Oral History Interview with

Jay Leavitt, Ph.D.

On July 10, 2020 (via videoconference)

Minneapolis, Minnesota

Conducted by Jeffrey R. Yost, Ph.D.

Charles Babbage Institute

Abstract

This interview was conducted by CBI for CS&E in conjunction with the 50th Anniversary of the University of Minnesota Computer Science Department (now Computer Science and Engineering, CS&E). Professor Leavitt briefly discusses his early education and interests. The bulk of the interview focuses on his education at Brown and his doctoral education at NYU's famed Courant Institute, his first faculty teaching position in University of Italy at Pisa, joining the University of Minnesota's Mathematics Department, research in applied mathematics and computing, becoming a founding member of the Computer Science Department, as well as the early evolution of this department. He offers context on his work in such areas as numerical analysis, computer art, and computer networking. He was also central in assisting the University of Minnesota with policies and initiatives to practically adhere to federal legislation on disability and working to create accessible educational and research environments at the University of Minnesota.   He also discusses his research, teaching, and administrative leadership at SUNY Buffalo, where he served as Director of the school's Academic Computing Center.

Keywords:

Brown University, Courant Institute, New York University, computer art, applied mathematics, numerical analysis, UMN disability policy, SUNy Buffalo, University of Minnesota, Computer Science Department, UMN, computer science curriculum.

Yost: My name is Jeffrey Yost, and I'm here this afternoon on July 10, 2020 interviewing Jay Leavitt. This is part of the Computer Science and Engineering 50th anniversary history project—oral history project/initiative. Jay, I understand you were born in Fall River, Massachusetts.

Leavitt: Right.

Yost: What year was that and did you grow up there as well?

Leavitt: I was there until I went off to college and I was born in 1936.

Yost: Ok. As a student in school, so prior to college, were there particular subjects that you were especially interested in?

Leavitt: It was all math. I--in those days, it was very competitive to get into to college and I was not a good student. So, they sent me out into the country, to a country school, where almost nobody went to college. There were very few kids. I think we had a reunion and only 18 of us went to college. So, I would hitchhike in and invariably be late, and that was plain geometry. I had no problems with that whatsoever, and even went through a singulation of trisecting the angle, which is clearly impossible. And since the teacher couldn't disprove me, I got an A. Subsequently, by the time we got to trigonometry, that teacher, his wife, had a difficult pregnancy, and so they sent a clergyman in to teach the course. He knew nothing about trigonometry, so I taught the course, and that was my start in mathematics.

Yost: You went to Brown?

Leavitt: Yes.

Yost: What year did you start at Brown?

Leavitt: Class of '57, so '53.

Yost: Ok. And you knew you wanted to be a math major from the start?

Leavitt: No!

Yost: Oh, you didn't. Tell me about that.

Leavitt: Brown wanted—Brown thought, initially, that I would be on their football team. My father wanted me to be pre-med. I instead, through one circumstance or another, became head cheerleader. I had a half a case of beer in me and decided to do some tumbling and broke my neck. So, I'm home, trying to recover, it wasn't a total break. So, I ultimately ended up being able to walk but I decided then that I wanted to become a math major. Unfortunately, I was entering my junior year, and was two years behind the rest of the class. So, in the 10 days of Christmas vacation, somebody came to me, a friend, and we did the two years in the 10 days, and when we got back to school, I passed all the qualifying tests. So, then I was a math major.

Yost: At Brown, did you have any exposure to computers?

Leavitt: Yes. My first exposure—I took a computer science course. And we were led to this brownstone one day, and they had a tape machine. They had knocked out the ceiling so the room was now two-stories high, and they covered the whole wall and four sides with blackboards and wrote zeros and ones all over these blackboards hoping to find where a zero should be changed to a one and a one to a zero. And they had us write a simple program that could be fed into the computer, and I asked when mine

would be finished, and he said, oh, by the time his finger was off the button. It had completed, which was quite amazing. What was interesting was soon after that session, I met a student who was considered the star in the math department. And we went for a walk and he asked me why I would study computers. He said, after all, within four years, all significant problems would've been solved.

