Dr. Bernard Galler

Oral History by Atsushi Akera

Part I: Early Life and Career (Recorded on day one, January 18, 2006)

[Tape 1, Side A]

AKERA: I'm speaking today with Dr. Bernard Galler, a member of the board of directors of the Software Patent Institute and emeritus professor of Electrical Engineering and Computer Science Department at the University of Michigan. You're also past president of ACM. If I can just ascertain, am I correct that you served as the ACM President between 1968 and 1970?

GALLER: That's correct.

AKERA: Wonderful. The purpose of our interview will be to focus on your involvement with ACM. Since there are other existing interviews, particularly a very good interview filed at the Charles Babbage Institute that focuses on many other aspects of your life and career.¹

However, Rick Snodgrass over at ACM has also asked me to conduct these as self-standing interviews. So the interview today is basically going to be divided into three parts: the first part covering your early life and career; the second on your involvement with ACM; and then the third part on your subsequent career. Throughout the interview, I'll be trying to make some interesting connections between the different phases of your career.

PART I: Early Life and Career

AKERA: So, just starting at the beginning, could you tell us something about your early life and upbringing? Where were you born? Who were your parents?

GALLER: Sure. I was born in Chicago, in October of 1928. My parents had immigrated from Russia, from the Ukraine, about 1921. I have an older sister who's five years older, now living in Oregon. I went to the public schools in Chicago. I did very well and the teachers liked me, and so they would encourage me, sometimes let me teach a class, and so on. So I was able to progress very well, especially in mathematics, but in English and everything else.

AKERA: If I recall, you mentioned that by high school, you were in fact already taking a fair number of collegiate-level courses, or at least advanced high school courses.

¹ "An Interview with Bernard A. Galler," interviewed by Enid Galler, 8, 10-11, 16 August 1991. OH 236, Charles Babbage Institute for the History of Information Processing, University of Minnesota Libraries, Minneapolis, Minn.

GALLER: Advanced because I went to the University of Chicago partly through high school. That's where that happened.

AKERA: Was that an official program? I know that the University of Chicago has a major education school.

GALLER: Yes. But no, this was when Robert Hutchins was president of the University. He instituted a special program built around the great books and so on, which you could enter with the 11th grade in high school. Between the 11th grade and for the next four years, you would cover the last two years of high school and the first two years of college and get a degree nobody recognized, a two-year Bachelor of Science. A Bachelor of Philosophy, it was called.

AKERA: Was that the bachelor's degree you received at the...?

GALLER: Well, yes. Let me give more—go back to high school for a moment. In Chicago, I went to Marshall High School, which was not in my district, but because I played the violin, Marshall and Lane Tech School were *the* two orchestras schools in the city, so I was able to go to Marshall. In the 10th grade, I took the scholarship exam for Chicago, and I didn't get it. Honorable mention. Fine. So I took it again the next semester and I got the scholarship. So I entered the University of Chicago, what they called the College Plan, in the middle of 11th grade. Three and a half years later, I got the Bachelor of Philosophy. But I had been taking so much advanced mathematics at the university level that one year later, I got a four-year Bachelor of Science, a regular degree. That was in 1947.

AKERA: Great. If I could try to fill in some of the connections there. In high school how did you develop a strong interest in mathematics?

GALLER: That started when I was ten years old, because my father was very interested in education. He would help my sister, five years older, with her algebra, and I would sit in and listen and developed a strong interest in mathematics, which, as I said, the teachers encouraged. So I was always taking the most advanced math classes available.

AKERA: What was your parents' background?

GALLER: When my father was in Europe, he was studying to be an agricultural engineer. He was a remarkable person because in those days a Jewish boy couldn't get into university, but he managed to do so well on the exams that he did. So he was studying to be an agricultural engineer, my mother was planning to be a doctor, and then the revolution came and all the pogroms and everything, and they came to America. My mother sewed buttons in a garment factory. My father was a peddler for a while. But my father was a strong person, and he eventually got his own store in Chicago. Even at age 60, he got a degree from the Northwestern University's business school and then became a real estate broker and so on. He was a person who valued education and put it into us, too.

AKERA: That's wonderful. Can you tell us something about your college education? What were your interests? How did you come to focus your interest in mathematics and such?

GALLER: Hutchins' plan—it's not that well-known—but you studied the great books and integrated courses in biology and social sciences and so on. It was interesting because you never had to go to class. You didn't have to do anything. At the end of each year, you took a six-hour exam, and what you got on that exam was the grade in the course. It was a wonderful education because even while we were in high school, we were using college-level thinking, source material, and so on. So we always felt we got a great education. My wife started at the University of Chicago in kindergarten and came all the way up. We met when I got there.

AKERA: Oh, really. That's wonderful. Now, mathematics would have been a fairly difficult field to get into, one that was getting a lot of attention in the postwar period. Did this training at Chicago give you the preparation you needed to work on your master's degree first, and then...?

GALLER: Well, yes. As soon as I got to Chicago, I skipped the high school-level courses and jumped right into what they called the divisional level at the University and kept on going there. Eventually, I taught there as a graduate student. It was interesting. When I got my four-year degree, Caltech did not admit me for graduate work, I believe, because I had not yet had differential equations. But I went to UCLA, where I took differential equations and everything, and got a master's degree, and then I came back to Chicago for the PhD

AKERA: That's great. Who did you work under at Chicago?

GALLER: I had two chairmen, Paul Halmos and Marshall Stone—two wonderful people.

AKERA: What area of mathematics did you work under?

GALLER: Mathematical logic, which is what led me into computing because I read a book about the use of logic in computer design, and there I was.

AKERA: In fact, that was my next question: I'd like to trace the intellectual connections and figure out how you became involved with computing. If I can take a step back, your master's work was more in the field of topological algebra. Is that correct?

GALLER: That's right.

AKERA: How did that shift into an interest in logic?

GALLER: I think when I got back to Chicago, I think the courses I took somehow moved me in that direction.

AKERA: Was that a very current topic at the time? This was 1948 or '49, I believe. That would have been when von Neumann's work was known and logic was emerging as a serious discipline within the United States.

GALLER: Right. But Halmos was interested in cylindrical algebra and things like that. I just loved the way he was teaching, and I worked very closely with him.

AKERA: Would it be correct to say, however, that mathematical logic was not very closely tied to the kind of ‘logic’ involved with computing? At least at the outset?

GALLER: I think that’s right, but it was concerned with structure or systems that had structures.

AKERA: It certainly gives you certain perspectives about how to approach problems in computing and computer design. I think it’s also very commonly said that a lot of people working in computing depend not on a specific training in logic, but really more of an outlook that mathematical logic gives to computer professionals and mathematicians, and the advantages of entering these fields.

GALLER: I think that’s right. The specific connection that I had: I was interested in Boolean algebras and got involved with Boolean notation and so on... and the Polish notation. I looked up a book...I then found a reference to the book *High-Speed Computing Devices*.²

AKERA: By Arthur Burks?

GALLER: No, the paper in which I found the reference was by Burks. There was a bibliographical reference to the book *High-Speed Computing Devices*, which was published by Engineering Research Associates in Minneapolis. There they talked about how logic was used to design a computer. I had never seen a computer, but I found it very interesting. So when I got to Michigan...

AKERA: ...you started to follow computers.

GALLER: I saw that there was a course by John Carr, and I visited it. That made me start out in this direction.

AKERA: Before going there, especially because I know that a lot of this material is available on the Babbage Institute transcript, I’d like to try to fill in some of the history in between. What I’m particularly interested in is to see if you can recall your initial excitement at the time. Once you discovered this book on high-speed computation, did that in a sense open up a new field for you? What did you do to follow up on that interest?

GALLER: It was very interesting. Everything was secret in Chicago because of the Manhattan Project. I had heard that there was a computer hidden somewhere inside the Museum of Science and Industry near the University of Chicago, but I never got to see it. It was a very secret, interesting idea that there was a computer. So when I followed this reference and saw the book, I said, “ah-ha, so there’s something I can learn about a computer even though I can’t see it. I was reading this book when I got to Michigan. I was hired as a logician to teach logic. So it was natural for me, when I just happened to see in the time schedule that there was this course on computers. So each little thing led to the next.

AKERA: Yes. Now, I’m sorry. When did you receive your PhD?

² Engineering Research Associates, *High-Speed Computing Devices*, reprint edition (Los Angeles: Tomash Publishers, 1983). Originally published 1950.

GALLER: August '55.

