try to. Because Bell Lab also have a lab. So they are thinking how they shrink those into integrated circuit.

**Hsu:** Right, so they were already--

**Chang:** And I'm doing the research in that area.

**Hsu:** Okay. So they were already building transistorized computers, but with discrete transistors?

**Chang:** We tried to build the computer, so they are thinking how they can make integrated circuit.

**Hsu:** I see. Okay.

**Chang:** Yeah, so my function is build a computer, working computer, so they can try to using integrated circuit to implement that.

**Hsu:** To implement that. All right. Because that was already '67, so yeah, so there already were integrated circuits at that point in time, right. So you were at Bell Labs for two years until August, 1969, you said, right?

**Chang:** Right, right. Two-and-a-half years.

**Hsu:** Two-and-a-half years, yeah. So why did you decide to leave?

**Chang:** Well, actually, during the winter, let's see, it probably '68, during the winter area.

**Hsu:** Of '68?

**Chang:** I live in apartment near the Murray Hill. The apartment is little hill. So if you go to the street, you have to go through a little road, you know, a hill road. And my apartment on top of the little hill. And that time, actually probably '69 maybe, because I already have the baby.

**Hsu:** Oh, okay. So you had gotten married already.

**Chang:** My-- the first daughter is May '69. So we just had a baby. Or maybe we don't have a baby yet?

**Hsu:** When did you get married?

**Chang:** Huh?

**Hsu:** When did you get married?

**Chang:** We married in '67.

**Hsu:** '67. Oh, okay! So pretty soon after you met your wife, you got married!

**Chang:** Yeah, pretty soon we're married. What happened is I met her in February '67. So then I long-distance call her. And in June '67, her brother, who live in Los Angeles, getting married. And then her brother-in-law just graduated in June '67. And he decide to go to Harvard for a post-doctorate research. But before go to Harvard, they decide driving car from Illinois to L.A. to attend the brother-- my brother-in-law's wedding. And so I thought that's good opportunity to see their family. So I say, "I want to go to wedding as well!" <laughter> And also I propose to her, and we decide day after the wedding we were have engagement in Los Angeles. So that's give me a chance to go to Los Angeles. So she accept my proposal. So we all went, her brother-in-law and her sister and her driving from Illinois to Los Angeles. I fly from New Jersey to Los Angeles. So we engaged over there after her brother-in-law wedding. Then she fly back. My future wife fly back into New Jersey after we engage. Then when we actually marriage is September '67 in New Jersey.

**Hsu:** So then did she complete her degree at Illinois?

**Chang:** No, no, she give up. <laughter>

**Hsu:** So she just moved in with you.

**Chang:** So her sister and his brother-in-law also left.

**Hsu:** Oh.

**Chang:** And she have a problem with her English, after she just gradu-- I mean, in U.S. very short time. So she was afraid to stay alone in Illinois.

**Hsu:** Okay.

**Chang:** So I convince her, "Go with me." Yeah. <laughter> And we have a child in '69, May. My first child. But probably before maybe my wife was not labor yet, during the winter, one day I took my wife to go to-- I forgot the reason we go out. And my car was on top of the hill.

**Hsu:** Ohhhh.

**Chang:** And instead of go down, you know, you have to roll this way, your car go that way normally, right? But my actually car was slide down sideways.

**Hsu:** Sideways.

**Chang:** Go down up until the bottom. We were scared, because my wife was pregnant. So I decided, no, there's no way-- I can't stand the winter, because the car is always parked outside.

**Hsu:** Yeah.

**Chang:** And after the big snow, the snow plow push the ice on your car. So you have-- each time you have to car, you have to spend an hour to dig us out of the car from the snowpack. So I decide, "Well, I better go to East Coast." Because we had--

**Hsu:** The West.

**Chang:** -- Los Angeles, before, right? I like the Los Angeles. Beside her brother-in-law in Los Angeles. So and my boss in RCA, Andy Lin, that time also joined Xerox Scientific Data System[s].

**Hsu:** Ohhhh.

**Chang:** In '69, they bought the [Scientific] Data System[s], and Xerox at that time have ambitious to build a computer [to] compete with IBM. So they hire a lot of people. And I learn that, I talk with Andy Lin. Andy Lin wanted to hire me.

**Hsu:** Oh, okay.

**Chang:** So that's how I decide in August of '69, I joined Scientific Data System[s], Xerox.

**Hsu:** Okay. Right. So they had just bought SDS.

**Chang:** Yeah, they just bought, I think in summer of-- and then decided they [want to] expand. Wanted to compete with IBM. Build a main computers.

**Hsu:** Minicomputers?

**Chang:** No, main.



**Hsu:** Oh, mainframe, mainframe?

**Chang:** Yeah, that time there are no minicomputer yet. They all mainframe, timesharing. So I was hired in August '69. I'm in a group mainly designed CPUs, the hardware. I think 5,000-- 500 series.

