Computing Educators Oral History Project

An Interview with *Susan Gerhart*

Conducted Monday, 10 March 2008
At Austin, TX
Interview Conducted by Vicki Almstrum

[0:00]

V: So, to put the official start on it, this is an interview with Susan Gerhart from her own company, apodder ["A-podder"]; is that the way to say it?

S: Yeah, apodder.org is basically a website, the name for the activities I am doing.

V: And we'll be talk more about that. This interview is being conducted by Vicki Almstrum. This interview is being recorded on March 10, 2008, in Austin, TX at The University of Texas at Austin. It is part of the Computing Educators Oral History Project. Did we give and pronounce your name correctly?

S: Say it again?

V: Susan Gerhart.

S: That sounds good.

V: All right. So I'd like to start from your youth, your roots, and ask about your parents. Did they have college degrees? The type of support that they gave you growing up …

S: My father grew up during the depression era and he was a scholarship student at Kenyon College [in Gambier, OH] for a couple of years, but he never graduated. And Kenyon College was a liberal arts college in the nearby town where he grew up.

V: And that town was …

S: Mount Vernon, Ohio. And my mother was not … never had college education. And she had worked in drug stores in Utica, Ohio … was the town where I grew up.

V: So they had high school education.

S: Yes.

V: And your dad a couple of years beyond that.

S: A couple of years of college, right.

V: And what was your dad's field?

S: He was an accountant for Pittsburgh Plate Glass Company in Mount Vernon. Manufacturing glass. Sheet glass.

V: And you mentioned your mother worked for drugstores. What did she do for them?

S: Clerk.

V: OK. So it was not the medical side of it or the prescriptions …

S: That's right. Retail. In a family-owned drugstore before the days of chains.

V: Yeah, way back, before chains. So your father had some mathematical leanings, since he was doing accounting.

S: Yeah.

V: And self-taught, essentially, after high school? Or the college he had was enough to help him?

S: Actually, I believe he probably got his accounting training during the War, during World War II. So he was in the South Pacific, as … in the army, basically keeping track of equipment and things like that. So I think he probably got most of his accounting training in the military.

[3:45]

V: How long was he in the military?

S: Probably three years.

V: And was this before or after you had come onto the scene?

S: Ah, he was shipped out the night that I was born.

V: No!

S: Yeah! [chuckles]

V: Oh my!

S: So I don't think he saw me until I was two years old basically.

V: So your mother had a period of being a single parent.

S: Well, she was living with her parents and my aunt and uncle at that time.

V: So you really had extended family as part of your early days.

S: Yeah.

V: Do you think that those family members had … Part of where I want to go is the influence that your parents had, but since there are such close extended family ties, it could be interesting to hear what mathematical or scientific background they had that might have helped influence you.

S: Let's see, my aunt probably had the most influence there. And she was also in … I don't know if you would call it accounting … but she ended up running the business office for a rural electrification company. And nothing in particular mathematical there, but she was — my aunt — was a very exploratory person, you know, go fishing and things, but there was nothing that was mathematical in the family background there particularly.

V: So you went to school for how long in Ohio?

S: My entire elementary and junior high and senior high was in the same town, in Utica, Ohio, and then I went to college at Ohio Wesleyan, which was about 45 minutes away from the town where I grew up.

V: Were you a good student?

S: Yepp! The valedictorian type.

[5:25]

V: Were you very active in other areas?

S: In music, in the band and orchestra.

V: What instruments did you play?

S: Flute and piccolo. And some of the … I believe the … there was a science, (I think something like a science club), and science fairs, things like that, Girl Scouts, 4-H …

V: Ah, 4-H …

S: You remember that?

V: Oh, yes! So, what did you do in 4-H? Which areas?

S: I actually sewed a blouse once [chuckles]. And I think … that led … I don't remember whether the 4-H led to it, but to a summer job, actually, at a 4-H camp … washing dishes. That gave me, sort of, my first job … in being an assistant at a summer camp nearby.

V: About how old were you then?

S: I was about 16, … 15, 16, 17.

V: So, as you went through elementary and junior and senior high school, what are your memories about the math and the science that you studied?

[6:55]

S: We had a very good high school math teacher … two or three good math teachers … one, in particular, that I can remember. There is a significant event that occurred here, which was Sputnik. And that occurred … what was the year? … in 1957. I graduated from high school in '61. So, after Sputnik there was much greater emphasis on math and science. And I think, unlike today, it was much more effective. It was really very concentrated. And so teachers were … math teachers were … they weren't gods, but they were much more respected and had much more responsibility to help the next generation. And there was … the new math was coming along at that time, which was basically set theory. The math teachers really had the chance to do, I think, a lot more with the students that they could pick out as ones that would be good for math and science.

V: Were your math and science classes tracked in any way so that there was a special line for honor students and a separate one for others?

S: There was a college prep, and then there were a couple of us who were … we had a chance to take a calculus course … basically, sort of an individual-study type of calculus course, given by the math teacher. But this was a fairly small high school, so there were not a whole lot of tracks.

V: So, what size was the high school?

S: Probably the graduating class was about a hundred. And this was at the time that many high schools were being merged … very small schools were being merged together into a larger

school, so there were people coming from different communities nearby, you know, about a 10-15 mile range, so that these were consolidating high school districts.

V: Were there any of your teachers through elementary, junior high, and high school who were especially significant, or another administrator at the school?

S: Yeah, the Latin teacher was particularly … I think particularly … dynamic. She was a very remote person in many ways. Silver hair and very … she looked Latin … like a Latin teacher in many ways. But she worked us hard and, of course, I remember no Latin now, but it was probably a more rigorous course than some of the others I had. And a physics teacher who was young. I think this was like his first job right out of college, and he was very proactive and took me to a science fair. And then the math teacher that I mentioned, who also was fairly young and was trying to do the new math thing, what was new math at the time.

V: Was this a man or a woman?

S: Man.

V: Okay.

S: So, the only female high school teacher that I can remember having much effect was the Latin teacher. Most of the teachers were male.

Then the principal of the high school, who again was probably on his first or second job, who became the principal of the high school, was very supportive. And he was the one who got … he was a graduate of Ohio Wesleyan, and he kind of steered me, he and his wife steered me, in that direction. Mainly from lack of other choices; I had no idea where to apply to college. Ohio State was kind of the default school. And then Ohio Wesleyan was a liberal arts college, because I got a scholarship there, that was the choice that worked.

[13:00]

V: Before we move more into the college stuff, let's talk a little bit about your siblings. You have a brother, I know.

S: Mm hmm.

V: Do you have any other siblings besides your brother?

S: Two brothers, yeah.

V: Yes, OK. And so where are you …

S: I'm the oldest.

V: You're the oldest, and so two younger brothers. What were your interactions with them over the years?