AKERA: That's great. If I'm correct, by that point, computers were already being fairly openly discussed in the literature. IBM would have already had their 701 system out since 1952-'53, and certainly, the Univac I was out. Did you also become familiar with these machines? I'm sort of curious about why you chose to go to Michigan. And separately, were you more broadly aware of computers?

GALLER: No, not more broadly than what I just described to you.

AKERA: That's wonderful.

Now, can you tell us about your earliest academic appointment at the University of Michigan? What brought you to Michigan and what was the start of your academic career?

GALLER: When you get a PhD, the question is, where are you going to go? I was at Chicago. It happened that the April meeting of the American Mathematical Society was at the University of Chicago, and it was a job meeting. All the new PhDs gave ten-minute talks. It happened that I had rehearsed my talk very well. John Addison, who was a young professor in Michigan's Mathematics Department, heard my talk. The next day, I got a telegram from the chairman here offering me a job. I also had offers from Bowling Green and Washington University in St. Louis, and maybe one or two others, but by far Michigan was the best. I had never been here. I knew nothing about Ann Arbor. Nowadays, you don't get a job offer without visiting first.

AKERA: That's right. So this was really the norm at the time. It was very expensive to travel, and jobs were very much offered without a site visit. But if I'm correct, this was not a tenure-line position?

GALLER: Oh, no, it was Instructor. A one-year appointment as an instructor—as a logician. Nothing to do with computers.

AKERA: Was that typical of the time?

GALLER: Oh, yes. I think it was.

AKERA: So that most people went through instructorships before they received tenure-line positions?

GALLER: That's right. The category eventually faded out.

AKERA: Yes. It was much more common back then.

GALLER: It was standard.

AKERA: So, you were an instructor at the University of Michigan through the Mathematics Department?

GALLER: That's right. I taught calculus and advanced calculus. I'm not even sure I ever got to teach logic.

AKERA: Was the position immediately renewed at the end of the year?

GALLER: It was already during that year that I became interested in computers. The second semester I was there, they asked me to teach the computer course that I sat in on during the first semester. By that time, they already realized that they should have somebody besides John Carr teaching, who was the only man in computing. So they offered me I think a three-year appointment as an Instructor.

AKERA: And really focusing more on computing as opposed to mathematics.

GALLER: I think they saw me doing both.

AKERA: I see. Now, can you tell us a little bit about Paul Dwyer? He's somebody that you worked very closely with early on. At what point did you become involved with his work and programming? Can you describe to me some of that?

GALLER: He was a very eminent statistics person, and in linear programming and so on. He and Cecil Craig ran Michigan's statistical program, the Statistical Research Laboratory, and the courses involved in it and so on. When John Carr saw that I was interested in computing, he said, "The only way to learn it is to write programs." He said, "I'll introduce you to Paul Dwyer." I guess he already knew somehow that Dwyer needed someone to write programs in linear programming. Dwyer was interested in the transportation problem, which is a restricted class of linear programming problems. He introduced me to Paul, and I began to write a program to implement Dwyer's algorithm for the transportation problem. I did it on the MIDAC, which is the one-of-a-kind Michigan [digital] computer. The MIDAC was located in a classified section of Willow Run Airport, so John used to take things out there and nobody else could go out. He would carry the programs out there by hand. By the way, Bob Graham, who later collaborated with us on the MAD language, was an operator on the MIDAC. That's how we met. So, there was my relationship with Dwyer. He had the mathematical algorithm for linear programming, and I implemented it, and I got interested in linear programming.

AKERA: So really, you were sort of brought on to the project as a programmer, although your principal job at the same time was as an instructor. So you're still teaching at the same time.

GALLER: That's right.

AKERA: What is it about linear programming that made computers such an important part of the work? I know that you basically outgrew the MIDAC at Willow Run and then moved to the IBM 650 at the Statistical Research Laboratory, and then eventually to IBM systems that were set up at...

GALLER: Actually, it was the other way around. The order was different. We outgrew the MIDAC, and John introduced me to the General Motors people to use their IBM 701. I made that step.

AKERA: Before the 650?

GALLER: Before the 650. The IBM 650 came to the campus afterwards. I did implement-- Well, wait a minute. Maybe you're right. I know the 650 came in '56, so I guess I did write some of the program for the 650, but we outgrew it so quickly. It was almost simultaneous that we went to the 701.

AKERA: And again, what was the nature of the problems that you were working on that made such large computational capacity necessary? Was it memory capacity or processing speed?

GALLER: Well, at that time, everybody was very impressed with the processing speed. That wasn't a limitation. It was the memory. We needed to do large arrays--

AKERA: Matrix calculations, in other words.

GALLER: Yes. We didn't actually do matrix calculations so much. It was operations on the arrays, but I never thought of them really as matrix algebra.

AKERA: In fact, is there something unique about this project? Because you differentiate the work you did from the work of George Dantzig.

GALLER: He had the simplex algorithm and was solving the general linear programming problem. The transportation problem was restricted to integers and a very specific set of constraints and so on, so that you could apply different kinds of algorithms to it.

AKERA: Who was the principal sponsor for that project? The Air Force?

GALLER: I don't remember. I really don't remember.

AKERA: That's great. Thank you.

GALLER: I was never paid by anybody for that work, by the way!

AKERA: Now, the major question I want to ask is this: What made you leave mathematics? You had received a very prestigious PhD from the University of Chicago, worked with Halmos, so a very impressive lineage and on a very current topic—in logic, I would imagine. Yet you chose to move into computing and rather quickly. Can you...?

GALLER: Okay. First of all, and you say a current topic in logic, but it was mostly Paul Halmos' interest. I'm not sure how widespread the interest was. That's one thing. Another thing is I never saw myself as a great research mathematician. I did a nice PhD, but it was not great research. But more than that, the challenge-- There's a difference. If you're a mathematician, you sit off in a corner and you think, and you try hundreds of little models to see

if they work or don't work, etc. But if you're a computer person, the excitement of seeing something work and the potential of applying it down the road to societal problems, which at that time we hardly knew, but someday we thought, "These are important ways to use a machine." So that was exciting.

AKERA: So it seems that there were two separate appeals. One was the appeal of applied mathematics-- you know, that this kind of mathematics could make a difference. The work that Dwyer and others were doing was very much built around very current problems. This was not long after the Korean War, I imagine.

Then the other side of it was just the excitement of computers.

GALLER: The excitement of seeing something work right away... but also the applications.

AKERA: Did you feel the larger culture of computing calling you to get involved with the field?

GALLER: I think so. Now, I also was interested, although I never really did much with it, in operations research. The linear programming was kind of a special branch of it. The kinds of applications they did during the second world war, optimizing, for example, the search for submarines; and for example, the industrial application of when they had to cut paper into certain shapes, minimizing waste. You know, things like that, you can begin to see the benefits. In almost anywhere you look, operations research had real potential for making things better. I never followed it up. I'm not sure operations research ever really was as successful as I'm making it sound, but there was excitement in that area also.

AKERA: It also sounds like part of what you're saying is that coming in as a mathematician, your perspective at that point wasn't necessarily computing per se, but that the computing and applied mathematics were not that far separated. That it really was part of doing the same...

GALLER: Right, but I never really thought of it as applied mathematics.

AKERA: You really did turn more towards programming once you began working with Dwyer?

GALLER: Started programming, yes. Not formal logic, but logical thinking and how to do it well. The idea of data structures and the effect of choosing a good structure, the interaction between writing code and choosing a structure.

AKERA: So really, the excitement of designing these programs drew you in?

GALLER: Yes.

AKERA: That the work itself had an intellectual appeal?

GALLER: That's right. But also, I don't want to minimize the excitement of seeing something work, watching the output come out right. I used to tell my students, "Nobody has as much fun as we do."

AKERA: That's right. I remember my first programs on the TRS-80!³

GALLER: Okay. I've got one upstairs, by the way.

AKERA: Great! I'd like to move on the University of Michigan, if I may.

GALLER: Sure.

AKERA: You were working on Dwyer's project, and then you became really involved with their central, academic Computing Center in an intensive way. Can you explain how or why this happened? You sort of got roped into developing the software for the computer.

GALLER: I wouldn't say "roped in"—I had the "opportunity" [chuckles]. The General Motors people were really among the first to develop operating systems. They had a very good system on the 701. They cooperated with North American to develop an even more general system.⁴ While I was working with them (and we've sort of skipped over how I got to do that), but when our IBM 650 turned out to be too small, very quickly and immediately, Carr introduced me to the people he knew at General Motors. Don Hart and Ed Jacks and other people. They let me use their 701, and the IBM 704 which followed, and I wrote the same, but more extensive linear programming codes for Dwyer. Meanwhile, I got interested in how the operating system worked. Jim Fishman, the main guy in operating systems there, was very kind and showed me everything. When we outgrew the 650 here at the University, and in '59 we were setting up the computing system...