Yost: So, I meant to also ask you about—you developed a very strong interest early on in trading stocks, correct?

Leavitt: More or less. At Minnesota, I wasn't using computer for that.

Yost: OK, so that came later. So, you finished at Brown in 1957, did you decide immediately to attend graduate school?

Leavitt: Yes, but I lost a year because of the accident, so I finished in 1958.

Yost: 1958. OK.

Leavitt: Yes. So, I went to the Courant Institute at New York University (NYU) for grad school upon graduation.

Yost: Can you tell me how you came to select the Courant Institute?

Leavitt: I simply wrote a letter. I didn't ask for funding, and to my shock they accepted me without a transcript. So, I showed the letter around the department, different faculty members, and they told me I'd be crazy not to go there. So, that's how I ended up at the Courant.

Yost: Were you especially interested in applied mathematics at that time?

Leavitt: More or less, yes.

Yost: Who was your primary advisor for your theses--at the Masters and then at the Doctorate level?

Leavitt: Well, at the Masters' level, I would say, Cathleen Morawetz and when I wrote my thesis, it was Robert Wickheimer who was one of the directors of the Manhattan Project.

Yost: Can you tell me a little bit about him as a mentor to you?

Leavitt: No. What happened was he gave me the assignment and helped me get started and then he went on a leave to Los Alamos for a year. When he came back, I had competed it. I know he liked playing a string instrument, but we never got close together. He had a very traumatic experience with regard to computers. He had his computer across the street in the original computer science building. It was sitting there unplugged with a guard sitting next to it 24 hours a day. It had all bulbs down the front of it so what he would do was sit up all night and watch the lights, and periodically pause the computer, and sometimes flip a light from on to off. So, he had his little machine there. When he got to Los Alamos, his shock was that they were introducing batch processing. Well, he was so discouraged, he had to hand in a deck of cards the night before and wait until morning to get his results. Came back to NYU and gave a speech entitled, "The End of the Usefulness of Computers to the Natural Sciences."

Yost: Interesting. In 1962, you published, you co-authored an article, entitled "Circle Supports the Largest Sand Pile." Can you tell me about that?

Leavitt: We had a 'problems' seminar, and half the problems were unsolved problems. This turns out to be related to the theory of plasticity, and when I got the problem, and looked at it, I didn't realize it, but I had invented a new inequality that allowed me to solve the problem. So, the instructor who presented

6

the problem and knows its significance, was the first author on that paper. But in the theory of plasticity, they had, many had hypothesized that it was not a circle.

Yost: In 1963, you defended your dissertation, and it was entitled "A Power Series Solution Compressible Flow Past a Conical Shock Wave".

Leavitt: Right.

Yost: Can you describe that project to me?

Leavitt: Well, effectively, it was a reentry problem. Ordinarily, well, most people solve this problem doing an indirect method. The—we knew the equations were analytical and so I used a mathematical property to analytically do it directly by keep on, keeping on marching through the flow until I could construct what it looked like. And I discovered that there was a singularity in there of a square root. Turned out that another student at the same time, was solving it indirectly. She came to the same conclusion that there was the same singularity. I had met somebody from the Soviet Union who was part of their National Academy of Sciences at Courant. He was visiting Courant, and he said that the way I was doing it wasn't possible, so I lucked out.

Yost: So, can you tell me a little bit more about being at the Courant Institute at that time and the environment with your fellow graduate students and any of the faculty that were especially influential to you?