S: Well, the one was 3 years younger … 3 or 4 years younger. And then the other is 8 years younger and he's the youngest one … is the one who, well, I've been helping to raise his children. We've been sort of co-parents, for about 15 years, of his children, so that relationship remained close.

A significant thing was my mother was ill with Lupus for … essentially from the time that my younger brother was born until she died at age 62. So, in our youth we were sort of taking, trying to take care of our parents, as well as ourselves, as they taking care of us.

V: So, that added a lot of responsibility for you as a child.

S: Yes, yes. And it made it difficult for my parents to do as much for us, as I think they would have liked to do — although they certainly did quite a lot.

V: Once your father returned from War, your family was in its own home, not quite as intimately with the extended family as during the time he was overseas.

S: Well, that's right. I mean it was a separate, a separate household, but in a small town you know, everything was within blocks.

V: Ah hmm. So, you had a lot of closeness to family over the years?

S: To the … to my maternal family, in particular, yeah.

V: Did either of your brothers follow a mathematical or scientific path through high school on into college?

S: No, not really.

V: No. So, do you think that you had the same educational training and were sort of reinforced in the same way for your career aspirations as your brothers?

[15:55]

S: I think I probably got more … maybe got more, from my parents — encouragement from my parents — in terms of college because I was just a very good student. It was kind of obvious which route that should take whereas my brothers were more "iffy" on the scholarly side of things.

But, the high school that I went to, and now in talking about this with you, I realize that one of the effective things may have been there, that so many of the teachers and the principal were early on in their careers, with the exception of the Latin teacher, so they were not so much trying to make a mark for themselves, but they were much more, maybe, receptive and fresh in the teaching that they were doing. And, because they were young in their careers themselves, you know, they were looking for one or two good students that they could push along and claim as successes. And, because it was a small school, there wasn't a whole lot of competition there.

V: You mentioned the Girl Scouts and 4-H. Were those influences, as well as church, or any other activities that you did, formative in taking you towards what you became eventually?

S: I don't … I just don't remember that much of those two. Uhm, no.

V: No.

S: It certainly broadened the activities that I did, but there was not anything that I remember that contributed specifically to science or technology careers.

V: I can glean from what you've said that there weren't so many outside activities at the high school itself. There was band that you've mentioned, but there weren't the proliferation of clubs and activities that exist now.

S: Yeah, I think that's true. I think that partially because this was at a consolidation time that the clubs were not as in existence … but, also, that it was just small. It would be very hard to get together enough students to even make a band.

V: Interesting.

S: Some people got drafted to be trombone and they didn't want to be trombone, but, you know, the band leader had to find enough people to give him a full-scale distribution across the instruments.

V: Yes, it doesn't sound the same if there are no trombones [laughter].

Let's see … so on to your undergraduate education. You talked a little bit about why you chose Ohio Wesleyan. Do you want to say anything else about that?

[20:05]

S: It was primarily the influence of the principal. The proximity, but the distance of 45 minutes was enough so that, you know, I wouldn't pop home all the time and I would live pretty much like most of the students on the campus, but I wasn't that far from home in terms of travel expense … and the scholarships that were available to me. I …

There's one important event that happened here. Right after high school (and probably this was set up where the information was provided by the high school itself) I had the opportunity to go to a National Science Foundation Summer Institute for high school students. It was, I think, juniors and seniors. And that was at Southern Illinois University. And, again, this was in the Sputnik "we've got to have more scientists and engineers to beat the Russians" and Cold War type of mentality. There was a sense of urgency there. And so, in that program I … I don't know … I took some science program, physiology or something, I don't remember, but I also had a computing course. So, this was in 1961. And this was a course taught by … the Summer Institute courses were taught by regular college professors, and they were, you know, they were not dumbed down, but, you know, shorter courses and geared toward high school students, getting high school students interested in math and

science. And we basically learned how to program an IBM 650. So, there were about, maybe 10 students in this class. And this was, you know, at the very beginning of time with respect to learning how to program. I don't even remember which what language it was, but it was probably a Fortran or a Fortran dialect. It might have been assembly language. But we had to program a few loops. And that really drew me in. That was a moment where I got hooked because just the sense that you could program a loop that could do an array of any number of any size, any number of numbers, just seemed to be such a fantastic thing. And, though I didn't realize it as much at the time, but the other side of that question is: "So you can add up all the numbers. How do you know you've got the right answer?" Which became the basis for my later career of program correctness.

So, being able to program just seemed to me like the most natural thing in the world. Programming … I just took to programming. I had that introduction and then whatever problems were assigned were ones that were interesting enough and hooked me. And we got our hands on a machine … I don't remember … it must have been punch cards … and we ran our programs and we were hands-on. That was the defining moment, probably, in my career. And from that, when I went to college, then it was natural to move on to math, being the closest thing. So, that was an important … the most important point … the defining point … And that goes back, I think, very interestingly, to the effects of Sputnik and then to start up of these National Science Foundation Summer Programs and then having some college teachers drafted into, or given the opportunity, to teach those courses, and having the availability of the computer.

[25:20]

V: Something that was significant.

S: Yes.

V: So, when you arrived at college you knew math was the direction you were going, it sounds like.

S: Well, math, mainly by virtue of being the closest thing to computing. I didn't … never really liked calculus and differential equations.

V: Mm hmm.

S: And later on in my career, when I had the opportunity to learn logic and set theory, that was the branch … more discrete math was what I liked. And then statistics, too; there were statistics courses. But, as I was in college, the chair of the math department there was very forward-thinking and he got in a computer, an IBM 1620, which …for students to use. It was also the IT machine … it was *the* computer on campus. And I don't know whether he got it by donation or if the school bought it, but again, by virtue of there being not too many students taking courses, and by having him offering, and he had a particular interest in programming, and he also had a woman professor for at least one year — I don't remember how long she was there, it was not the whole time — but she taught programming also. And that was, because there were so few students, it was almost like a personal computer in many ways. I could go in any time to the computer room and have access to the IBM 1620. When I

became a senior, when I did a senior project, I did a compiler basically for that machine, so I spent a *lot* of hours programming. And having access to the hardware in the … and having it … it was a natural part of the courses, which was not usual at that time period.
[28:00]

V: So, what was the compiler that you wrote?

S: Well, it was basically kind of a dialect of Fortran. For some reason, IBM was … with the 1620, was distributing the source code for their Fortran compiler. So, I didn't have a course in compilers, but I went through [chuckles], kind of reverse engineered, the Fortran source code and had different syntax, different statements. So, like a variation on the "if" statement. So, it was not a wholly different language, but it was sufficiently different that I had to redo all the parsing and everything in the compiler. And … so, I learned something about compilers, basically, by reverse engineering the source code and redoing it for a new language. So, it was essentially a Fortran variation.

V: So that was your senior project or … ?

S: Yes.

V: Did you write a report about that?