AKERA: ...through IBM largesse with a direct intervention by Charles DeCarlo,⁵ I believe.

GALLER: Yes. Even before that, when IBM got their 701 or 704, other people on the UM faculty began to write programs and were given permission to use the General Motors computer. It became natural for me—I was going back and forth every week—to take other people's decks with me and run them because I was there. I'd put them in the stack and they'd run and I'd take the output back. So I was kind of a courier, in many ways. I became the person to help people know how to use that computer.

AKERA: Both at GM and at the University of Michigan. Is that correct?

GALLER: Well, yes.

AKERA: I'm sorry. I seem to be getting into too many details here.

³ Tandy Radio Shack, TRS-80. One of the early, Z-80 processor based microcomputers.

⁴ I believe this was done through SHARE, which tended to draw more active participation from industrial installations than university computing facilities, though most universities also belonged to SHARE because they could get systems programs for free.

⁵ DeCarlo used to be the Detroit area special representative from the IBM Applied Science Department. By then, DeCarlo had come to replace Cuthbert Hurd as the head of the department, possibly Division by then, at IBM.

GALLER: No, that's okay. The funny thing is that I became a consultant. You're right. I became a consultant at General Motors. I was called a consultant, and this helped me get in through the gate.

AKERA: You got a parking space out of it.

GALLER: Parking sticker. But then people began to think of me as a consultant. So in fact, I was a consultant for General Motors for maybe 20 years.

AKERA: Actually, if I can ask this... I'd like to go through this phase fairly quickly. But this is wonderful; this is very rich material.

General Motors, of course, is a private corporation, and yet they, in a sense, opened their doors to the University. Did this have to do with something with the culture of computing at the time, particularly on the software side, as far as being open and exchanging ideas?

GALLER: Absolutely. To the extent that they had extra time, they were very willing to let other people use the computer. We all knew that the time that went by when you didn't use a computer was lost time, like airplane seats. So they were very willing to do that. But you're right, the whole culture, exchanging programs, exchanging software—there was no selling of software, no industry at all. Everybody cooperated to make things better for everybody. It was a wonderful time.

AKERA: In fact, SHARE was already in existence.

GALLER: SHARE came in. I'm not exactly sure when, but right. GM was very important in SHARE. We subsequently got into SHARE. I did my part too, but General Motors, one of their early people, part of SHARE's operating system work and so on.

AKERA: They were willing to engage deeply in that exchange.

GALLER: Yes.

AKERA: Separately, Michigan has always had a relationship with the local auto industry, at various appropriate levels. Did this help as well? Was GM, in a sense, also more willing to work with Michigan because of a longstanding, general sense of cooperation between the two?

GALLER: Maybe. That was never part of my thinking. I met the people. They were nice guys. We worked together.

AKERA: Okay. That's wonderful. Now, as I understand it, General Motors had a wonderful operating system, but it wasn't one that was suitable for the Computing Center at the University of Michigan.

GALLER: They had different goals.

AKERA: I understand that, of course, you ended up rewriting a lot of that code. You claimed, in fact, that as much as 90% of the code was rewritten.

GALLER: Right.

AKERA: What was the reason for this? Why was it that the operating system had to be changed so substantially to meet the needs of an academic computing facility?

GALLER: Their goal was to accommodate very large design documents. Blueprints. They had to have very large databases and so on. Our goal was to run short student problems very rapidly. We were very frustrated by how long it took to run a Fortran program. We got into MAD and so on. But I needed to modify the system so that the transition between jobs was very efficient. For them, this didn't make that much difference. If a job ran an hour, and then it took a minute to get to the next job, who cared? I needed to get the transition down to a couple of seconds to end one job and get the next one going.

AKERA: Do you recall, in practical terms, what that meant in terms of the extensions you had to make to an operating system? Was it to be more efficient with the subroutine libraries on tape, and things of that nature?

GALLER: Yes, it was things of that nature. I don't recall the details now. I think I did a few things like taking part of the operating system and putting it on a separate tape so that while one was rewinding, I could be loading in the next part.

AKERA: So a very intense interest in the efficiency of the system.

GALLER: Yes.

AKERA: Wonderful. These all make connections.

GALLER: Yes, I'm sure.

AKERA: When the Computing Center was established—and I may be wrong on this—but Bruce Arden and Bob Graham, as you mentioned before, who happened to be operators with some of the earlier facilities, were really brought in to be, in a sense, the staff of the center.

GALLER: That's right.

AKERA: And if I understand it correctly, your first [tenure-line] appointment was as a research associate—it was set up as a joint academic appointment between the Mathematics Department and the Computing Center. My sense was that you actually did not have any specific obligation to do systems programming, is that right?

GALLER: Not an obligation, but I was *allowed* to do it.

AKERA: [laughs] That's good. I guess I'm actually very curious about how the role definitions unfolded within the computing center because you had a few people coming up the ranks as

operators. You were coming in as a professor with a PhD in mathematics from the University of Chicago. And yet, in some sense, it seemed to be that you occupied the same space. You worked on very similar kinds of activities. Can you tell us something about the social dynamics there that made this happen?

GALLER: A good part of it was due to the first director, Bob Bartels. John Carr had expected to be director, wasn't, and he left. Bob Bartels, who had worked on the Oracle during the war and was an applied mathematician, had a wonderful sense of what was needed to run the computing center. He chose not to make it hierarchical. He said, "We've got a group of people. Do your thing." I felt like I was just one of the guys. We were all new to this phenomenon, so in no sense was I going to be somehow superior to the other guy. We were all learning.

AKERA: So it was collegial from the outset, between you and Arden and Graham?

GALLER: 100%. Right. Bruce Arden, by the way, is back in Ann Arbor now.

AKERA: Is he? Oh, good. I know that he was the chair of the Princeton Computer Science Department and went on to become--

GALLER: That's right. And then Rochester.

AKERA: Yes.

GALLER: Right, then he retired. He's back in Ann Arbor now. And Bob Graham, I just heard from.

AKERA: He went to MIT for a while?

GALLER: MIT and then UMass, right. Bruce had experience on the CPC system in the [administrative] data processing part of the University. Graham had been an operator on the MIDAC, but was also interested in writing programs and things. It was very collegial. As we brought other people in, everybody took on parts of the system. Bob Rosin was there, too. It was a wonderful, wonderful environment. You suggest that I had a PhD and was in the faculty and so on. It never occurred to me to think that way.

AKERA: I mentioned that to point to this, of course. But that's the wonder of the environment that I think you all worked in.

Now, the computing center was not an academic department. Am I correct?

GALLER: That's correct. It was in the graduate school under the graduate school dean.

AKERA: Yet if I'm correct, both Bob Bartels as well as other members of the administration pretty much explicitly understood that research could take place within the Computing Center. Is this correct?

GALLER: Yes, and that was unusual for university computing centers. MIT, for example, all the research was in Project MAC, and the computation center was second-class.⁶

AKERA: They separated the two out.

GALLER: Right. At many universities, there was a very clear separation between the computer science department and the computing center, and this led to a lot of computer science departments getting their own equipment and exacerbating the separation. I remember once at a meeting at the National Science Foundation, I was on a committee of some kind, and we were talking about how to get people to cooperate more. I said, "Well, joint appointments like I have." Oh, but that's Michigan, you see. Somehow it was understood here, and we had somehow solved that problem. Other people had a hard time doing it.

AKERA: In fact, they were averse to the idea. There were very traditional, academic walls that you did not cross, and one was between faculty and staff or between academic services and faculty research.

GALLER: That's right. There were different classes of people, which we never really had. I visited one university (which will remain nameless), where I was asked to do a site visit on computer science, and I said, "I'm surprised you don't have any joint appointments to communicate with people." They said, "We don't believe in joint appointments at this university."

AKERA: And it showed!

GALLER: It showed, right. Exactly.

AKERA: That's great. Now, I'd like to get into some of the specific work that was done within the Computing Center. Actually, I first have a remark. It seems that not only was there no real distinction between faculty and staff within Michigan's computing center, but that this was also somewhat characteristic of computing as a whole—as a field at the time. That in a sense, it was very hard to separate systems programming work from systems programming research. Would that be fair to say?

GALLER: I think so. Although, if you get to the business side, the data processing side and so on, they were still very hierarchical and very organized and structured, and that was one reason why we wanted to keep ours separate from that...