Leavitt: Well, I'll tell you a funny story with Richard Courant. He had escaped from Germany in the 1930s, and he was famous for minimal surfaces, studying minimal surfaces. He would meet me at the elevator in this ten-story building, and we might be going in opposite directions. Well, he was—he didn't

want to embarrass me, and he was also a mountain climber. So, when he saw us—after our first encounter there, he climbed all of—up the ten stories rather than embarrassing me. Later on, when they built a new building in his honor, I asked him about it, and I subsequently learned he got stuck in the elevators. I'll think of their names. I'm a little bit slow. I didn't expect this because quite a few of them were quite significant, influenced me quite a bit. Oh, let's see there's Herbert (Herbie) Keller Kellogg, his brother…I'll figure it out.

Yost: We can move on. Thank you. When you finished your doctorate, I understand you were awarded a Fulbright and you went to the University of Italy at Pisa. Can you tell me about that?

Leavitt: Yes. That was a great opportunity. While at Courant, a visitor—visiting professor from Pisa was spending a year with us—and I approached him, and he said he would help arrange it. So, when I got to Pisa, the only romance language I had was French. I was terrible in French. I had no language labs. It was all literature. So, after I'm there, I was asked to teach a course in numerical analysis at the University but in Italian.

Yost: Wow.

Leavitt: Which I did. The—that was kind of crazy. I don't know, have you ever heard of the Postcard Incident, which came soon after President Kennedy talked about the Peace Corp? Anyway, so this initial individual at the Peace Corp simply sent back a postcard, which anyone could read, and obviously someone did read, because she wrote on the back of it, "This place is the pits." Well, just to continue the story, I thought I was going to become the second postcard incident. When I first arrived, the president threw a welcoming party and told us about the student riots and he also told us what he was going to

grant them in terms of what they were asking for. I was in this Medici building. It had a large courtyard. The walls were actually the offices. And my office was within—I hope you can hear me.

Yost: Yes, I can.

Leavitt: --was within this wall when the students took over that particular area. Well, so I had a key to the outside of the wall, and so I had no other place to study. I went up to my office every day, and so they happened to look through the door one day and came into the office and they had someone from a newspaper with them. They, you know, were asking all sorts of questions, and it turned out that the information that the president had to offer them was never delivered, or at least they were unaware of it, so I told them about it. And soon afterward, the strike ended. Now it turns out that there was, afterward, a bad story and a good story about the ending. We used to have somebody that in the US, you might call a gopher. He would go for pads and pencils, stuff like that, if we needed them. He had a single-speed black bicycle, thin wheels. And when there was the takeover—and the students, they learned I was in the wall, they thought he had let me in, so they destroyed his bicycle. When the strike ended, he was given a new bicycle, multi-colored and multi-speed.

Yost: Worked out. Can you tell me about your job search, coming back to the United States, were there multiple openings of interest—you took a position at the University of Minnesota, were you considering other positions as well?

Leavitt: No. I was still oblivious to everything. I don't remember his name, but he was traveling around. Stopped at the University of Italy, Pisa and asked if I would consider the University in Minnesota. He told me if I didn't like it, I could get a position as a mathematician in any college I wanted. So of course, I said yes.

9

Yost: So, was that 1965 that you joined the Mathematics Department at the University of Minnesota?

Leavitt: I guess so. Yes.

Yost: Can you tell me about your experience with the Computer Center initially?

Leavitt: Well, they gave me my own computer, but at the time, IBM had just come out--come out with the latest computer, and the engineers in Pisa built their own which apparently was quite comparable in performance with the IBM machine. Oh, I have to tell you one more thing about the University. There are many [locations of] University of Italy, namely, the town in which they're in. Napoleon had built a normal school in Pisa that, essentially, was still functioning, so that, I mean, it was face to face with the university. As a result, it was an effectively a double faculty. It was the strongest math department in Europe, except, of course, it was mixed with computer science.

Yost: That's fascinating. I had no idea.

Leavitt: Yes

Yost: Can you describe the Mathematics Department, your impression of it when you arrived at the University of Minnesota?

Leavitt: They were very good. They were looking at partial differential equations and looking at numerical solutions to them in the same way that they [in Pisa] were looking at them in Minnesota in the math department. I—at one point I visited the University of Genoa, I forgot who the individual was, and he said that—he showed me his work—he was also—everyone was essentially working on similar problems, how to construct numerical solutions to these very complex partial differential equations.