S: Probably, I don't actually remember. I suppose I probably had to give a presentation on it. I don't remember that there was … I mean, there was a little bit of a user's manual, but I don't think there was a report.

V: So, were there any instructors at university … for those … you did it for the standard 4 years …

S: Yepp.

V: … your bachelor's degree. Were there any faculty members who were significant in helping you see your vision for where to go besides the President [chair] who had brought in this computer? … And I don't know how much influence he had.

S: The key person was the math department chair who taught most of the courses and brought in the computer and integrated it into the classes and then made it available also for students like me. And I wasn't the only person who was influenced by this. I think there have been Ph.D.s in computer science … about one student every graduating class when there were like 5 or 10 graduating math students. So it turned out a very high proportion of Ph.D.s in computer science. The other professors who were influential were largely liberal arts … because this was a liberal arts college. So I took science courses, you know, chemistry, biology, but it was maybe, maybe the literature courses, or the professors in the literature courses, were almost all female, that I took, as far as I remember. And they were just, you know, good courses.

V: Do you want to share the name of the math professors or any of the others?

S: Robert Wilson was the name of the math professor. And he's still alive (I think) and I've run into his son at various times in my career. I don't remember the name of the female professor. I haven't thought of those names for a long time.

V: So, as you finished your bachelor's, what were your plans?

S: Well, you know, kind of for lack of anything else, and not having much of a sense of what the job market was like, I decided to go into graduate school. And I went to University of Michigan. They had the closest … now, there weren't computer science departments in universities at that time, so there wasn't a natural progression there. And, you know, in math, in graduate school, was not what I wanted to do. I wanted to do more computer science. So, the University of Michigan had a computer and communication sciences program, which was very broad, it was like … it had speech, it had physiology, it had some automata theory. John Holland was famous in complex systems and taught … some sort of a course. This was pretty far out stuff. But I didn't really want to go on in that either. I had an automobile accident at that time also so I was injured and recovering from that, so I basically stopped with the master's degree at the University of Michigan and then I got a job, sort of an instructor, at the University of Massachusetts. And then, after that I … by then computer science departments had come into existence, and so I went back to Carnegie Mellon.

[34:30]

V: So how long were you a lecturer at … an instructor at the University of Massachusetts?

S: About a year and a half.

V: Teaching math, or …

S: It was just the beginning of computer science there.

V: So, this must have been around '66, '67?

S: Yes, so that was about the time that the first textbooks on programming languages were coming out and automata theory as well was becoming an established field.

V: So, your exposure to automata theory was at University of Michigan. Is that when you really started becoming aware of the discrete math side of mathematics?

S: Well, actually, probably going back into college. I don't … there weren't discrete math courses. Everything was calculus and differential equations, but it may have actually gone back to high school, with the math professor there who tried to teach us set theory and … or at least that was a part of one of the math courses, like a junior-senior math course. And then also during college, yes, during college, I was a summer assistant at some more National Science Foundation-funded institutes that were taught there at the college. So I was like a teaching assistant. Of course, I had to learn the stuff too and it wasn't being taught in my college courses, so I think that there was a set theory course that was taught at that time … in the summer institute at which I was a teaching assistant.

V: So you finish at [Ohio] Wesleyan, go to University of Michigan until you're sort of forced to stop there because of the recovery from the accident.

S: Yes.

V: Taught for about a year and a half at the University of Massachusetts. You gained some experience. It sounds to me as if you understood you needed to go on, that there was more to do with your education.

S: Yes.

V: Can you talk about that transition and realization?

S: Well, it was at that time … now we are really tracking … my development is tracking the development in the field in many ways. It was at that time that you could start to see that there were publications and a new field was really taking shape, that wasn't math and it wasn't a branch of any of the physical sciences or biological sciences. It was a distinct field in itself and because I was in tune with programming languages and compilers, and … not operating systems … but above operating systems, compilers, and assemblers, that seemed like … that kind of defined a path. And so I applied. I was accepted at Stanford as well as Carnegie Mellon, but I went to Carnegie Mellon because it was close. It wasn't Carnegie Mellon at that time, it was Carnegie Tech. Because it was within 3 hours of Ohio, where I grew up.

[38:50]

V: So, you left University of Massachusetts and started in graduate school. Did you have a good idea of a topic yet, or did that develop?

S: No, I didn't. And at the time that my class, my cohorts at Carnegie, came in, for some strange reason they decided not to have as many courses. So we had an abstract algebra course, which was hard for everybody. And we had more programming languages, which was the main field there at the time. And artificial intelligence had a few courses, but not a whole lot of structure to the program. It was the faculty teach what they wanted to teach. So, Nico Haberman came in at that time and he taught operating systems and the curriculum kind of got defined by what the faculty wanted to teach, which was OK but it wasn't as structured and I think maybe as broad or as integrated as it might have been. But, we all kind of found our way through. Now, I was hoping to have Alan Perlis as my thesis advisor. And Alan was … he left to go to Yale at about that time, so I had a kind of disjointed Ph.D. trail. That is, I got started on a couple of things working with him but they never matured before he left and by then I kind of picked verification of APL systems, and Don Loveland, who taught logic, got kind of drafted in as my thesis advisor. But Perlis was influential. People used to say, "Perlis has a lot of good ideas, but then Perlis has a lot of ideas and they're not all good." And I got kind of buffeted around among his many ideas as to what would be a good thesis topic.

V: Did you begin knowing you were in a Ph.D. program or did you think you might be going for a master's?

S: No, it was definitely a Ph.D.

V: Did you earn a master's along the way?

S: Not … not in that … No. It was … I believe it was pretty much strictly Ph.D.

V: So you were part of a cohort that pretty much followed the same courses together. About how many of you were there?

S: Probably about a dozen.

V: And have you kept in contact with many of those folks?

S: Yes, yeah. So Anita Jones was in … and we were roommates in graduate school and continue as friends all the way since then. Larry Snyder is at University of Washington, Tim Teitelbaum at Cornell. And I have seen these people many times over my career, and, you know, watched what they've done.

[43:00]

V: How many years was your Ph.D. program?

S: About four years. Yes. Four, four and a half, I think … it stretched. Yes.

V: And, can you tell me anything about the process of developing your research and writing your thesis?

S: Well it was pretty painful because I … Robert Floyd had been there and had left. I think he may have been one of the reasons I wanted to go to Carnegie, and as often happens, you get there and the professor you were interested in is gone. But he had created the field of … defined program verification, as … it was called the verifying compiler … in an article that he wrote. And then there had been one thesis in that area and I was kind of trying to follow in those tracks, kind of a merger of automated theorem proving and programming languages. And I had been entranced by the language that Perlis was interested in at that time, which was APL. So, I took verification of APL programs as my thesis topic and I thought I would get the union of everybody that was interested in verification and everybody that was interested in APL and I actually got the intersection, which was me and one guy in Israel and another person somewhere else. It was not an optimal selection in terms of topics, in terms of … APL was, was an oddball but fascinating language and remains so today … you know with things you can do with operators. In my thesis I had a one-line Hamming code … Hamming encoder program … you know, so it was all APL operators strung together, 26 operators or something like that to do a Hamming code. And that was the basis for the verification … some of the verification techniques that I was looking at. That was an oddball language and it wasn't particularly interesting to the rest of the verification field either. I mean, it didn't have much generality to it, I guess, is the problem.