AKERA: ... 'that' referring to administer data processing within the University?

GALLER: Right. We kept saying we don't want...

AKERA: ...that IBM culture. Am I correct?

⁶ Project MAC was a computer time-sharing research program funded by ARPA's Information Processing Techniques Office. Although the MIT Computation Center continued to aspire towards doing systems programming research, including research on more elementary time-sharing systems (with NSF support), the dynamics Galler refers to did unfold in the relationship between the two units at MIT.

GALLER: No, no. No, we never saw it that way because we felt very close to IBM.

AKERA: That's right. Applied in that sense, but...

GALLER: No, no. We said we don't want our faculty to have to wait for their results because payroll was late. That's how we saw it. But looking back, I can see that part of it was how they were structured—how they ran things—and we were much more freewheeling and [set up so we] could try things.

AKERA: But there's a fairly complicated connection there, because I think in the tabulating machine tradition... In that part of IBM, there was a very tradition-bound, hierarchical culture where you had supervisors, operators, etc., and there was not a lot of fluidity to cross job categories.

GALLER: Right. But we were dealing with the mainframe designers at IBM, and others there, and that was different.

AKERA: So when it came to the computing side [of IBM's machines], this was an exploding field, and there were, of course, [at the time] no computer science departments. Nobody was producing systems programmers and educating systems programmers, per se. That meant that you had to create these systems to make the computer run, so you went with whomever you had, and in some cases you had machine operators and others who very rapidly moved up the ranks, I think.

GALLER: Right. It was a merit system, apparently.

AKERA: What I want to get to then is the specific kind of software work that was done at Michigan.

GALLER: In the Computing Center in particular? We had people in various departments doing lots of that stuff. Well, we started out because I was doing the operating system very much as an operating system environment. Partly because of John Carr, who was involved in the ALGOL developments, we got into MAD. So we were interested in language translators.

AKERA: What was the impetus from that? Why did Michigan have to come up with MAD? Michigan Algorithm Decoder, for those who don't know.

GALLER: Michigan didn't have to come up with it; it was a natural thing. Here's what happened: The first thing that happened was a meeting in Europe of four Europeans and four Americans who were trying to decide-- "We see a lot of proliferation of languages. Can we unify it?" John Carr was one of those individuals.

AKERA: Really. Quite a leader in that movement?

GALLER: Yes. He and Perlis and others. When he came back from that first meeting, the ALGOL 58 meeting, he came back and said to us literally, "We have got to try to implement this

[ALGOL 58] to find out what's wrong with these specs." They had agreed to meet in '60 to see what was accomplished, and to change the language, because they realized that some things they tried to do would be hard to implement.

AKERA: In other words, they simply specified the language, went back to all the different universities to try implementing it in different versions, and then basically agreed to meet back two years later and see what their experience was.

GALLER: Right.

AKERA: So it seems that that was pretty much a research project, although, if I'm correct, Carr enrolled both Arden and Graham to do that work initially. Is that correct?

GALLER: Initially, right.

AKERA: So they were staff at the computing center, but this seemed to be a project that really was driven more by research interests because that ALGOL was not going to be operational anytime soon.

GALLER: Right, but we didn't think of it as research. "Here was something. Let's try it!"

And they were doing it, but I was looking over their shoulder and talking to them. As we began to design this thing, it became clear that there were some things in the language that just were going to be either impossible, or so awkward that they would be terrible to have in the language. So then we said, "Okay, let's do a language which doesn't have these problems." After a while, we said, "This is not ALGOL 58 anymore. We must honestly call it something else."

AKERA: At this point, do you think that some of your training in formal logic really helped you to think through the implications of these formal languages?

GALLER: Honestly, no. I mean, there were people who later went on to the formal specification languages—the Vienna Definition Language and so on—that was logic. I don't think I ever really applied logic to language development.

AKERA: So in many ways, once you used logic to get into the field, it was something that you let go of. There were no specific ways in which you were drawing on your knowledge of logic to work on programming languages.

GALLER: That's right, except when I'm teaching, I always taught students how to specify a design using logic, just to make the connection for them. But that was as far as it went.

AKERA: That's great. I know of some of the other circumstances surrounding the introduction of the MAD language. If I understand it correctly, when the IBM 704 system was installed at the Computing Center in 1959, I believe, the initial decision was to install Fortran. Of course, this is a time when Math 183 was still being taught, but no longer by Dr. Carr.

GALLER: Yes.

AKERA: And also, there was a significant project called the Ford Foundation Project under Donald Katz, from Chemical Engineering Department. It seems that you worked on MAD because both-- Actually, Math 183 started sending their students first. And, if I recall, the compile time of the Fortran routine... Basically, the 200 students from that one course alone ended up using a very significant proportion of the total CPU time available on the 704. My sense was that it was really this statistic, along with the fact that the Ford Foundation was going to start sending thousands of students into the computing center, that created a minor crisis that led those in the Computing Center to say, "We need to have a much more efficient compiler." Was this something you recall?

GALLER: It may have been. I don't recall. I mean, we were frustrated about Fortran, but I don't remember specifically connecting it to the Ford Foundation Project. It was going to slow things down a lot. But Fortran came with the operating system from General Motors, so it was the first thing-- Even before I brought it to Michigan, when I was taking faculty programs to run at GM, they were all in Fortran. So that was always available. It was only after we got MAD working in 1960 and '61, so from a couple years earlier, Fortran was being used. And assemblers. People who found Fortran too frustrating would use the assembler. We've never forgotten Chris Nordman, a crystallographer, who wrote an assembly language program. It worked the first time. Never forgave him—he's a friend, but we never forgave him for that.

AKERA: Yes, that's not supposed to happen... Not in assembly, that's for sure.

GALLER: Right. But we learned a lot about how to implement MAD. Bob Graham, in particular, studied the source code for Fortran.

AKERA: Something about a translation table? Is that correct?

GALLER: Yes. The key thing was they stored their tables on the drum.

AKERA: Which is a much slower storage medium.

GALLER: One comparison. It took forever to find something on the drum, because one comparison per revolution. So immediately, we said, "We're not going to do any searching on the drum. We're going to store things and bring them in."

AKERA: On an as-needed basis.

GALLER: As-needed. That gave us the whole organization of the MAD compiler. You process the language and put things out on the drum.

AKERA: Process the language in core, and then put the results out there.

GALLER: Put the information you got on the drum. Then you bring it in from drum and used it, and you're never going back and forth and searching for anything.

AKERA: I read about that. That was a very clever solution for the time. In fact, I believe you made some very strong claims about the MAD language at the time, in various computing circles.

GALLER: Yes.

AKERA: Would you care to elaborate?

GALLER: I can't remember what you might have meant. You're probably thinking of a SHARE meeting.

AKERA: The 1960 SHARE meeting.

GALLER: Yes. That was fun. I remember standing up at the meeting of the Fortran Committee, and they were complaining about this and that. I said, "You've got to come over and hear our presentation about MAD because all the things you're worried about are gone."

AKERA: You don't have to worry about it.

GALLER: That's right. We solved those problems.

AKERA: A very bold claim, I believe.

GALLER: A bold claim, but true, of course. I wouldn't tell them wrong [laughs].

AKERA: Absolutely. That's wonderful. More seriously though, it seems that compiler design was a very substantial research topic at the time. Is that correct?

GALLER: Yes.

AKERA: Compiler optimization, I imagine.

GALLER: Compiler optimization. Language specification with a view toward making the compiler optimized.

AKERA: My understanding of the contribution of Michigan was really that-- There were a lot of people working on optimizing Fortran to compile scientific applications. Very substantial, mathematical problems. But that in working within the context of an academic computing center, where you're often dealing with very large numbers of very small programs, I think that the one thing that MAD demonstrated was that there really was no single optimum toward which to optimize a compiler. Would this be a fair characterization?

GALLER: I think that's right. One of the more important things we showed was that you didn't have to suffer with Fortran. You didn't have to take it as it was. Perlis, when he did the IT language, a predecessor [to MAD]. His goal was to show that it didn't take 30 man-years to write a compiler.

[Tape 1B begins]

AKERA: We were speaking about the compilers, compiler designs and such. What I'm doing, in part, is kind of establishing the extent to which Michigan really did come to occupy the center of systems programming research, and research in programming languages that was happening at the time, because I think in a sense this became a segue for your very active involvement with the ACM.

GALLER: There's one other area in which I think we're also pioneers, and that's virtual storage.

AKERA: That's wonderful. Actually, I will be asking about that later. But let's leave that until later—I'm thinking of chronology.

GALLER: You're the boss. Go ahead.