Yost: I understand in 1967, the department started graduate instruction in computing, and then several years later in 1970, the Computer Science Department was formed at the University of Minnesota. Can you provide any context to the start of computer science as a field of study, early courses, as well as anything you knew about the discussions with the launch of the Computer Science Department?

And did you, from the start, want to move into that department?

Leavitt: Yes, I looked forward to moving into that department. My roommate was Krzysz Frankowski, office mate, and it was Marvin Stein and Bill Monroe, the four of us. So, we sort of put together a curriculum and—there was a big transition until it became a full department, acquiring new faculty and the like. My activities, I didn't limit to the department. I felt that computers were not a tool exclusively reserved for the sciences. My objective was to promote what computer science has to offer with my multi-disciplinary activities.

Yost: Do you recall any details about discussion and debate on what the curriculum should be early on with the computer science field there?

Leavitt: No.

Yost: Ok. You mentioned Marvin Stein, Krzysz Frankowski, and Bill Monroe? Can you say a few words about these individuals and what you remember about them?

Leavitt: Well, Marvin Stein was—he was dealing with the basics of computer science, what constitutes a machine word. How does it operate, things like that? How does it multiply? What does a shift do? He really got down to the fundamentals of building a basis for what became computer languages. So that's what he was involved in. I don't know what activities Bill Monroe was in except that I knew that he had

worked with the police department in setting up optimal strategies for sending out cars into neighborhoods where there were thefts occurring. We, initially, we did not have seminars.

Yost: What about Marvin Stein as a leader? Can you comment on the leadership qualities he brought to the early department?

Leavitt: Well, there were several things happening. Initially, the department was closely wed to the Computing Center. So, in addition to his fighting for more faculty, he had to upgrade the Computing Center and he had certain ambitions for that. Some of them, I thought, went too far in that—I will give you an example. He wanted to have the operators wear uniforms and if there was a problem, they would signal their supervisor who would come in and resolve the problem. I guess I would've simply had him focus on getting the best tools out there rather than how they were to be operated on. But he had a lot in his buckets to deal with.

Yost: What was your sense of the level of support from the Institute of Technology, the College, as well as the University overall with regard to the Computing Center, as well as this new emerging department?

Leavitt: Oh, well, it's always difficult to get additional faculty. My own activities brought me to different departments which would increase in demand for a better computer center, and indirectly for the Computer Science Department. So as computer science became more important to more departments, it was inevitable that it would grow.

Yost: In the formation, in the first years, were there schools that already had computer science departments that provided a model that was influential to you and Bill and Krzysz and Marvin to any degree? Or did you feel like you were really kind of charting your own path?

Leavitt: We were doing our own path. I will give you one example. I met an economics RA who was analyzing the Crisp (common nickname for CRSP, or the Center for Research in Security Prices) tapes. His department did not have a computer. The CRSP tapes have the record of all transactions of the New York Stock Exchange. It's gigantic! And no computer at the time could handle the whole thing. So as computers improved, their analysis improved. They were looking for the extreme. Well, I learned that virtual machines were about to come out. So, I wrote a simulation of the virtual machine on ours and solved his problem reading the entire set of tapes. It turns out that other people studying this didn't know whether or not to accept it. When the actual, virtual machines started being delivered, they found that we had the very same results.

Yost: Impressive. I'd like to ask about some of your researcher areas, and I'll just go through several of them and anything you would like to comment on with these. So, supersonic flows and shock waves.