V: You mentioned from very early on this idea of how do you know you've gotten the right answer as a precursor to your interest in verification. Can you reflect a little bit on how you became aware that verification was going to be the area in which you specialized?

S: I think probably Floyd's article on the verifying compiler just brought together a number of ideas there. There was a cartoon, I don't know whether it was in his article or it came separately, but it was something about, somebody was in the first frame of the cartoon, was, "We can now answer this great big question by adding or multiplying (I don't know) some large number of numbers" and then somebody else naively says, "But how do you know you've got the right answer?" And that just struck me as being a pretty fundamental thing to be concerned about. And also very hard to answer because if you are computing something, do you have a different way of computing it? You know, computing is a sum of numbers. Do you have a different way of doing it? And, Floyd's article was very obscure but it was clarified later in other work. I think Jim King's work, the use of assertions. That you have an assertion working through the loop that assures you that you're getting the correct result at the end … mathematical induction.

V: And so, you were at University of Massachusetts teaching and you were already becoming aware that this was the direction you were going to go.

S: Yes.

V: So, you were pretty focused as you decided the programs to which you were going to apply?

S: Well, I just picked the programs that seemed to be the most relevant, the most interesting, yes. And it was computer science. By then computer science was defined.

V: So this was in the late sixties, or earlier?

S: Starting in '67, I think.

V: OK. It is interesting to me knowing about the computer science education timeline because Curriculum '66 is a defining moment. And then also knowing that Dijkstra line and all of the things that were happening in '67 through '71 there … sounds just like it was an exciting time to be "you."

S: Yes, in probably around '70 or '71, Dijkstra gave a seminar in Albuquerque, hosted by University of New Mexico, and I was able to attend that. So, people have been finding out ever since then that they were at that seminar that Dijkstra taught and we didn't know each other but it was kind of a gathering place where people had similar interest and Dijkstra taught that. I remember that at the end of his (Dijkstra's) course he gave us a chance to pose a problem to him and I can't remember what the problem … oh, it was like a … organizing a family tree. You get the pairs of parent and child and you want to organize it into a tree. We

gave him that problem [chuckle] … he didn't do very well with it. He had never programmed those kinds of algorithms. He had a little trouble finding the assertions.

V: Interesting.

S: And it was just not a familiar data structure to him. Well …

[50:45]

V: Hmm … Is there anything else from the time when you were a student that you would like to share?

S: Well, I think there was one more course that I took that was influential and it was philosophy of science [at Ohio Wesleyan]. And I wrote a paper on mathematical induction in that course also. And again there was a professor who was fairly young. And it was more … the realization that there was structure to theories of science, science had … it wasn't just something going on … that there was structure to it. And I don't think I ever had a strict philosophy course, per se (I might have), but I find that area very interesting now when I look back at it, partially because I have a friend at Santa Monica College who is teaching robotics in a philosophy course, so we talk a lot about the rules of philosophy and religion and mind and things like that, that are the larger topics. And by having a … I think having a liberal arts education was critical to how I developed.

V: I can see it in some of the things we've talked about as well now in how you're adapting to your vision loss that that has had an important influence as well. So it's interesting to get this filling in on some of those parts. So, now you've completed your Ph.D., that was in '71?

S: I think it was actually '73. The oral thing.

V: OK. And so, after that your career … isn't exactly a ping-pong match [chuckles] but there are parts that are very clearly focused on education and parts that are clearly focused on research.

S: Yes.

V: I don't know the easiest way to talk about those two aspects, so I'll leave it open to you to start.

S: Well, yes, I went from opportunity to opportunity. Not all opportunities turned out but the … why don't I just go through chronologically.

[53:50]

V: That sounds fine.

S: And then you can pick out what's interesting there and I'll try to highlight something. So, I … after I left Carnegie, I really didn't know exactly what I wanted to do. I wanted to go, for some reason, to Canada. I don't know if it was the [Vietnam] war or whatever, but I spent a year at the University of Toronto. And that gave me, actually, much broader exposure to

more computer science than I'd gotten at Carnegie. A different … more like a British culture of computer science. Then, my thesis advisor, Don Loveland, was … became the chair of Duke University and I was hired there … very standard computer science curriculum developing at that time. I taught, I think, you know, programming … programming methodology, became a sub-field around then.

After four years at Duke, I was not having a whole lot of fun. Not much social life. I liked North Carolina, but I wasn't having a lot of fun and one of my graduate students, somebody who had been a year ahead of me, was working at the Information Sciences Institute at USC. And he liked a paper that I wrote on correctness-preserving program transformations. Also at the time that I was at Duke I had a couple of summer jobs. One was at SofTech with John Goodenough. That turned out to produce a paper that really brought a lot of attention to my career. It was a seminal paper. It wasn't all that earth-shaking, but it brought together a whole lot of ideas, so that was on program testing. And program testing kind of fit in with correctness. They were thought to be opposing types of … ways of doing things and I tried to bring them together. And so I had … and I also spent a summer at ICASE at NASA Langley, where I got exposed to more NASA-type things.

But, I wanted to have a little more fun in life and went to the University of Southern California with Information Sciences Institute based in Marina del Rey. And I lived in Santa Monica and I had … ah … I was in my thirties at that time and I lived the single Southern California life to the hilt … and developed a relationship there, too. One of the things that was neat about Information Sciences Institute was that a lot of the Internet work was going on at that time. In very early periods I had a joint seminar between my verification project there and Jon Postel's Internet protocol project. Jon Postel, I think, is one of the key figures in the Internet. He died about 10 years ago, but he was a leader in the development of protocols. We were trying to merge those two areas. And we did write some papers on protocol verification. So I kind of got in sync with the Internet at that point. Let me stop there and see if you've got any questions.

V: No, this is … OK.

S: When I was at ISI I also got … I was kind of a hot item for a while after the theory of test data selection paper got out there and the program transformation work. I had a body of papers … publications … and … that were pretty interesting to a lot of people. So I got to do some seminars at Newcastle in England and got more European exposure; got to go to a lot of the [ICSE and IFIP] Conferences and really a much broader and more international set of colleagues.

V: Had you traveled outside of North America before that?