AKERA: Is that right? That's after the timesharing era, when you really get fully into virtual storage, right? Because you were president in '68... It's a tough call, but I'll leave that conversation for later.⁷

GALLER: Okay, although the timesharing stuff started in '65, '66. In '67, the computer was already running as a virtual machine—with virtual storage—so this was before ACM.

AKERA: It's true. Okay. But let me try it this way anyway. Now, we might have to edit the record and move things around after the fact. But before I move to the ACM, maybe I can ask about some of the other organizations you might have been involved with. I don't have historical records on this, but you mentioned SHARE already. How early did you become involved with SHARE, and what was Michigan's role?

GALLER: I don't think Michigan was terribly involved. I got somewhat involved.

AKERA: What year and what kind of topic?

GALLER: Well, I was already there in '60 when we when we spoke to the Fortran Committee about MAD.

AKERA: Yes, absolutely. That's right. Now, they had a committee on programming languages, I'm sure, at the time, as well.

GALLER: Yes. Actually, though, I published recently an anecdote in the annals about relocation bits.⁸ I don't know if you saw that.

AKERA: No, I didn't.

⁷ Actually, the slippage here was that I was interested in establishing the connection to how Michigan (and Galler) became involved with ACM, which occurred before his tenure as President. The work on virtual storage, and Galler's term as ACM president, not only coincided, but preceded it by a little bit.

⁸ Galler, B.A., "Relocation Bits," *IEEE Annals of the History of Computing* **26** (2004): 70-77.

GALLER: You might look at that, because that article documents a couple of letters that were written back in those days, and the evolution of relocation bits in terms of processing subroutines and things, laying them out in storage. Now, that was because I'd met with the Fortran Committee and got involved with them at that level.

AKERA: The SHARE Fortran Committee?

GALLER: SHARE Fortran Committee, right. So I was somewhat involved. I used to go to SHARE meetings sometimes.

AKERA: Were you a regular attendee, or did you only go to some of the meetings?

GALLER: I can't even remember, so I might have been a regular. I don't know.

AKERA: It really was set up first and foremost by IBM's industrial installations/customers, especially firms in Southern California, although I don't think it's fair to say...

GALLER: No. Although GM and Westinghouse were also there--

AKERA: ...No, right. It was a national organization without doubt, but sort of was started by the West Coast installations, and then everybody got involved. In fact, my understanding is that if you were working with any of the early IBM systems—701, 704, 709—that you drew on SHARE for all of your early programs. Although in the case of Michigan, I guess, you had General Motors as a direct source as well.

GALLER: Right. But SHARE was the distribution mechanism for software, so you would put your stuff into SHARE and then draw out other things that would be useful to you.

AKERA: They just sent you all the cards. Is that correct?

GALLER: IBM supported it.

AKERA: Yes. They supported the distribution function.

GALLER: Distribution, yes. Now, there was GUIDE, also, for the data processing people. But I was never involved with that.

AKERA: No, of course. So were you involved with SHARE in any other capacity? The Fortran Committee, I guess...

GALLER: Not really. I don't know. I was never really...

AKERA: I was just wondering because SHARE came up in the earlier transcript. So I was wondering whether you were actively involved with them.

Were there any other organizations that you were involved with other than ACM at that time, '60 to '63, '64?

GALLER: No, I don't think so. But I did get involved with ACM.

Dr. Bernard Galler

Oral History by Atsushi Akera

Part II: Involvement with ACM
(Recorded on days 1 & 2, January 18-19, 2006)

Part II(a): Becoming Involved with the ACM

AKERA: Okay, good. Let me shift to ACM, then.

GALLER: For example, I'll just mention that in 1960, when the *Communications [of the ACM]* was started, Perlis was the first Editor in Chief. He made me what he called his "University Editor." I was supposed to gather information about university computing for the *Communications*.

AKERA: And that was based on your very close working relations with Perlis, I imagine.

GALLER: Yes.

AKERA: That's great. In fact, that's sort of where we're headed. The general question I wanted to ask was just simply, how did you become involved with ACM? Was it related to all the work you were doing at Michigan?

GALLER: Well, Carr was involved with ACM, and so he would have talked it up. And my membership card says I'm a member since '58.

AKERA: Yes.

GALLER: Yes, I suppose. So I don't remember when the Detroit chapter started. We never really tried to start an Ann Arbor chapter because it was too close to the center of Detroit. But I started going to meetings right away, I think. Partly my GM connection; all my friends were there.

AKERA: Actually, can you tell me specifically what was the motive to go to the local chapter meetings? I mean, was it just the friendships? Were there real technical exchanges going on? A mixture of both?

GALLER: A mixture of both, right. I don't recall any specific speakers, but we had them, and, of course, it's where you exchange information.

AKERA: And it's in your field, and these are the people that are doing the current work, so of course that becomes a natural place to gather. Was it a particularly active chapter? Did you meet on a fairly regular basis?

GALLER: I think we met almost every month, yes.

AKERA: Each month, that's wonderful. And occasional speakers? Not a whole program, but a single speaker that speaks after dinner?

GALLER: I think so, yes.

AKERA: That's great. Now, I want to sort of work a little bit more on establishing the full breadth of the connections that made you become involved with ACM. Now, if I'm correct, one of the other things that you did during this period, specifically in 1962, is that you published a book called *Language of Computers*.¹ Can you tell us a little bit more about that?

GALLER: It's actually tied to the Ford Foundation project. During the Ford Foundation project, I did a couple of things. One is I began to offer a non-credit course for students to help them learn about computing. Interesting, and maybe you've seen it referenced somewhere, that the faculty wanted to learn too, but they didn't want to be seen learning with the students. I had to give them the course during Saturday mornings.

AKERA: So you had to give the Saturday morning seminars or whatever it was, yes.

GALLER: Yes. But I was involved with the Ford Foundation Project in that way. MAD was already coming along by that time. I thought it was a good language, and they were using it, in fact, in the Ford Foundation Project, so I said I would like to write a book introducing the language. And Don Katz supported me. I guess I must have had a part-time appointment or something there, and I wrote the book on the grant, on Ford Project grant.

The first typing of it was from the project. I wrote it longhand—there were no computers around for that then. I mean, there were, but not word processors. Yes, I remember writing it on yellow paper and then a secretary in the Project typed it up, and eventually it was published as a sort of a paperback thing, as a report, almost, on the Project. My idea in that book—by the way, it actually ended up in *Fortune* magazine as one of the recommended texts in an article on computing because it was so early. The idea was each chapter was a new kind of problem, a statistical problem or a weather problem or... I don't know. And in order to solve that problem, I needed a certain construct in the language, and so I added that construct. By the end of the book, I had the MAD language. And it was a pretty good book, but of course it never sold that much because MAD was not that popular. But it was an interesting project.

AKERA: Okay, now let me ask specifically about the offices that you held within ACM early on. I have a list here. My understanding is that you served on the editorial committee, from 1958 onwards; that you became the chair of the metropolitan Detroit chapter between 1962 and '64. It was also then that, between '62 and '65, you served as the Great Lakes representative to the ACM Council, and also between '62 and until '67, you were actively involved with the ACM National Lectureship Committee. It was in 1964 that you became a member of ACM's Programming Languages Committee, and then by '66 you became the Vice President of ACM.

¹ Galler, Bernard A. *The Language of Computers* (New York: McGraw-Hill, 1962).

Now this is the sort of connection that I'm trying to establish: It seems that during this whole period, you became more involved with languages. You were working very closely with Alan Perlis, who I imagine was very involved with the language side, and with ACM in general. Can you fill in some of the details here, and tell us about the synergy that might have existed between the work you were doing at Michigan, the development of computing as a discipline, and how ACM was developing as an organization?

GALLER: Okay. With regard to the Detroit chapter, I somehow got the reputation that I would always ask the first question after the speaker finished his talk—not that I tried to, but I was interested and I asked the [first] question. So I got to be known in the chapter, and eventually I became chairman.

I guess one thing that spread the word about Michigan for a while, once MAD got working... We never had a bug once we settled the language down. We didn't have a bug for five years. I made changes, but they worked. We used to invite people in regularly, maybe twice a year, to come to Michigan for three days, bring tapes, we will teach you how MAD works, and when you go home you'll have it on your tapes. And so we made a lot of friends and met a lot of people. So then you get known, for a while. So if somebody nominates you, you get elected, right?