Leavitt: Yes, that was my background. I was always doing that on the computer. At the same time, I was reaching out to different departments to spread the word and give them some help. For example, I went to Franz Halberg's Chronobiology lab. Al Hanson joined me in that effort. We were trying to figure out the period of different waves that we could find, and it turns out that life--that waves of people are composed of several different waves of different periods representing probably the amount of time, the length of the day wasn't constant. It would change periodically, and its influence was there in the blood, the urine, all of the records they could keep. The blood pressure. It was a phenomenal effort. I ended up producing a paper called "The Estrus Cycle of Rats." Turns out that the Vatican was interested in my working with them, but I did not accept the offer. Another area I worked in was--the chairman of the English department, Larry Mitchell, his specialty was linguistics and he was trying to do authorship identification of the Pauline epistles. It was not homogeneous, and I was trying to assist him with that. So those are a few examples.

13

Yost: And computer art was a very important area. Can you tell me about your book *Artist and Computer*?

Leavitt: That was very interesting. There was—we got an early graphics machine that was tucked way behind our analog computer, and it was rarely used. So what I developed on it was essentially a deformable canvas that my wife—a pattern would be placed on the screen and then she would deform it, and the resulting image was used as the basis of prints, paintings, even sculptures. We once made a video as well. *The Artist and Computer*, a lot of the images can still be seen with Gopher. By the way, talking Gophers, before the world wide web, Gopher was the browser. I developed the cornucopia of disability information. It was once described in *Computers for Dummies.* The web, at that point, was what was called a 'Store and Forward' system, namely if you wanted to communicate between A and D, you had to wait until communication was available from A to B, and then available from B to C, and then available from C to D. So, it was pretty iffy. Apparently instructors around the country wanted to display, whatever that meant, the cornucopia to its students, and when it wasn't available, I would get telephone calls from wherever, you know, saying, "I got to do to this lecture," and there was nothing I could do.

Yost: So that's an area that in addition to resources on the web, you were very involved with at the University of Minnesota after Section 504 of the Americans with Disabilities Act. Can you talk a little bit about your role in helping the University of Minnesota develop policy with regard to the disabled at the University?

Leavitt: So, in 1973, the Rehabilitation Act passed. It—the act turned out to be the basis of the ADA that was passed several years after. The University put me on a committee to bring it into compliance and to make recommendations of modifications. So, I would go out and look at a building and suggest things

like, "Well, let's put a handrail up here. Put a ramp here," and so forth. And in general, I was told it was too expensive. So, then I would come back the following week and describe something that was twice as expensive, so then they would grant me, "Go ahead with the first one."

Yost: A smart strategy.

Leavitt: Yes, really. But the idea of introducing elevators into buildings, it was just a continuing hassle. I mean, I can appreciate how difficult it was in all of these classical buildings that never anticipated the disabled. So—

Yost: What about the computer as a tool to be an assistive technology for those with disabilities? I know the ACM got involved with that at some point. Were you involved in those efforts at all?

Leavitt: Not until I left the University.

Yost: Ok.

Leavitt: But let me tell you a little story about ELIZA. Don't know if you've ever heard of this program.

Yost: Weizenbaum's ELIZA?

Leavitt: Yes.

Yost: Yes.

Leavitt: Anyhow—the students--it was public domain, so the students went in and made it into a 'Dirty' ELIZA, and it was easy to force ELIZA into a corner at which it would come out with all of these nasty

expletives. So, I set up a date to go to Duluth to tell them a little bit about networking and to display ELIZA. So, there I am in the middle of my presentation and go to get ELIZA, and it's not there. The students were too embarrassed to let me show it, so they took it off the computer.

Yost: Can you talk about both your own sponsored research; where it came from as well as the importance of different categories of funders for the first decade of the department in terms of NSF, DARPA, industry, and potentially other sources of funding?

Leavitt: Well, I only dealt with the NSF. I did do a consulting problem with the Pillsbury Corporation. But I wasn't aware of all of what other people were doing in terms of—[interruption] So, I really can't help you very much.

Yost: In looking back at those first eight or nine years of the Computer Science Department when you were at the University of Minnesota, what did you see as the greatest achievements of the department, as well as what were the greatest challenges in that decade?