**Hsu:** 500 Series. So then what was it like being in, I guess, what had been SDS, now is XDS, in El Segundo?

**Chang:** Oh, actually the life there is very tough. The reason is the pressure is very high. Because we have to do a lot of thing. And I work really, really hard at that time. Because I started having kids, right? And also, I bought a house, so I have a pressure in payment. So I work really hard. I work the pressure so high that I got ulcer.

**Hsu:** Oh.

**Chang:** I wasn't well. One day my boss have a party. He living in Palos Verde Peninsula, which is in kind of-- it's a hillside house, house in the hillside. I living in Torrance, which is in bottom of a hill. And I drive my car to their party. And go to in the party, because I didn't know that I'm bleeding inside. I lost a lot of blood. I was actually faint in their living room.

**Hsu:** Oh, wow.

**Chang:** Yeah, and my boss, first I thought it maybe because I driving too fast, or something, go up. That was Sunday, I think. The Monday I went to work. And my boss look at [me, said] "Very pale." He said, "Oh, you look very bad. You better see a doctor." So I drove my car to see a doctor. To see a stomach doctor. And he look at me, he said, "Did you drive yourself?" I say, "Yes." "You better not!" Because he discover loss of a lot of blood, and he said, "I have to give you blood." So I stayed in the hospital, I got a blood transfusion. And at that time, I got Hepatitis B.

**Hsu:** Oh, wow.

**Chang:** From the blood transfusion.

**Hsu:** From the transfusion!

**Chang:** Yeah. But that time, because the pressures are too high. I work, you know, day/night, and sometimes skip a meal, because got to-- actually I got to twice for the Xerox.

**Hsu:** Oh, wow.

**Chang:** <laughs>

**Hsu:** So your boss there was still Andy Lin, the same boss that you worked for at RCA?

**Chang:** Yeah, yeah, yeah! <laughter>

**Hsu:** What was the culture of the division like, of that part of the company?

**Chang:** I think, I guess apparently it's not very good. I mean, pressure's really high, I guess. Because Xerox took five or six year to realize couldn't compete with IBM, so they in '75 decide to quit computer business. Right?

**Hsu:** Mm-hm, yeah.

**Chang:** So that time, I think the pressure's really high. So we work very-- not pleasant. <laughs> I get. That's how I got twice hosp-- also too much lost blood at hospital like twice.

**Hsu:** Wow. So was it really just terrible morale all around among the engineers?

**Chang:** Well, in the first two years, not bad, because that time, you know, in the beginning Xerox is pump a lot of money. But afterwards, the years and years getting worse, yeah, yeah.

**Hsu:** So did you work on the Sigma series of computers?

**Chang:** I don't remember Sigma, but I remember 500 series.

**Hsu:** The 500 series, mm-hm. Hm. So then, I guess you transferred to PARC after they decided to--

**Chang:** After they close. Then PARC [at] that time decide they already have Alto I built, right? And they decide they want expand more, so they since Los Angeles area computer division closed, there are a lot of, you know, people working in the computer business, so they transferred me to PARC, I think in September of '75 to work on the Alto.

<1:00:11>

**Hsu:** Right. And how many of your colleagues were also transferred?

**Chang:** I really don't know. In my department, I mean, my group, only me go to there, yeah.

**Hsu:** Oh. And so did the rest of them lose their jobs? Did the rest of them lose their jobs?

**Chang:** Oh, no, they stay. They actually Xerox still working on the company printer.

**Hsu:** Oh, okay.

**Chang:** The large printer, you know. Actually, Xerox make a lot of money for that.

**Hsu:** Oh, the laser printer.

**Chang:** Yeah, laser printer. Yeah, yeah.

**Hsu:** Yeah.

**Chang:** I think they stay doing those, yeah.

**Hsu:** Oh, okay. Yeah, that makes sense. So then, yeah, so talk about, you know, coming to PARC and what was that like and how was that different from working in El Segundo?

**Chang:** Well, the first impression I got to the PARC is that, one, Butler, Butler Lampson.

**Hsu:** <laughs> Butler Lampson.

**Chang:** He talk really fast.

**Hsu:** <laughs>

**Chang:** Ah. You know, my English even though I stay in U.S. for '75, so it's already many years, right, but I still couldn't really follow him.

<laughter>

**Chang:** So that's the first impression. I found that he talked very fast. I remember one day he gave a talk in PARC. He said, "Well, I try to speak slow. I'll promise I'll try to speak slow." But even that, I still feel he talked too fast.

**Hsu:** <laughs>

**Chang:** Second one is that I met Chuck, Chuck Thacker, because he's the-- actually my boss. And Chuck is very tall and well-built, a strong person. But his handwriting is very small. And actually I have a sample.