AKERA: Yes, yes. And in fact, I have a wonderful anecdote. Now, we might be missing some connections here, but it says here that in May of 1967, you issued a very special letter to the membership as the *Vice President* of ACM, in which you spoke to the members about "getting involved." And there you mention how, as an average member, you might not think that the organization was responsive, but that before you knew it, you can do this and that, and get involved with a committee, participate in a local chapter, and lo and behold, find yourself a regional representative [to the ACM Council]. You end the letter with the line, "Who knows what else? It could happen to almost anyone. It did to some of us." Was this a reference to your own career?

GALLER: It probably was, yes. But no, I think what I was emphasizing there was the fact that it did happen. "It could happen. Do it!", Right?

AKERA: Yes. It was surprising how once you started to get involved, you kept getting drawn into more and more committees, and into positions of responsibility, until eventually--

GALLER: Right. It was fun. We met people. We were doing interesting things.

AKERA: It was a dynamic field. It was exciting that there was a clear need to do this work.

GALLER: That's right, yes. I tell people I never taught the same course twice. Something changed every time.

AKERA: I currently teach as a member of the IT faculty, and it's still happening today, very much so. That's great.

Now, you became Vice President in 1966. I was wondering if you could tell us how you got that position. You moved up rather quickly.

GALLER: As a matter of fact, I was in Israel over the holidays, and I got a phone call saying, "Would you run?" I don't know who decided it, but I said, "Sure." I'd been on the Council, I knew the workings of it, and sure, I'll do it, so okay, you know.

AKERA: Yes, I believe that ACM had a nominating committee at the time. Paul Armer was chair, John Carr and Walter Bauer were on the committee.

GALLER: Really? I didn't remember that. Well, maybe that's why they thought of me. Who knows?

AKERA: That's right. Very interesting. So, by 1966, you were very well known within ACM circles, or relatively well known anyway.

GALLER: I'd been in the Council, so yes, and I'd been involved with SIGPLAN.

AKERA: Which is the SIG on--?

GALLER: Programming languages, which, by the way, it may not be important now, but it was *the* SIG at that time.

AKERA: The most important SIG?

GALLER: Yes, it was.

AKERA: I'm trying to figure out how to ask this. Because it strikes me that you very quickly became very prominent, you know, very visible in the ACM organization. Was there something about the specific work that you were doing at the time that made you seem like the appropriate candidate? In other words, you were working with programming languages, which is a very important topic. You were certainly well connected with individuals like Alan Perlis, who was also very visible inside the ACM. Can you conjecture a bit and say why might it have been that you were somebody that people looked to as the right person to pick?

GALLER: I guess I really don't know. Let's remember that university people were very involved with ACM. Well, ACM was very academic oriented at the time. One of the letters that I wrote that we just reviewed was about ACM's shift from being academically oriented toward more industrially oriented. Yes, at the time, it was very academically oriented, so if you were known in academic circles, you were known.

AKERA: So it was because you were a faculty member at the University of Michigan, and this was one of the more prestigious institutions involved with ACM at the time...?

GALLER: Well I never thought of it that way, but I guess so. But the fact that we had invited all these other universities in and were friendly and offered information and help and so on [must have helped].

AKERA: Right, so you had exchanges with other [university based] programs. Your name was certainly known within the larger circle of academic computing centers, which might have had its influence at the time.

Okay, I wanted to just ask about one task that you performed while Vice President, before becoming President, and that is the Committee on Information Dissemination. This was one of the administrative committees under ACM. Do you recall what that committee was for, what work it did?

GALLER: I really can't.

AKERA: The Committee on Information Dissemination. Actually, I can fill in some of the background partly because I just spoke with Dr. Tony Oettinger last week. He mentioned how approach to the general administration of the organization was to delegate things. Things came up as issues within the organization, [and he let those who were passionate about them to work on it].

GALLER: Let's mention, you're talking about when I was Vice President. Oettinger was President. So that's the connection, now, with having talked to him last week about this.

AKERA: Yes, that is correct. That is correct. What he suggested was that, at the time, there was interest on the part of the membership for a more broadly readable set of publications, and so the concern was about the *Journal* in particular. So this follows quite well on the conversation we were just having, namely that the *Journal* was too academically oriented, focused really on mathematics, and even then not representative of all of the different kinds of research on computing that there was at the time. *Communications* was better in a respect, but especially as a larger membership was coming in that really did not have serious academic credentials, there was a need for things like tutorials, and other kinds of materials. It was for this reason that the Committee on Information Dissemination ran a study, somewhere in the '66-'67 timeframe. And it eventually came up with the recommendation that ACM inaugurate *Computing Surveys* and a more regular news periodical as new publications.

GALLER: I hadn't made that connection. But let's point out that at the time, what were the journals ACM had? We had the *Journal of the ACM*, we had the *Communications*, we had *Computing Reviews*, and really, I think that was all. The SIGs had their newsletters, but those were not real publications yet...

AKERA: Of course the National office subsidized these newsletters to some extent, but they really weren't full-fledged academic publications.

GALLER: That's right. And they were soft-cover newsletter-type things, not prestigious publications. So we had the *Journal*, the *Communications*, and the *Reviews*. Okay, go ahead.

AKERA: With that as sort of a refresher, perhaps, you can recall or conjecture on what might have been sort of the work that this committee was trying to do?

GALLER: Well, I think we were beginning to recognize that the people who were becoming programmers who were not mathematicians... People were becoming programmers, and they were not academics, and in particular they had not studied what had gone on before. We began to realize the importance of building a history now, and we didn't want people to reinvent the wheel. Thus, *Surveys*. This is one of the things I'm proud of, because *Computing Surveys* did happen in my time, in my term as president. I'm very proud of that, because I think it was a very important development for the average member.

AKERA: In other words, in a lot of computing centers, there was a tendency to reinvent the wheel. You know, you needed this particular application, operating system component, or whatever, and you just tried to write it all yourself.

GALLER: Well, if you've read *The Soul of a New Machine*,² those guys thought they were the greatest things. We did it all before, right?

AKERA: Yes, that's right. And so the intent of the *Surveys* was really just to address this issue, and give people a primer that said, "This is where the state of the art is. You don't have to work on this, because this is where you go to get a program like this."

GALLER: That's right, and, "Here are the lessons that were learned."

AKERA: And so I imagine one of the major topics in the ~~Survey~~ *Surveys* must have been about programming languages?

GALLER: I think so. Again, I don't remember.

AKERA: Okay. Now, some of these themes will continue through the interview, because I believe there was an underlying tension here that the organization was contending with at the time.

Where that leads us to, at this point, is the 1968 election, when you became president. Now, you ran opposite of Richard Canning, for whom some of the appropriate descriptors would be that he worked on the West Coast, he was also an independent consultant and did not have a PhD, probably only had a Bachelor's Degree, but he had a very important career in the computing community. I think I have some of the details here. Perhaps most importantly, he was the chair of ACM's Ad Hoc Committee on Business Data Processing. By contrast, you had an academic position; your work was primarily in programming languages; you were very involved in the emerging computer science circles at the time. In a sense, this was the ballot as it appeared. Was this implicitly a reflection of certain tensions that existed—not destructive tensions, but certain tensions—that belonged as part of ACM at the time?

GALLER: I guess yes. Tension is almost too strong a word.

AKERA: I apologize. I couldn't come up with a better word.

² Tracy Kidder, *The Soul of a New Machine* (Boston: Little, Brown, 1981)

GALLER: It's more indicative of a trend, so for example, after I was president, Jean Sammet was president, okay? Now, she was at IBM. She was not academic, but she was still an academic person.

AKERA: Yes, in the programming research, very much. Yes.

GALLER: And then Herb Grosch. Now, Herb was already industry. And I think after him, almost everybody for quite a while was industry. So this was already the way things were going.

AKERA: So really a major shift. There are so many interesting things I can follow, of course, but, you know, yes, that's good.

GALLER: I missed Tony Ralston in there somewhere. He was right after Jean, I think, but academic.

AKERA: Dr. Oettinger was from Harvard—academic as well. So there really was sort of a changeover in the organization at the time?

GALLER: That's right. And I realized it, and you can see in some of the presidential letters, I knew this was happening and I knew we had to stop being so elite. But the question was, "How do you get there without losing the academic people?" I didn't want to suddenly switch the organization over and lose all the people who were doing a lot of the [valuable] research [in the field]. We needed everybody.

AKERA: Now, this is to jump ahead a little bit, but can you tell us a little bit about the Data Processing Management Association (DPMA)? Tony Oettinger in particular pointed out that he didn't think there was a lot of tension inside ACM. But he said the one thing that definitely was on his mind was the DPMA, because the way he characterized it was that these were sort of the "Tab" people, originally, who had worked with IBM's tabulating machines, but then as the business world shifted to computers, they started acquiring the same sort of skills as the 'computer people,' but coming from a very different trajectory as compared to the academic culture of computing. And that there really was a point of ambiguity about whether this whole group of people should belong to the DPMA or to the ACM. Is this something that became more clear under your tenure?