S: No, no. I … all my European travels were really for conferences. So, Information Sciences Institute, we developed a verification system that was quite elegant and, mainly due to the work of one of the people in the project who just had a flair for, you know, very good taste in user interfaces. Now this was done in Interlisp. He later left and became a newscaster. He was not interested in computing.

[60:00]

V: What was his name?

S: David Thompson. We had a good project there, and I was the project leader. Unfortunately, as will happen with DARPA Projects, DARPA-funded projects, the funding shifted to another field, so that came to an end. And, you know, you hate to have a project die. But, it continued on a little bit. Actually, Dave Musser was the brains behind this, but he had left to go to RPI. And he continued the project for a while but eventually it totally died. But it was one of the first demonstrable prototypes and at one point in a magical evening a couple of guys from MITRE, who were going around to the verification projects, trying to see if we could verify a security kernel, and Dave Thompson and I and these two guys sat down with our verification system and we verified this fairly significant little security kernel … some security properties of it. And, you know, it was the sort of thing where, you know, you just sit down, you've got your system together, you get the minds who know something about the project and know about the tool, and we did more in that one evening than I think we've ever done in many projects where we … you know, you plan, and you've got a strategy, you're going to do this part and then that part, you're going to prove this and that. We just sat down … we just did it, you know, the energy flowed through it. That gave us another boost because it was a significant technological accomplishment to be able to get through that.

So the ISI AFFIRM project died. And I went … had a contact, Nancy Martin, at the Wang Institute of Graduate Studies in Massachusetts. And so I ended up on the faculty there for three years. So that was … that was a good time. Also, because this was a Master's of Software Engineering program. There wasn't a software engineering curriculum … you know, who knew what you taught in software engineering. There weren't any books. We collected papers and used the papers and developed the courses and much of that curriculum later became the basis for the Software Engineering Institute curriculum. In fact, you know, some of the people went to SEI [Software Engineering Institute At Carnegie-Mellon University] after the Wang Institute died. And so I spent three years there working with projects and there I became interested in logic programming, which was starting to get hot due to the Japanese fifth-generation project.

And I learned Prolog and I actually reprogrammed the verification system from ISI in Prolog. And went to Japan, actually, for one of the fifth-generation projects. To me that was one of the fascinating and lost treasures of computing, that logic programming was such a different paradigm. And there wasn't much in the way of object-oriented programming at the time. You know, you had imperative … isn't that what it is called?

V: Yes.

S: Imperative programming, just very sequential, yet concurrent programming, and then logic-programming rule-based approach which, to me, has been lost and could be … have solved … many of the problems. Many of the systems we're building now would be built better and more simply with a logic-programming or a rule-based approach. And that got me interested then, when MCC [Microelectronics and Computer Technology Consortium] was formed, the Research Consortium, and I had a contact with Les Belady, who was the head of the software

technology program, so I moved to Austin for several years — about six years, seven years — until the software technology program ended in a very demoralizing way. I had a project there, which was called … *A Transition Study*. So, we had … we put together … our own little consortium of about twelve or thirteen companies and government agencies, NASA and NSA and Kodak and NCR and Digital Equipment and organizations who contributed a small amount of money to learn about … what was the variation of formal methods at that time. But that project was not able to continue.

So, then I worked for about six months, one of my MCC colleagues put together a project that was an international study. Him, Ted Ralston, Dan Craigen from Canada, who I'd worked with for quite a while, and me, and we went and did interviews on how formal methods (as they were then called) — so the verification term morphed into formal methods — how they were being used in companies. So we talked to Boeing, the French transportation company GEC Alstom, Lloyd's Register, and NASA Center at Goddard — about twelve different companies, and that was another paper that ended up having a lot of citations, because it was a structured empirical study, it wasn't that we did technology things, we just interviewed people.

And, then I needed a real job and … because that didn't pay very much … and needed … and went to the National Science Foundation for a year. Nico Haberman, this was the … he was the Assistant Director of NSF … he hired me to be the division director for what was then … I think it was called CCR then (Computer Computation Research). It was a theory and software engineering program and I was at that time … my niece and my brother, were living … started to live with me. My father was also in a retirement home nearby and I couldn't maintain the Washington contact when I had everything in Texas … all the family in Texas, so I came back and took a job at the University of Houston-Clear Lake, as a director of an institute. They'd been a part of my project at MCC and I developed a good relationship with somebody from NASA, Bob McDonald, and Charles Hardwick, who was at the university, and we … so I sort of became the director of this institute. And that was a bad time for NASA, with the companies, the space companies, coalescing, consolidating into the United Space Alliance, or whatever it was, and money going away. So that died. Then for about five years I worked on my own developing some search tools, software search tools. Did some consulting, again working with one of the MCC colleagues.

But I was also having vision problems at that time. So at the time just as I was starting the job at University of Houston-Clear Lake, I had a major retinal detachment and surgery and a long recovery and had later vision problems, two or three times. But after a while my brother and I decided we wanted to get jobs in the same area, and so we happened to pick Arizona, moved to Prescott, where he … his job was a casino dealer and I had a job there at Embry Riddle University for five years. Then, about three years ago, I was fired by Embry Riddle for lack of, they have … uh … ran out of students, just like many places. And we, we're not on very good terms for reasons that related to women who were … wanted to see the University change. And I was having vision problems and it was a good time to get out of there in any case. Since then I've been retired and learning a lot and continuing to program, actually, in Java, continuing to develop a student project I started there, a pod catcher. [71:45]

V: So, in the times that you've been in classrooms and teaching, what have those experiences been like?

S: Well, if we work … if we work backward from the Embry Riddle time, one of the interesting things is the contrast in how structured, you know, computer science is now, compared to what it was when it started out. In the beginning, you know, you didn't have textbooks and exercises and, you know, standard curriculum. You know, you just pretty much had to put together all your own material and to the best of your knowledge figure out what the course was about. Now you can, you know, pick up any number of database books and you can pick among what you want to emphasize. And it's all highly structured material. I love teaching databases because that covers everything in computer science. You know from the logic of SQL and operating systems in concurrency transactions and ER diagrams that cover software engineering. And so, you know, I see the big thing now in computer sciences is the "pick and choose" issue. You have so much structured material and it's a matter of what's your choice of topics to emphasize to use the materials that you have available. To use the textbooks and the …

V: Yes. Do you have a teaching philosophy that you can share?

S: I think projects are extraordinarily important. When I look back at my career, when I … the project I did … the compiler … that I did, I actually wrote an assembler-type … instructional assembler-type project when I was at University of Massachusetts and I programmed again. These were not programs in teams. But these were individual projects that I had. But, that, you have to program enough to get into the complexity of the product, that you understand what the technical problems are … and, you know, so you'd have to be working. Now it's mainly working in team projects to do that, which brings a whole different dimension. But, you know, the thing I think is lacking in many curricula is there's just too many, you know, just small exercises. And you have to have a big enough one to really teach you the complexity, the hardness of the complexity issues, as well as to develop your confidence. So, once you know that you can start a project, and you're going to get into it and it's going to get horrendous, but you can … you have to figure out then how to deal with those problems and you can believe that you can get to the end of it so that you don't stop. So, I believe students need to be given experience where they get into the messes and have to deal with the complexity and make mistakes and fail. Working in teams, I think, is also very important. And I used … I used the … what's it called? … the team framework that …

V: Personal Software Process?