**Hsu:** Oh, really?

**Chang:** I'll give you a copy. There's a sample. His handwriting was very very tiny. <laughs>

**Hsu:** Right.

**Chang:** That's Chuck made the schedule.

**Hsu:** Mm-hmm.

**Chang:** Of the project.

**Hsu:** Oh, okay. Wow. And so that's his handwriting there.

**Chang:** Yeah, that's his handwriting.

**Hsu:** <laughs>

**Chang:** And the other thing I discovered that, you know, way back in Los Angeles, I'm with the hardware group. And in the hardware group, and there's another group called software. But with the hardware group, know nothing about software at all, nothing involving anything in the software. But way back in Palo Alto, that's quite a difference. The people not only know hardware very well, they produce a lot of software. That's the impression I got. For example, like Bob Sproull, I remember when I got there and we already have a logic diagram near where you put chips. You put the chip together it connect line together. And then it's a logic diagram, your hardware design. And Chuck wants Bob to do a program, take those logic diagram and make-- put maybe several logic diagrams into a board and also generate the backplane and for wiring nests and eventually make a logic board for the designer, what they want. I think he only take five days.

**Hsu:** <laughs>

**Chang:** Take the whole software. Well, that really impressed me. So I realized that in PARC you not only have to know hardware, you have to know software as well. And when I joined PARC, I only knew the hardware because I used to do, you know, in Los Angeles, all the hardware things. But I only do the implementing. Like, a soldier, you know, like but Lampson or Chuck Thacker, they are like a general. They put out a spec and I tried to put into the silicon and make the hardware realized.

**Hsu:** So was this the first time you had done any software or--? I mean, I guess you had to read some theory back in school.

**Chang:** Well, first I only do the hardware, implement the hardware.

**Hsu:** Right.

**Chang:** Well, I remember do Alto using the ECL technology.

**Hsu:** Right.

**Chang:** Because that's at that time it was more fast.

**Hsu:** Right.

**Chang:** However, they are more expensive. And later on, Texas Instrument come out the TTL logic. And then when we implement Alto in TTL logic, that's more cheaper.

**Hsu:** Right, yeah.

**Chang:** Then I decide I want to get involved in Sil. So when Bob designed the Sil system, I volunteered to maintenance that.

**Hsu:** To maintain it.

**Chang:** Maintained it, the software system.

**Hsu:** The software, right.

**Chang:** Add more components, you know, add changes. You know, other people ask, yeah.

**Hsu:** Right. Okay, so it was Sil that Bob Sproull had been-- wrote.

**Chang:** Oh, yeah, yeah.

**Hsu:** Right.

**Chang:** Basically, he wrote the whole thing.

**Hsu:** The whole thing, right.

**Chang:** I just maintained it.

**Hsu:** <laughs> Yeah. Could you talk a little bit more about working on the Alto CPU?

**Chang:** Yeah. I think that in the very beginning I just implemented CPUs, the microcode. The microcode is very, very complex because I used to do microcoding in Los Angeles as well, okay. However, at that time, we have very-- a lot of fields are fixed, you know. You, if you have a 16 bit and each bit have a function or maybe you separate in subfields and you know, two bit or three bit, five bit totals, sixteen bit. But each field have a fixed interpretation.

**Hsu:** Right.

**Chang:** But Alto's microcode, it's very complex. Not only the six <inaudible> you know, one format. Sometimes depending on first two bit, you have some other format.

**Hsu:** <laughs>

**Chang:** I never see so complex microcoded field. That was something I never done before. But why is choosing this way, because you want to create much more different microcode. Sometimes Alto microcode even allow you, the user can specify.

**Hsu:** Wow.

**Chang:** Well, that's something very, very different. But that also make the decoder is much more complex.

**Hsu:** And so you worked on the decoder.

**Chang:** Oh, yeah, I just implement the micro-- Well, whatever, But-- Butler and Chuck, they sort of put out a spec, what they want. I just implement.

**Hsu:** Right.

**Chang:** Yeah.

**Hsu:** <laughs> So then, let's see, you said you worked on two bus systems and the memory and cache also.

**Chang:** Oh, yeah, the cache memory, you know. Because later on when we found out we needed more memory, yeah. As an implementer, you know, I choosing available from Texas [Instruments] or other semiconductor [companies] when they come out [with] more high density thing, then I implement.

**Hsu:** Right, I see. And you also worked on an Ethernet controller?

**Chang:** Yes. I think.

**Hsu:** Could you talk a little bit about that?

**Chang:** I don't quite remember.

**Hsu:** Okay.

<laughter>

**Hsu:** Okay. And then so you've already said that you were the maintainer of Sil.

**Chang:** Yeah.

**Hsu:** Was that very complicated or was it fairly straightforward?

**Chang:** Bob already, you know, lay out all the things. So for my software beginner, it's not tough. Yeah. Actually, I have this Sil library.