Leavitt: Well its greatest achievement was becoming a complete department, where all different disciplines of computer science could be taught. The four of us couldn't be—couldn't touch half the fields without starting all over again. We needed people who were experts in their field, and we were able to acquire them.

Yost: Do any challenges stick out in your mind as especially significant?

Leavitt: Well, no. I can tell you a story that will show you the environment of when we were initially formed. The department was associated closely with the Computing Center. Our offices were adjacent. In those days, there was no air conditioning because the University was barred from having it. The

legislation—legislature argued if it did not have air conditioning, the University shouldn't have it either.

Of course, the legislature never met during the summer. So, during that period, I often did my work

inside the Computing Center just to keep cool. Because of the student riots around the world, and

someone throwing a Molotov cocktail at the Wisconsin computer, our computing center got moved off

campus. So that's when we started separating.

Yost: Can you tell me about your decision to leave the University of Minnesota to accept leading the

academic computing operation at SUNY-Buffalo?

Leavitt: I felt it was another opportunity to be able to spread the word. They had a good computer and

it was at a time when things were starting to change. After several years, microcomputers started

appearing but before that, there were minicomputers. There was still tremendous competition for time

on the main computer. But yes, it was definitely a big opportunity.

Yost: So, that was in 1978 that you went to Buffalo. Are there any initiatives or developments you led

that you would like to tell me about at SUNY-Buffalo?

Leavitt: Well, the—I remember that the Computer Science Department was trying to develop the

mathematics for an MRI machine, and they were using a business machine for their computer and they

wanted to upgrade. So, I felt that they should have a more contemporary machine that was amenable to

scientific computing, and ultimately that's what they ended up with. They were our machines—the main

machine was always overloaded, and people were scrounging for time and space on it. I was on the, an

advisory panel to the Cornell National Supercomputer, and that was pretty interesting, particularly since

it was called upon to develop the backbone network—essentially for the World Wide Web. I mean, we

had whole towns, they weren't small towns, that only had 300 Baud access and we had to bring them—I

mean, we talked about how to bring them up to date so they could handle the future demand, and they were quite reticent to accept it. There was a lot of education involved. I taught some noncredit courses in the School of Business, and I also gave lectures in the School of Medicine on one thing or another.

Yost: Jay, before we conclude, are there any topics I haven't brought up that you would like to discuss?

Leavitt: I've got one more network story, and it's not about me. I was a friend of John Anderson, a blind and brilliant individual. I convinced the Computing Center to hire him. It was the dawn of networking and it was difficult for tech support of remote users to visualize their problems. Even though the Computing Center was initially resistant to hiring him, he became an essential member of the computing center. Because he could answer these telephone problems—these problems over the phone. So that's—yes, that covers all the things I was thinking about.

Yost: Ok. Well, thank you so much, Jay. This has been fascinating and extremely helpful and it's great to document this history for the Computer Science and Engineering Department long-term and I thank you so much for your time this afternoon.

Leavitt: Oh, by the way, the two faculty members at NYU were Joe and Herb Kellogg.

Yost: Ok.

Leavitt: Oh, let me tell you a quickie.

Yost: Sure.

Leavitt: You know the movie "Hidden Figures"?

Yost: Yes.

Leavitt: Alright. I've got two points of contact with that story. One was that we essentially, I was using essentially the same machine as they were, but mine was more powerful. Theirs was owned by NASA and mine was owned by the Atomic Energy Commission. But that's one point. The other point where we were associated, they were recognized at a very early age as being brilliant, and at every stage of their education, they got the best education. Well, I had a very handsome and athletic black friend. I mean, he would work out periodically with some of the professional basketball teams in the area. He was that athletic. But as he described it, he had the same education as they did, and let me tell you this guy could—intellectually, run circles around me. I really admired him. So that's that story.

Yost: Interesting. Thank you. Well, again, really appreciate this, Jay. It's been terrific and kind of you to spend this time.

Leavitt: My pleasure.

Yost: Ok. Bye.

Leavitt: Bye-bye.