GALLER: Not so much in my time. Maybe later, when ACM may have been perceived as closer to that [kind of] interest. But during my period, it was very clear that [DPMA folks were] different. We got along, but I think, as I noted in one of my letters, when AFIPS was formed, DPMA was not one of the sponsoring organizations. They were separate. They saw themselves as separate. I remember I was once invited to be a speaker at one of their meetings. I was amazed at how formal everything was, how structured.

AKERA: That's partly what I was referring to [in speaking about an] IBM culture—sort of the business side, not the [elements of] IBM that worked directly with your group at Michigan--

Part II(b): The Contemporary Character of the ACM

GALLER: Not the part I saw, yes. Right. It was a different culture. Actually, just like we're different from IEEE. But that's yet again a different culture.

AKERA: Can you speak about that a little bit? I am jumping ahead, but this would help keep things together. So how was ACM different from the IEEE?

GALLER: Well, let me give you the microcosm of this university. I was in LS&A, [College of] Literature, Science, and the Arts, in the Mathematics Department. And we started an unusual computer science department.

AKERA: Yes, originally Communication Sciences?

GALLER: Communication Sciences, right. But it was within LS&A.

AKERA: This is at the University of Michigan in 1965.

GALLER: Yes. We merged into engineering in 1984. I realized then, although I had never understood it well, but the engineering culture is totally different. I was never comfortable in engineering because the goals, and standards, and values are quite different from the sciences and the LS&A environment.

AKERA: Can you point to something specific [about this difference]?

GALLER: Yes, I can tell you very specifically. When a person comes up for tenure in LS&A, we ask how many and what kind of publications, how many PhDs were produced, okay, and those are the criteria. In engineering, [they ask,] how much money had they brought in. That's it. I mean, there's a very different thing.

AKERA: There's a sort of a parallel contrast that I was also thinking about, which is, if I understand correctly, that the Department of Computer and Communication Sciences had a very interdisciplinary culture, perhaps borrowing from the tradition of Communications as studied at MIT, in the Research Laboratory for Electronics, and its contributions to computer science.

GALLER: Well, we had joint appointments with departments such as psychology, philosophy, pharmacology, electrical engineering, and mathematics. Okay.

AKERA: That's right, whereas if I understand it correctly, on the engineering side, instead, there is a drive to hone down the curriculum, right?

GALLER: Once we merged into engineering, this was all dropped. Everything was ABET.³

³ Accreditation Board for Engineering and Technology. It is said that ABET plays a more direct role in shaping engineering curricula than the accreditation boards that govern curricula in the sciences and liberal arts disciplines.

AKERA: All the interdisciplinary components were dropped?

GALLER: Yes. Everything was now [driven by the] accreditation of the College of Engineering, and so it's very different.

AKERA: So especially at the undergraduate level, you had to constrain the curriculum to conform to what the principal engineering accreditation body required.

GALLER: Right. Although here at Michigan, we have maintained a computer science degree in LS&A--

AKERA: Undergraduates can get [their computer science degree] through LS&A as opposed to the College of Engineering?

GALLER: Through LS&A, right. The core courses are pretty much the same, but around it are the College's expectations and requirements that are very different. So we managed to hold onto both in that sense, but the difference in values that I just described at our university applies, I think, in a more general way, between ACM and IEEE. They are engineers and we are programmers, scientists, or whatever.

AKERA: So ACM really sort of comes out of more of a mathematical tradition. Certainly the first president, J.H. Curtiss, was an applied mathematician with the National Bureau of Standards.

GALLER: Right, although we do want other scientists. I mean, the man in Indiana, Marshall...I forget his name now, who is the computing guy at Indiana, was from Astronomy.

AKERA: So in other words, programming really was seen an interdisciplinary field in the context of the ACM. ACM itself was designed as a very inclusive organization. If it started on the academic side, even then, or perhaps despite that, it tried to be very inclusive in the different kinds of ideas that would come to synthesis in computing.

GALLER: That's right. And, as people realized how the data processing side, like databases and things like that, were really part of this [as well], we moved it toward industrial applications as well.

AKERA: Now, Tony Oettinger has said that by the mid-'60s, ACM developed a comfortable relationship with the Society for Industrial and Applied Mathematics (SIAM); with the American Mathematical Society (AMS); with IEEE; etcetera, that there was the sense that each had a distinct disciplinary configuration and place within the computing field. But what he said was that with DPMA, things were different. One of the issues was that by this point, it was becoming clear that roughly 50% of the programmers out there belonged to the corporate, industrial computing tradition, and that if ACM wanted to encompass all programmers as sort of their mission—if ACM was to serve as the association for programmers—then this created some concerns. I know that during this period, ACM-- you yourself, I believe, felt that ACM's growth in membership was not keeping up with the growth in the field.

GALLER: I think that's right.

AKERA: Can you maybe tell us a little bit more about this... how you understood the problem back then?

GALLER: Yes. What it revolved around was that you could be a programmer without taking programming courses. I mean, you could pick it up. And we all thought, "Well, you can write a program, but it isn't very good." I mean, we knew how to do some things, and we knew why we did them, and a guy who just picked it up by writing a program or modifying somebody else's, etcetera, wasn't going to be able to do the kind of optimization that we felt was necessary for efficiency. He could make the program run, but...

AKERA: ...you needed a certain academic background in order to really take the state of the art forward.

GALLER: I think maybe we didn't talk about it, but I think we felt that. And yet they were computing people, and we thought we could do them some good if they joined our organization.

AKERA: Tony Oettinger said it was a sort of "colonizing mission." To grab that group of people, and brings them into the ACM, the field really, to elevate their level of skill for the betterment of computing as a whole.

GALLER: I think that was at least part of it. On the other hand, you know, we wanted ACM to be the leader in the field, and you can't do that by ignoring this group or driving them away.

AKERA: That's right. So there was a very conscious decision not to just simply close down and become an academic computer science organization.

GALLER: Yes, I think it was quite conscious, although I'm not sure we ever talked about it. The decisions we were making were always in that direction.

AKERA: Now, was there a sense within ACM itself that there were different voices? An organization is not an individual, obviously.

GALLER: Well, we always had voices. We had very articulate people. I have a papier-mâché gavel upstairs that they gave me when I finished my term because I pounded my gavel so much at the meetings. People were articulate!

AKERA: Interesting. I want to ask more about that somewhere down the road.

Actually, you said that there wasn't any explicit tension in the organization, but I just want to draw your attention to a quote, if I may. This actually goes to your parting letter as President to the membership. You wrote this final letter, as you were departing office, and you wrote, "I think you'll agree that this has been a most interesting term of office." Can you speak more about what made you say this? What was going on during this time that really sort of made this a very dynamic period for ACM?

GALLER: Well, I remember one very specific development because of the Vietnam War and the-- Remember, I became President in '68. You had the '68 Chicago, right.⁴ I wonder how many of our people who might ever read this transcript will understand that. That was a very important time.

AKERA: And, of course, the 1971 ACM national meeting was scheduled to take place in Chicago. Is that correct?

GALLER: I've forgotten. All right, but the point was, people were, Mike Harrison in particular—a very good friend of mine, a professor at Berkeley. In fact, I was on his doctoral committee. He was one of the most vociferous to put pressure on the Council and on me that ACM should take a political position as an organization, and of course, what I wrote in a couple of letters to the membership, "The Council and I don't think we should do that. That's not what this organization is. But as individuals, we should get involved." But that was a real tension. I was very embattled at that time, in that respect.

AKERA: Yes, you really felt the pressure from multiple sides.

GALLER: I did.

AKERA: Because there were also voices on the other side, am I correct? More subtle voices of a silent majority?

GALLER: I don't remember too many voices. I just felt that it was the right stance to take.

Now I'll mention a different kind of pressure. One that comes to mind in particular was a young woman named Rebecca Prather, who was in the AI field, but she was not one of the leaders. We had [Marvin] Minsky and [John] McCarthy and so on, and they formed the SIG on artificial intelligence. She wanted to be in it, and somehow they were keeping her out. And it came to the Council, this fight: How can they be so elitist to decide who should be in it and who shouldn't, if they weren't one of their clique? And I remember taking a very strong position that these SIGs had to be open.