**Hsu:** Oh, cool. Oh, wow.

**Chang:** Yeah, this is the first page.

**Hsu:** Mm-hmm.

**Chang:** There's a draft memo. And these have the library, the components and so people can use to design logic. There's ECL logic. There's, there are-- This is TTL.

**Hsu:** Uh-huh.

**Chang:** I think that I have another one that has ECL logic.

**Hsu:** I see. So did you create some of those components, some of those libraries?

**Chang:** Yeah. You have to, you found out what's available on, you know, outside. Then you feel it's good for use, so you create the diagram. It's an icon, so people can pick this and then connect the pin together.

**Hsu:** Right. So you've mentioned working with Chuck Thacker and with Butler Lampson and with Bob Sproull.

**Chang:** Right.

**Hsu:** Who else did you work with?

**Chang:** Bob Metcalfe.

**Hsu:** Oh, Metcalfe, right. Yeah. Right, because you were working on the ethernet controller.

**Chang:** Right.

**Hsu:** Yeah.

<laughter>

**Hsu:** Anyone else?

**Chang:** Other people I don't remember.

**Hsu:** I see. Okay. <laughs> Is there anything else you want to add about your work on the Alto specifically?

**Chang:** Alto using PROM for control store--

**Hsu:** Right.

**Chang:** And we borrowed a programmer and I program-- so I can using this program to zap the PROM.

**Hsu:** So that was part of your work is to--

**Chang:** Yeah, yeah.

**Hsu:** Is to flash these PROMs, yeah.

**Chang:** Yeah.

**Hsu:** <laughs> Are there any other diagrams that you want to show us?

**Chang:** Let's see. I discovered this Janus Etch Input Procedure. Written, me, myself and two other person. So there's this procedure it is called a draft.

**Hsu:** Oh, okay. Janus Etch Input Procedure. So this is for etching semiconductors or--?

**Chang:** Yeah. What happens, if you create the logic diagram by the Sil, then eventually it will come out using this procedure to come out it will control the etching machine to make a board.

**Hsu:** Okay.

**Chang:** Yeah.

**Hsu:** Oh, wow. No, that's neat.

**Chang:** This is a memo created from Chuck. It's called D0 Module Revision Control.

**Hsu:** Oh, D0 Module Control.

**Chang:** Control.

**Hsu:** Okay.

**Chang:** Yeah, it controlled. The reason I have it is because there's my name in the distribution.



**Hsu:** D0. So that's one of the D machines, the D series?

**Chang:** Dzer- the, yeah, D0 machine.

**Hsu:** Hmm.

**Chang:** This is the ECL Sil icon.

**Hsu:** So then in 1977, you transferred to the Xerox Personal Computer division?

**Chang:** Actually, I think I'm not quite sure the name of the division.

**Hsu:** Okay.

**Chang:** Oh, when I come into Palo Alto, I think Chuck at that time joined the Special Division for the Alto project.

**Hsu:** Oh, okay.

**Chang:** So I think I joined that group. It's not really belong to PARC.

**Hsu:** Oh, I see.

**Chang:** Because I look at PARC's organization, I saw Butler name but I don't see Chuck's name.

**Hsu:** Oh, I see.

**Chang:** But in some other talk, Chuck talking about he was changed over to the Alto project. So I probably joined that group. But unfortunately, I search that group, I don't have an organizational chart.

**Hsu:** Right.

**Chang:** So I don't see where I belong to. I don't know. <laughs>

**Hsu:** Okay. Yeah, I think I remember that there was a group that was trying to make more production versions of the Alto.

**Chang:** Yeah, yeah.

**Hsu:** Like an Alto III or something? Or mass produce the Alto. [ph?]

**Chang:** I remember, like Dover is a printer.

**Hsu:** Right.

**Chang:** Then Dorado, I remember the name.

**Hsu:** Right.

**Chang:** And I also remember Dandelion.

**Hsu:** Right.

**Chang:** Yeah. And I also remember Star.

**Hsu:** Right.

**Chang:** Yeah.

**Hsu:** So the division that you were in were doing all of those machines?

**Chang:** Yes, yes.

**Hsu:** Okay. Right. Yeah, so you were working on the-- So you were working on the D machines after the Alto.

**Chang:** Yeah.

**Hsu:** Right, okay. Did you want to show us that photograph? Is that of your team? [ph?]

**Chang:** Oh. I gave you a picture of that.

**Hsu:** Okay.

**Chang:** And this is another one. For some reason, this is one more people than the other one.

**Hsu:** Oh.

**Chang:** That's in Palo Alto PARC. I don't know which building it is. That's our group.

**Hsu:** Right, I see. So that's your group and you're in the corner there.

**Chang:** I'm in right here.

**Hsu:** Right. <laughs>

**Chang:** Now I remember her. She's our group's secretary. She's from Hawaii. She was very nice to me.

<laughter>

**Chang:** And then she also went during the lunch hour went jogging quite, you know, every day, yeah, around PARC. It was a very nice neighborhood. And also I remember bringing something-- I remember-- I don't remember which year and we decided to join the Bay to Breaker.