S: Yeah, not the personal, but the …

V: Team Software Process.

S: The Team Software Process. I just used the matrix that defined the different roles on teams. And I did this, also, at the Wang Institute in a more informal way, but defining … having defined roles to follow, you know, manager and QA, and tried to get the students to … not necessarily to go with the role that most matched their personality. So, pick … like if

somebody is more naturally … like I had Air Force students often at Embry Riddle. And, of course, they've got rank and you know who's going to be the leader and the manager. Well, you put the manager in the QA department so they learn more about the technical stuff. And you put somebody who may be, not necessarily, a leader type, but you put them in the managers' role. And sometimes they find out they really hate doing that kind of work or playing that kind of role, and sometimes they really take to it. But they learn some different experiences from being in different roles. And I did this with the software engineering lab and then later with the senior projects. So, a lot of … of mix-and-match types of things, where you have the role defined well enough so that they understand what their responsibilities are and they learn a few techniques, but they also find out whether that's a good role for them … going on. And, also, they understand better when they are working in a team. They're more empathetic about, more understanding of what goes on in a different role.

[Added note: I did not use PSP or TSP in toto because I wasnn't fully convinced of the utility despite colleagues being devoted to the techniques. In addition, the process was too complex in the context of limited course time. But that one matrix of team roles covered a lot of management issues and got the projects up to spec with minimal overhead and also allowed allocation of responsibility for failure.]

V: How has your teaching style changed over the years?

S: Well, toward the end I became very much the active … what is it, active …?

V: Active learning?

S: Yes, active learning. And I've always been … liked projects vs. lectures. So in discrete math, I would have … only about half the period would be lecture or whatever, introduction to the next topic, then cover some of the things in it, send the students up to the board in teams of one or two or three and have them, you know, try to solve problems together with me going around to coach them. And [chuckle], that backfires on … and I took a course at a SIGCSE on active learning and the guy who taught the course warned, he said, "Nobody knows how to evaluate. They don't know how to evaluate that teaching style. Your evaluator comes in and sees the students wandering around the room and 'Are they learning', you know, 'What's going on?'" But I much enjoyed using that for a couple of years, because I think that they did learn a lot more. I think I always put more emphasis on exercise, on picking the right exercise, in having, you know, some sort of a significant project in the course. And a subpart of the course, the database course you would build a little database at the end. And that, rather than trying to cover the subject matter. I would make a judgment as to what was important about learning, say databases, and forget the rest of the material that … you know … their job is not to learn the field of databases in a research sense, but to get some blend of the practical and the theory and as much of the subject matter as you can, but to try to get it put together in some sort of a project. So in terms of change, you know, from the early days, it's probably much more of a dropping, trying to cover less.

[81:50]

V: Do you have any particular stories to relate about any of your students or any of your classes?

S: Well, one of the student stories was actually at Embry Riddle and it was a … we had a project. We got a grant from the National Science Foundation on computer security education. This was in their Federal CyberCore or something, needing more education in computer security going on, and one of the students and I worked one summer to … he did the programming, I didn't know Java at the time, but he learned it and did it. And we built a buffer overflow applet that you could demonstrate in a computer security course. We put it on the web and as far as I know it's still there and it's still being used. Actually it's being used more outside the United States than inside the United States. But I learned so much from this student, Jed Crandall, who, I think, is getting a Ph.D. in computer science from UC Davis. And I've had this experience a number of times, that I like it when I can feel like a colleague to the student. You know, when there is something I don't know, but they do know. And we can work together as more like equals, in order to complete some project, which it's usually a project that I've set up, but it's not necessarily that I am the leader, but we are trying to work as co-equals.

V: Professional organizations. What professional organizations have been significant in your life?

S: Well, I've been a member of ACM on and off. IEEE on and off. I'm a member of neither right now because I don't read the print publications and I've kind of lost interest in trying to get the digital versions of it. ACM harmed my career a few times. They published these papers that were anti-verification and that influenced … in the Information Sciences Institute, at that time it influenced the DARPA funding. And it wasn't that they didn't have the right to do the publication, it was that the papers were … not … the papers were attacking the field. This was … the Fetzer, DeMillo, Lipton, and Perlis papers were … they were … they were not reviewed by … they were kind of written in the factually … factual sense when they blended a little bit of what was real and what might be. They set up straw positions and were … I just thought they were biased and unfair papers and I've resented ACM ever since then for that. These papers should have been reviewed more or had counter … when they were published, had the counterpoints published along with them at the same time. And the same thing has happened with AI and other fields, but this was my field. So, I was a member of the IEEE Board for *IEEE Software*, you know, did a lot of reviewing, but I've never worked much with many of those professional subgroups.

I've, you know, on the women's side, been involved with Systers since the beginning, since the bathroom.

V: Yes.

S: And …

V: Right here in Austin, TX.

S: Right here at the Renaissance. And … but that's also been on-and-off in terms of being interested and posting and reading all the stuff. Now I pretty much read all the articles. I was involved with the funding, actually, of Anita Borg when … I think when she was trying to get funding, or we had some of the early conferences, where we were defining the things that NSF would be doing, and I worked with trying to set some goals there. I was a member of SWE for a while, Software … Society of Women Engineers. One of my students at the Wang Institute, whose name … Betty … Betty … Betty something [Shanahan], is … she's the executive director of SWE now. She was the one woman in the *Soul of the New Machine* book, was involved in that; she's a hardware engineer. And … I've never been loyal to any particular professional organization.

V: Has supervising undergraduate or graduate students played much of a role in your career?

[88:45]

S: Supervising in the sense of projects and students?

V: Yes.

S: Oh yeah.. And, like, most recently there at the Wang Inst … or at Embry Riddle, right, with this security education project we had three or four students who … three women … one woman and three male students … who were … worked on the project at various times. And I've always tried to get into the senior project, to be the supervisor of the senior projects, if I could. I've done that, you know, probably done dozens of those kinds of student projects.

V: But haven't had much in the way of graduate students?

S: Um, no. No, I've never taught in a graduate student program other than the Wang Institute, but that was a more … along the model of a professional school, not the long-term graduate program.

V: Right. OK. Have you spent any time volunteering in professional activities?

S: You mean like using computing outside of computing … ?

V: Right.

S: Not that much. When I look back at Austin I was involved with the thing that Elaine Rich and the other Elaine set up.

V: TWIST, Tomorrow's Women In Science and Technology.