**Hsu:** Oh. <laughs>

**Chang:** And this is the first year Xerox PARC people go to-- and some went in-- one of them created this T-shirt. I thought it [was] very nice.

**Hsu:** Start.

<laughter>

**Chang:** Copy machine.

**Hsu:** Okay.

<laughter>

**Hsu:** So they're coming out of a copier. <laughs>

**Chang:** I think she married one of our group's engineers.

**Hsu:** Oh. <laughs> Do you remember their names? No?

<laughter>

**Hsu:** So then after the Alto, which was the first machine that you worked on? Which of the D machines?

**Chang:** D0.

**Hsu:** D0.

**Chang:** Yeah.

**Hsu:** Mm-hmm. And that one, was that the Dolphin? I'm not sure which.

**Chang:** I don't remember the other name, yeah. But it's D0, yeah.

**Hsu:** So you worked on a number of them.

**Chang:** Yeah.

**Hsu:** So you worked on the Dorado and the--

**Chang:** Dorado and the Dandelion.

**Hsu:** And then the Dandelion is what became the Star?

**Chang:** Yeah.

**Hsu:** The 8010.

**Chang:** Yeah.

**Hsu:** Could you describe some of the challenges of working on those machines?

**Chang:** I think that mainly the challenge is to cut the cost. Because it was still too expensive.

**Hsu:** Right.

**Chang:** The only thing I regret is that you know, Xerox never make any money out of the Alto concept. But that time, my view is that Xerox too ambitious. They should look at this as a tool for the engineer, programmer, like a workstation.

**Hsu:** Yeah.

**Chang:** You see later some company was making a workstation out of it, make a good business. I think that Xerox should have go after that. But they think compete with IBM, the top machine, so they want to make it as popular as everybody. That's why Xerox never make any money. And later, Apple, Steve Jobs took over, he made a lot of money, right?

**Hsu:** Yeah.

**Chang:** Yeah.

**Hsu:** So the Star was specifically targeted at offices, correct?

**Chang:** Yeah, because too expensive. I mean, we can't make cheaper.

<laughter>

**Chang:** I mean, because upper management want us to target it to everybody. That's wrong.

**Hsu:** And were you still doing hardware on these machines or were you also doing software?

**Chang:** No, I was still doing mainly it's the hardware.

**Hsu:** Mainly the hardware. So the--

**Chang:** Except with the Sil.

**Hsu:** But you were still maintaining Sil this entire time?

**Chang:** Yeah, yeah.

**Hsu:** Okay.

<laughter>

**Hsu:** So were you still designing CPUs and things like that?

**Chang:** Oh, no. Later on, I designed other, like hard disk controller.

**Hsu:** Oh.

**Chang:** I do remember the original hard disk control designer. You know, even though I in America for many years, I still have a problem with my English. I don't have-- I have only limited vocabulary. I can't write a nice memo, okay. So that disk controller, I forget which project. Disk control, he never make it work. So finally, company want me to take over his project and I got I think a full engineer work under me. And we have a lot of pressure and with a fixed time to make it work. So I remember that.

**Hsu:** And were you successful?

**Chang:** Yes.

**Hsu:** Yeah.

<laughter>

**Chang:** I make it work.

**Hsu:** <laughs> You mentioned that your English still wasn't that good. Was that an issue with communicating with your coworkers or taking over this project?

**Chang:** I think probably yes. Yeah, because I'm still using Chinese-English. So most, there are not too many Chinese work with me. So they're not too-- not really understand what I'm meaning, okay. So I feel that I probably, you know, performance-wise is not as good as others, yeah.

**Hsu:** So then, but then how did you get your team to work, to succeed, despite the communication issues?

**Chang:** Well, fortunately, you know, when you're working like this, disk control, you are using code, you know, your language. So it's not too difficult to directing, you know, what you want.

**Hsu:** I see.

**Chang:** Or you can debug it yourself, you know, sometimes, yeah.

**Hsu:** So you can sort of communicate in a technical language, technical terms. Right.

**Chang:** Yeah.

**Hsu:** Could you talk a bit about your family life during this period?

**Chang:** Yeah. Then I transfer [to] PARC in September '75.

**Hsu:** Right.

**Chang:** And in '75, Thanksgiving Day and the company allowed me to bring the whole family. At that time I still have my mother and my wife and three kids, okay, into San Francisco to look at the area, okay. And that, this is the first time I realized it's very, very bad to fly on Thanksgiving Day.

**Hsu:** <laughs>

**Chang:** Boy. It's, we are waiting so long in the airport. So many people. It was jammed. And then their flight is late and, you know, my wife took-- my wife and my mother and the three little kids, that's-- Rae [his second daughter] I think is-- '75, so you are only three years [old]? Yeah. She is only three-years-old. My little son is two-years-old. So very little-- [ph?] Yeah. And we really go to a hotel when, you know, the company allowed me to have a hotel, really late. And we have, we don't have-- and we haven't eaten, you know. So this is the first time I realized we never should fly on Thanksgiving Day. <laughs>

<laughter>

**Chang:** And then we bought a house in '76. They moved from February-- we moved into it February 8th, I think, into the current house.

**Hsu:** Oh, okay.

**Chang:** And at that time, she was four. My son was three. My elder daughter was six, yeah. Yeah, and still my mother and we lived there since then.

**Hsu:** Oh, wow. So this is your current house in Saratoga?

**Chang:** Yeah.

**Hsu:** That you bought that in '76?

**Chang:** Yes. Yeah, fortunately I bought it really early.

**Hsu:** <laughs>

**Chang:** We already tried to find one in Palo Alto, but Palo Alto really expensive, and later in Los Altos. Los Altos we found out is cheaper than Palo Alto but still very expensive. Then I found Saratoga and so we bought one. Fortunately, we bought it and right now, I can't afford it.

**Hsu:** Yeah. Right.

<laughter>

**Hsu:** It's really expensive now in Saratoga.

**Chang:** Yeah, even the property tax I can't afford.

**Hsu:** <laughs> So you mentioned your mother. When did your mother come to the U.S.?

**Chang:** My father and mother came to U.S. when I'm working in Los Angeles.

**Hsu:** I see.

**Chang:** I think it's 1971. My wife, we married in '69 and-- Oh, we married in '67, then we have our first child '69. And we bought a house in Los Angeles in '70. And in December of '70, my wife took my first daughter back to Taiwan, like a visit for a couple months. And the next year, my parents coming over, my father already retired. My father was very healthy though, when we're living in Palos Verdes which is a hill area and I bought a bicycle for him, he bicycle every day up and down hill, a lot of places. But unfortunately in '60, let's see, when was that, '73, we visited Las Vegas, we also visit the dam, I forget what the name...

**Hsu:** Hoover Dam?

**Chang:** Hoover Dam, we visited Hoover Dam and when we were coming back, my father was diagnosed with having leukemia and he staying, you know, we have to do the chemo for a year and he died the next

year in '74. Then in '76, we moved from LA to Saratoga. My mother had a stroke in '89 I think and then [s]he has to go to because—para—half of-- so we have to take her to a residential hospital and she died three years later I think.

**Hsu:** So you said you moved from LA to Saratoga in '76?

**Chang:** Six, February of '76.

**Hsu:** February of '76, but you had already been working in Palo Alto for a year.

**Chang:** Yeah, yeah, I starting September, '75, yeah.

**Hsu:** Oh, I see. So for a few months, did you rent an apartment here while the rest of your family was still...

**Chang:** Yeah, yeah, I rent apartment in Palo Alto and then my whole family back in LA.

**Hsu:** Okay. So you continued to work at Xerox until 1989?

**Chang:** Yes.

**Hsu:** And what made you decide to leave in 1989?

<1:32:35>

**Chang:** Well that time, my family is really bad, my mother had a stroke so she has to stay in a sort of convalescence hospital, yeah, because we cannot take care of her right, because she needed 24 hour take care. And also, my first daughter is sick, she has to stay in hospital and so my wife look after her in the hospital. So that time, my whole family every night have three places, my daughter and my wife, and my mother in the other place and I took two of other kids in our own Saratoga place. So that's really the-- I was very depressed so at that time Xerox offer early retirement, so I took-- that time I had worked for 20 years so I thought I'd took the early retirement so leave the Xerox. But actually, my college friend, he lived nearby me, he was against it, he said, "Don't do that," because he's aware outside, the job community but I wasn't, [I thought] after a while I'm very experienced, I worked in computer, you know, timesharing, personal computer, I have a lot of experience, it should be very easy to get a job, but I was wrong.

**Hsu:** Really?

**Chang:** Yeah. After a few months, I decided to apply job but that time I already, this is '89 so it's 50 some years old, over 50, nobody interest[ed in] me.

**Hsu:** Really?



**Chang:** <laughs> But fortunately my friend introduced me to IBM, got a job there.

**Hsu:** Okay.

**Hsu:** So you started at IBM working on what?

**Chang:** It's doing the testing...

**Hsu:** Testing.

**Chang:** ...of the-- yeah.

**Hsu:** This is at Almaden, the IBM Research?

**Chang:** No, it's computer, I forgot the division, it's in the San Jose, the main complex, there are a lot of division there, not the lab.