S: It was the Expanding Your Horizons.

V: Right, so TWIST was the umbrella.

S: Right. And tried to work in that and … I don't really think many other cases … I've been trying to volunteer my services with respect to accessibility and assistive technology at the place that I live now but there aren't enough organ- … I can't find the organizations that are bringing the people together to make the contacts for volunteering.

V: But I would think that your blog is an example of service …

S: Yes.

V: That would be interesting to put on the record.

S: Yes. So, OK, after basically becoming legally blind in 2006 and fumbling around with a lot of the technology that was available, computing technology that was available, in 2007, I started writing a blog and I thought, "Now I'm not, I'm representative of someone who is very tech savvy and I'm willing to put money out, you know, to pay for the equipment that I need to keep me going, but I'm not a part of the regular rehab system." Things are very structured, so that if you're a veteran, or if you are employed, or you want to be employed, or if you're in the educational system, there are rehab, rehabilitation services and, you know, that will fund … fund you to get some training, but I'm not … I'm on my own, basically, learning on my own, and I also think that those organizations, basically by their very nature, are not necessarily going to be as far along in the technology cycles as I am.

So I've been … as I've been trying out different software packages: this works, you know, even if it's a little strange, like a magnifying mouse, a mouse with a magnifier that you can get from Microsoft. You know, it's just a little mouse, but it has a magnifier that can be useful to you. So I'd write up these, these little things, kind of thinking of myself as being an advisor to the baby boomers who were going to be losing their vision, want to maintain their technology communication abilities as much as they can, but are not going to have the rehab services. And even if they had the rehab services they wouldn't necessarily have the same … they wouldn't be given the same span of possible choices as I might be able to give. So, I've been trying to write up that experience. And my tag line is "Adjusting to vision loss with class, using technology." And looking at this as an ongoing process of how I change. The blog is not just about technology but is also about a few of the heroes that I've found, that are writing books or providing material. And they inspire me. So, I write about them and I write in a more personal vein than I would if I were doing this … this is not technology papers.

[Inserted comment on the blog: This blog is moving deeper into technical aspects of accessibility, e.g. standards, driven by experience from straddling the culture of disability and generations of technology users. I am morphing into an activist as I identify barriers for visually impaired people on the web and in everday life. Even more significantly, following the curb cuts principle, user interfaces and social processes will lead to improvements for everybody by removing these barriers. Accessibility, usability, universal design, etc. are poorly handled in computing at a high cost of unemployment, market limitations, and damage to reputation of our field. One message for computer educators is to maintain accessibility quality of their own web sites and those produced by students, learning themselves about the growing field of accessibility engineering.

[Using my newly found respect for the professional speciality of accessibility, I try to post blog articles directed at both the sighted but ignorant and the Vision Losers in transition to new modes of work. I find myself articulating situations like Synthetic Voice Shock for elders, how whitehouse.gov mangled accessibility principles, computational thinking for better use with screen readers, and questioning the premises of visual programming. When my blog stats show queries like "rapidly losing vision," I appreciate the opportunity to translate the positive spirit found within the blind community into technology pathways for those like me in continuing transition and promote a classy, positive attitude.

[A recent interview with Dame Wendy Hall reminds us how absolutely amazing is the computing technology developed during our lifetime. For me, this has been the 3 decades from working with Jon Postel at ISI to writing on a free Wordpress blog platform. I use technology shrunk from the room size IBM 650 and IBM 1620 to handheld text readers. I learned the cultural language of disability from podcasts and book sharing collectives. I found my inspiration from a blind writer my age in San Francisco, a college dropout open source developer in Australia, and a social entrepreneur MacArthur fellow in Silicon Valley, among many. I think the challenge for computer educators is to mesh the "classic" computing curricula with this "modern" momentum of social change.]

[95:00]

V: Have you had many opportunities over the years to serve as a mentor?

S: Well, more to males than to females. When I look back at it I find it disappointing that I have not had … not as many female students to work with as males. Ant it's not just the numbers, but also quality of work. The women that I've had were in my classes, like at Embry Riddle … were not as committed, I would hate to say this, but not as committed to computer science. But part of it was because they were more interested in other things that were kind of outside my range. Like, one student interested in computer security but also in global security in kind of the cultural aspects as well. So I've felt like I've tried very hard to keep women in computing, but I've seen a couple of cases where … the women just felt that they could not compete with the males … you've got a smart … "*Unlocking the Clubhouse*" kind of thing … you've got a real smart male and the female feels bad about it and it's very hard to keep, to bolster, the female's confidence and keep her involved. So I have not had … not been involved in any of the mentoring … structured mentoring activities (I don't think).

V: Are there any particular challenges that you've faced in your work environment over the years?

S: Well, partially because I was … I took the opportunities that came along. You know, I've had more organi- … been in more failing organizations [laugh] than I would have liked to, you know, organizations that have died. And they died because they were out of sync with their times or, you know, financial (it just happens). And there are a lot of lessons from that because when you're going through a period of one or two or three years where the organization is dying on you (e.g. declining student enrollments or declining funding), it affects you personally a great deal. It's hard to keep up your morale when your job is falling apart.

At Embry Riddle I had real challenges with dealing with male colleagues because of the background of the institution being maybe 7:1 students and about the same ratio of faculty (male to female ratio) and a number of women banded together basically to change the situation … making, trying to make it clear that women were not getting promoted and women faculty were uncomfortable being excluded from male activities or feeling that they were not being given the opportunities that were needed, and having to deal with male professors stating that women did not belong in engineering and other professors saying that the gay student's lifestyle was an abomination and it was their responsibility to change it.

And it's not that these people don't … are not entitled to their opinions, but there is a diversity code that is published. And, if the diversity code is not followed in some sense then women who are, are, I think, women who are standing up and trying to get the support of a serious diversity commitment are further harmed by their standing up activities. And, in these two cases, the faculty later became chair of the faculty and on the tenure and promotion committees and things that were, I believe, unacceptable, would be unacceptable to most women. But these things happen, and when you stand up, you're a troublemaker. And you are a troublemaker because if you didn't stand up there wouldn't be any trouble.

[101:00]

V: Looks like there were some real difficult times there.

S: But it was also a learning situation for myself in terms of, I had to decide to what extent I would put myself on the line. If you're at the end of your career (and I know of another woman who has gone through a … she went through a specific discrimination and retaliation thing, but … we've talked about this often …) at the end of your career you can stand up and do things you could not do earlier and, furthermore, you know better. You know … you just have the past history, you say, "This has got to change and I'm going to see what I can do to make it change. And the harm that might come to me, because I'm at the end of my career, is not as significant because it's just got to change. And so the benefits … if I don't stand up now against this, then this will go on." And it's not just me alone standing up against it, but others, you know, who are also willing to put themselves on the line, you know, not just one person, but a group trying to make it change. And it's painful, but it happens and at the end of your career you can take some chances you wouldn't otherwise.