**Hsu:** I see. So you did manage to find a job through your friend?

**Chang:** Well fortunately a friend introduced me, because usually IBM don't hire very old people.

<laughter>

**Hsu:** So you experienced ageism, did you experience any other kind of discrimination during your career?

**Chang:** I guess there are, I mean even Xerox, you know, like my boss A.T. Lin, he was main manager for all the CPUs but he never, he only go up, one level up and at that time, we have another Chinese, he finally become a division manager, that was very high rank, but he's really super guy but he never go up, okay, we can feel it because that was the top ceiling at that time.

**Hsu:** Yeah, yeah.

**Chang:** In IBM we can tell too, another really high up level manager.

**Hsu:** Do you think that's changed since then?

**Chang:** Yes, yes, nowadays I guess it's changed a lot, yes.

**Hsu:** So how long were you at IBM?

**Chang:** It's not very long, I think I joined them 1990 I guess until '96.

**Hsu:** '96.

**Chang:** Because there is a new CEO, that time IBM wasn't doing very good so he want to cut the cost so he have a mass layoff, I was laid off from '96.

**Hsu:** And did you find another job after that?

**Chang:** I only found odd jobs.

**Hsu:** Odd jobs?

**Chang:** Yeah, like odd job, I worked for LSI a little while.

**Hsu:** LSI?

**Chang:** Yeah, and I also worked for some little company, it no longer exists, <laughs> startup company.

**Hsu:** Right. So that was during like the dotcom era, the late '90s?

**Chang:** Before that I think.

**Hsu:** Before that?

**Chang:** Yeah, before dotcom.

**Hsu:** In, okay, '96 timeframe?

**Chang:** Well the last job I did is 2000.

**Hsu:** In 2000, okay, and that was that...

**Chang:** It was odd jobs, short term.

**Hsu:** Right. So at various startups and things?

**Chang:** Yeah.

**Hsu:** Okay. So then I guess you decided to just retire in 2000?

**Chang:** Well I can't find a job so I retired anyway.

**Hsu:** Okay. So how would you, sort of looking back, summarize your career?

**Chang:** Well I feel I'm lucky, you know, in the EE department and also it turns out U.S. during that, my working period, the computer business is really growing, okay, so I'm lucky in that area so I found various jobs and also the experience with the Alto is I'm fortunate [to have] participated.

**Hsu:** Right. Looking back on your work on the Alto, what are you most proud of?

**Chang:** I think I can implement the hardware, you know, Chuck, Butler, specify and also the microcode area, I implement that, those are the very complex one.

**Hsu:** Do you think at all about the impact that your work has made?

**Chang:** I guess I did contribute some, okay, you know, realize from an idea to actual physical thing. Of course, I'm just a soldier, you know, doing little things, like Butler and Chuck, they are far sight[ed], they look way down the area, and they can specify but I'm just the soldier who implemented it.

**Hsu:** Well that's important too, it still needs to get done. If you could change anything about your career or make a different decision, what would it be?

**Chang:** I shouldn't retire from Xerox, I should stay on.

**Hsu:** What would you have worked on if you had stayed do you think?

**Chang:** I think Xerox at that time doing a lot of printer business, yeah.

**Hsu:** Right.

**Chang:** Actually this is the only area Xerox make lots of money out of it.

<laughter>

**Hsu:** So since you've retired, what have you been working on or what have you been doing?

**Chang:** I'm really doing not much, I just-- I know a group of people in San Francisco Chinatown, the group of people is more, they are very old immigrant from way back, many years ago. And they are a group of people [who] endure a lot of discrimination, okay, so they now, they realize in America so they want to help the new immigrant, help them establish the life in America. So I joined those group and I spend a lot of time with them and also set up website for the groups, there are at least three websites I established, I still maintain it, just help out. They also put out a monthly magazine, so I put the magazine online so people can read those magazine. So after retire, doing those work.

**Hsu:** I see.

**Chang:** But most recently, for the past three years, I really become too old now, they are not asking me to do too much.

**Hsu:** I see. I think earlier you mentioned that your sister, your half-sister stayed in the mainland when you moved to Taiwan, did you ever reconnect with her later on?

**Chang:** Yes, my father, because he worked on a steam ship, sometimes he went to other places like Europe, U.S. so he have better chance to connect to Mainland China, so he have constant contact with my sister. But during the Cultural Revolution, my sister's family does [ph?] because of my father's and me in Taiwan so they were victims of those Cultural Revolution, their house constantly being searched, okay? But later on, after, mainland, the end of the Cultural Revolution and they feel that the overseas Chinese should be welcomed so they start treat nicely to my sister's family. And in order to compensate their suffering during Cultural Revolution, they allow their second son to join the army because in Mainland China only good families be allowed to join the army. So my nephew, one of the nephew go to army, he graduate from army and he learned how to drive so after many years, he back to Shanghai and he as a driver [of] truck.

**Hsu:** So he's a truck driver.

**Chang:** He's a truck driver.

**Hsu:** In Shanghai.

**Chang:** And my other nephew because during Cultural Revolution, he was sent to the countryside, very poor places, you know, as a reeducation.

**Hsu:** Right. So they're both boys?

**Chang:** My sister have two boys, four girls, altogether six kids. And the eldest son sent to the countryside, it's a very suffering experience. But later he-- actually he's very smart, the boy, and he doing the trade as a dealer for teas, right now he's retired. So at my home I have a lot of teas from him.

**Hsu:** So when did you first reconnect with your sister?

**Chang:** I first visit there in 1974.

**Hsu:** So soon after the U.S. reestablished relations with China.

**Chang:** Yeah, U.S. I think President Nixon visited them...

**Hsu:** Seventy-two?

**Chang:** ...'72 maybe, yeah, yeah. And then Mainland China allow people to visit, the overseas Chinese all[owed] visit so I apply, at that time U.S. don't have [Chinese] embassy or consulate in the U.S., I have to apply visa to Canada, and that time my sister—it's still Cultural Revolution though, but they realize that I have good-- they have to be good with the overseas Chinese so allow me to visit my sister. Most of the time they only allowed outside visitors stay in a hotel because the ordinary family is very poor facility, they don't want to look bad for overseas Chinese to see. Although, I insist, I want to stay in my sister's house and they approved.

**Hsu:** Why was that?

**Chang:** Because my sister house is in ghetto area, it's very poor condition so usually they don't allow outside to see it but they allowed me to live there.

**Hsu:** So why were you given an exception?

**Chang:** I don't know, I guess they just want to be friend with me I guess.

<laughter>

**Hsu:** So your sister's family stayed in the mainland, they never...

**Chang:** Yeah, they all stayed in Shanghai, yeah. Actually, yeah, all the kids never go to college, so they only are very common people, just working in the shop, labor work. The only one is my eldest niece, she is a nurse, she married a techno person and he's— [of] the offspring, he's the only one, is very good, he became a CEO of medicine manufacture [company].

**Hsu:** Oh, okay.

**Chang:** Yeah, so their life was very good. Other than their family, the other one is barely just passing the life.

**Hsu:** So do you see them often or...

**Chang:** In the beginning yeah, I visited them, first visit is '74, then in '77, I took my mother to visit. Actually my mother because [s]he has diabetes, in the U.S. [s]he always feel, "I'm so old," because I'm, I guess, 60, okay. In '77 I took her to go back to Shanghai then I go outside because they allow me to drive other places to visit and my mother she went back to the birth place to see relatives and then she discovered all the countryside, the relative are 80, 90 and still very good health. And she feel like she is much younger, she's only 60. So after this visit, when she go back U.S. she feels much better, she says, "I'm much younger."

<laughter>

**Hsu:** So what do you think about sort of what's happened to the computer industry since you've retired?

**Chang:** Well computer, the only thing cheaper every year.

<laughter>

**Chang:** Nothing else, like a car, every year it's going up but only computers are cheaper every year, that's great. And nowadays, networks all over the place and the network so nice, you get to learn a lot of things from website now.

**Hsu:** Yeah. What do you think are the challenges facing the computer industry?

**Chang:** The only thing I don't like is those, what do you call, hacker.

**Hsu:** Hackers.

**Chang:** Oh, that's really bad, you know, I was burned by few times myself and I constantly receive those junk mail and I really hate those and I wish there's a law really punish those.

**Hsu:** And why do you think that computer history is important?

**Chang:** Well it not only let people open eyes sort of to the world and also see much, much more than you immediately see in your-- around you, see, and that's important. Also, you can see other culture, other people in other way of life, that's very important and I think that will help different kind of people on the Earth understand each other and that's what make more peaceful and at least found out of problems and then try to resolve it, it make world better.

**Hsu:** What advice would you give to a young person today?

**Chang:** Learn more math, learn more logic, you know, a lot of people hate math, like my wife, she really hates math, but I guess because her teacher in elementary didn't do the good job so she kind [of] get behind the math, but I think every child should love math, love logic, so have a better view of judge things, to analyze things.

**Hsu:** Is there anything else you would like to add?

**Chang:** I advise young people, you should work hard and don't think of good life, you should go through tough life too and never give up when you have a difficulty, yeah, you should work through your difficulty, more independent, don't always want to rely on other people to help you.

END OF THE INTERVIEW