V: So, you've talked a little bit about outside familial connections, and, especially over the last fifteen years, with your niece. And you've mentioned, briefly, a relationship in Monterey. Let's turn a little bit to outside of work, outside of research, as we are winding down and talk about what family and relationships … how they have influenced your life.

S: Well, with the … the raising of … the working and raising of the children, I … now I understand how hard it is for women to maintain balance among family and work and … the benefits of the time that goes into the family. I didn't understand that, you know, when I was younger and I, you know, for one reason or another I just never made the, you know, the choice to have a family. I got one later in life.

In terms of friendships, I've maintained a lot over the … through my different jobs.

And in terms of male-female relationships there's been one that's lasted for about thirty years (off and on) and recently, actually, more on than off in terms of as we've grown older and … had more understanding, I think, of each other.

The fact that I've had vision loss has put me into a totally different world of contacts that have been quite interesting, both from a technology point of view … I've seen a lot of interesting … interesting tools that I would never have been able to appreciate … you know, just sort of a kind of technology drive that I think is fun because it is ahead of the … where some sighted people are. But also, I've made a number of contacts that I would not have otherwise, which seems extraordinarily strange that at a time when I can appreciate much more, relax much more, because I'm not in the competition, I'm not in the … I'm not a player, except where I try to be. I would like to be able to interact more with people but I can't see their faces, and I have all the awkwardness of the vision problems that now interfere more with developing additional relationships at this point in my life.

V: A lot of challenges that you wouldn't have thought about …

S: Yes.

V: … earlier, ten years ago, say …

S: Yes.

V: Are there any other strong outside interests that would help us understand you better?

S: Um, let's see. Well, I left out AAUW among the different membership things that I've been involved in, and that's been helpful to me recently. Mainly as I get older and I fit more into the AAUW demographics in the place where I live, which is largely retired women. And I'm reading *The Age of Turmoil*, by … the Greenspan book, for my book club tomorrow morning [chuckle] and much more involved in … trying to get involved in … group activities, where I have no particular domestic interest, you know, baking and so forth just did not capture my interest very much, but more diverse intellectual interests. And, if I were able to, I would be much more involved in nature activities, but I'm much more limited in that domain. I've traveled a lot on nature trips and eco-type trips, Belize and Guatemala and the Galapagos and the Barrier Reef in Australia, and places that … Baja a great deal. When I was younger I much enjoyed taking those kinds of excursions.

V: Fun stuff.

If you could give advice to a young woman starting out, what would it be?

S: When I look at the field … I went to this conference called "She's Geeky," which was kind of a spontaneous un-conference held in California last October, and I realized there are the very technological and the accidental technologist. And, you know, the accidental

technologists are … many of them are IT administrators, database administrators, and so forth, and that can be a very challenging job. And then there are web designers and these don't need the same structured approach to computer science as if you're a hardware designer or a software quality [specialist] or things like that … that … um … that when they start in, they need to get as much of the substance as possible. And not get … don't, um, don't fool yourself into thinking that because you can build web design, web pages, that that's going to be a whole career. That you've got to have a lot more substance … you're going to have … your career's going to change over time, the technology is going to change over time. Whatever it is that you do, whether it's graphic design or the hardware, or, um … you've got to get as much of the substantial courses, and I don't mean computer science theory, but as much of the rigor, you know, the ability to think through and to troubleshoot and to know the technology, because, if you think about people with a job at 25, are they going to be doing the same thing at 35, at 45, at 55, at 65? Well, there are a lot of women at the 65-year range who are doing programming, but many more who will have dropped out. So, how are they going to deal with … and they can't anticipate what all those changes are going to be, but they're going to be different people and there's going to be different technology and how are they going to make those transitions through different decades of their careers? Well, the main thing I think they have to have is as much substance as they can in whatever aspect of computing they're doing.

V: If you could change one decision you've made along your career path, what would it be?

S: Ah, that's a hard one, actually. Because every decision that didn't work out so well [chuckle], I actually tried to make the best of. I think when I made the change from the National Science Foundation to the University of Houston-Clear Lake, I did that for family reasons and I think I needed to have looked more broadly for the job opportunities. At that point I was 50 … around 50 at that point … because that meant significantly less income over the last 15 years of my life when … or my career life … where I would have had more benefits available to me. I had a lot of tradeoffs at that time and a vision accident that happened at that time, but I should have … I rushed into a decision. And I should have looked at more organizations, a broader set of organizations, at that point. Now looking back at it I would be much more looking at non-profit types of opportunities.

V: And your career now has turned more in that direction. That's sort of interesting.

S: Yes.

V: So, as we wind this up, is there any story that you want to tell so that it's going to be remembered?

S: Well, you mean a specific story or a general kind of?

V: It's up to you. Anything you would like to add.

S: Kind of a thing … OK. I think, for some reason, in my career I wanted to get experience in all different types of work. I wanted to be in industry, or close to industry … sort of industry. I wanted to be in a government, and I've become much more interested in government. And I wanted to be in academia. But I never wanted to be in any one of these things my whole life. And so, that the ability to go back and forth in these has been very broadening and, I think, you know, people need to think about doing similar kinds of things, to get as broad a kind of experience, even though they are going to work in organizations that fail, and they're going to work in places they hate, you know, the broader experience in the long run works well for you.

But the other story is … I look back to 1961 and my first programming and I still love to program. I'm learning Python and Java, and that, you know, if … people have got to get hooked into something that they want to keep coming back to. For me that's programming. And to have that … the joy of being able to write a program, even if it is not good to much of anybody else but yourself … but to be able to plan it through and get it done, and have something, you know, that is usable, and the experience along the way as well as seeing the product, is something I would wish that everybody would have that chance.

V: Very good. Oh, and in closing I just want to have on the record that you were one of the people who helped spark the Computing Educators Oral History Project in 2003 in Reno, Nevada. Barbara Owens remembers you walking up to her and saying, "You have to capture those stories." [laughter] Do you have any memory of that, just to end with?

S: Yes

V: Anything to add?

S: Just that Barbara was at that meeting. I think she was introducing or giving an award to Harriet Taylor from NSF and I had sort of forgotten that I'd met Barbara before when I was here in Austin and we'd been in college together. And, you know, just … I don't know what made me think about that except for the fact that it was, maybe, the Harriet Taylor thing that made me realize that there were a lot of stories to be told and nobody seemed to be interested in women of this … of our age. And, you know, there's the ENIAC pioneers and, of course, everybody's interested in the War, World War II and that age of women, but we were the women who were at the … our careers were paralleling much of the history of computing as it was developing and there had to be some kinds of interesting stories there are and I'm sure glad you guys are carrying it on.

V: Thank you so much, Susan. This has been great. I appreciate it.

[108:40]