AKERA: So in a sense, the "politics of the time" showed up in various ways. There were the explicit politics of the Vietnam War, and some individuals wanted ACM to take a stance on these national issues. But there was also a kind of spillover effect, where there was a lot more vocal... well...

GALLER: Tension about the nature of the organization, right?

AKERA: Yes, and people's willingness to bring all kinds of issues to the fore.

GALLER: And challenge the status quo. Right. So we had a lot of things like that.

⁴ This is a reference to the urban riots in Chicago, which occurred during the 1968 Democratic National Convention there. Note that Galler also grew up in Chicago.

AKERA: And that you personally had to render judgment on in your role as ACM President?

GALLER: Yes, I had to make some decisions, and, you know, [to answer directly the question,] “What was my view of what ACM was and what it should be?”

AKERA: I want to follow up on this question, because it’s in one of the letters somewhere, that you actually attended—I don’t know if you were a regular member of—SIC², the Special Interest Committee on the Social Implications of Computing. To begin with, was that a group that you attended regularly?

GALLER: I don’t think so, but I’ve always been interested in problems of society and so on. I encouraged that SIC (it was a SIC I think at the time). I guess I showed up once in a while. I don’t remember--

AKERA: So that was out of personal interest?

GALLER: Personal interest, yes.

AKERA: Now, just at a personal level, if I may (and you don’t have to answer the question), but at a personal level, were you sympathetic towards not just Vietnam, but protest movements and the desire to be politically active? Not about the ACM, but just in general, about your personal, political orientation.

GALLER: I was sympathetic. I guess I never got too involved, but I was always sympathetic. My parents were Socialist-oriented, and I remember marching in Mayday parades when I was a kid and so on. So I grew up—although my parents were never involved with unions—I was very sympathetic to unions and so on. I became more “center” later. We tell people that my parents-in-law, my wife’s parents, were so conservative we couldn’t talk politics; my parents were so liberal we couldn’t talk politics to them. We ended up in the center, and so I grew up very favorable towards unions. Later on I began to see some of the problems that unions had, and created and so on. But I was always personally interested and involved in understanding society and societal problems.

AKERA: Yes, and were not afraid to try to understand the politics of a situation?

GALLER: Absolutely.

AKERA: Yes. Now, if I recall, from the Babbage transcript, there was also an incident on Michigan’s campus at about this time where you sort of became involved in campus politics-- involved is maybe the wrong connotation. Can you tell us about that incident?

GALLER: Well, there were a couple of incidents. One time, the students were preventing, I believe, General Electric recruiters on campus, and I thought that was going too far. And I did lead this-- We raised money from all the faculty to put a full-page ad in the newspaper, and I wrote the ad and collected the money and so on, because I felt what they were doing was wrong.

Then at a later time, we had what we called the BAM strike, the Black Action Movement strike, and at that time, it actually resolved... It wasn't all Black students; there were significant others, and they disrupted my class of 200 students, and I charged them with--

AKERA: You also wrote something up on the chalkboard, if I recall.

GALLER: Yes, I made them very angry. I wrote "Hitler 1933" on the board, and they became very angry. That was an interesting time.

AKERA: Now, did any of that affect your actions at ACM... or did the relationship go the other way? Similar issues were unfolding everywhere...

GALLER: Yes, and I don't make any connection with ACM with any of these. These are [specific to] Michigan.

AKERA: But as a historian, what [I want to document is how] you went through this period. In the beginning, you seemed a little bit naïve in some ways, saying, "These are interesting issues; I want to get involved." This is just my personal reaction [to what I see] coming across in some of your letters. But by the end of your administration, it's very clear that you've learned to play the administrative role, really to say that regardless of what your own personal politics are, your role as ACM President was to understand that there [would always] be different voices within the organization and [that it was important to] find a way for the organization to be able to work it through so that it doesn't eat away [at] the organization and cause [a major] disruption.

GALLER: Right. Someone once told me when I first became ACM President, "You are playing a role now that people expect you to play. You've got to do it. You've got to dress like that. You've got to act like that." And I tell people that now. If you become a committee chairman, you've got to run the meeting the way people expect you to do it. They're counting on you.

AKERA: This sort of falls into organizational theory, in some ways—I suppose the organization has a life of its own apart from the individual lives. Yes?

GALLER: Right. But when you play a role, it's not what you want to do. People are counting on you to do the right thing in that role.

AKERA: Yes, and the "organization" fosters a sense of responsibility.

GALLER: Yes.

AKERA: Now, what strikes me, again, in drawing another parallel, is that there were similar kinds of motivations behind your "official role" at ACM, and your work in Michigan's computing center. In both cases, [there was an element of,] "This is what [the organization needs]. We have to develop the right solution." And the role... it didn't matter what your title was?

GALLER: That's right. And if you don't like it, if what you're doing in that role is distasteful, then you have to get out of it.

AKERA: Yes. And just to complete the conversation on the politics of the era, two of the specific initiatives that came forward, one was a referendum on the “questions of importance” on the Chicago 1971 meeting, where a vote was brought to the membership on whether or not to move the meeting. And I believe along with that, the ACM Council itself decided to advance a second referendum, on the same ballot, asking whether or not ACM should make an explicit constitutional change to allow the organization to take a broad political stance. Do you recall that incident, the referendum, and how it turned out?

GALLER: I think the vote was very much against taking a stand, but I think the reason they put the question forward—probably we knew what we thought was right—but that there were people out there who didn’t think so, and maybe we weren’t representing people properly.

AKERA: So it was really about democratic due process, and that whatever you felt, both the Council and as President, that there was a sense of obligation to go ahead and poll the membership and take the organization in the direction that [the membership wanted]--

GALLER: I think so, because we had the power to make the decision. But if you’re going to have any credibility with the membership, you’d better know that they’re behind you.

AKERA: It was, in fact, a four-to-one decision. At least as you reported in your own discussion of the event afterward, so that most people supported the more moderate stance.

GALLER: I’m not sure I’d call it moderate. [It was an] institutional stance of remaining [one] kind of organization.

AKERA: That’s right. It’s about [an organization that focused on its] technical work. That whatever policies ACM picks up needs to be based on the specific competence and goals within the [computing] field, and that a general stance on the Vietnam War itself was not within the [purview of] professional activities.

GALLER: That’s right. And I think they’ve continued that now. There’s a committee that’s taken a very strong stance on electronic voting, but it’s not whether we should have it or not, but “if we’re going to have it, let’s do it right.”

AKERA: Yes. What else I noticed, both under Tony Oettinger’s administration and yours, was an effort to define for ACM a role as expert witness; That you were willing to go to Washington and provide testimony...

GALLER: ...but not lobbying. Which, of course, I’ve continued in my expert witness consulting work in the same way.

AKERA: This is with regards to software patent issues, yes?

Okay. Discussing a slightly trickier side in ACM’s history, this referendum on “questions of importance” reminds me of certain passages in the early history of the ACM, particularly those having to do with an individual named Edmund Berkeley. I was wondering, first of all, do you

know much about Edmund Berkeley, his history, and what he did during the early origins of the organization?

GALLER: No, not really. I know of him. I never met him. I remember giant brains and whatever. No, that was Booth?

AKERA: No, that was in fact Berkeley, that's correct. That was a 1947 or '49 publication.⁵

GALLER: Right, and it was important, but it was before me.

AKERA: Sure. I'll ask more generally about Berkeley and his legacy in a second, but one of the concrete connections here is that I believe this matter of the "questions of importance" dates back to Berkeley. It goes back to 1953 when Berkeley actually resigned from the ACM. He was the first secretary of ACM and served until 1953, when at the point he resigned, to become, "the member of the loyal opposition."

He resigned specifically because—and this will echo some of the things that happened within your administration—but it was over two issues, if I recall. One had to do with raising the membership dues from two dollars to six. This was because the ACM Council wanted to publish a new journal, the *Journal of ACM*, and this required money. Berkeley's stance was that ACM should be as broad and inclusive of an organization as possible, and as such, he wanted to keep the membership dues very low. He was only the Secretary, but being the permanent secretary from the point of ACM's founding until '53, he was quite influential in the organization. He had controlled all of the organization's communications, because initially everything was mimeographed in his office. He distributed all of these memos as 'reports.' He was the one that did this distribution himself. You may sort of get the picture.

[Tape 2A begins]

AKERA: We're speaking about Edmund Berkeley. The second issue had to do with the decision to incorporate ACM, and Berkeley was also against this.

[Now, there's a chance that my recollections here are faulty, but] this is based on my own, earlier historical research. I didn't go back and check my notes [prior to this interview]. But what happened is that it was because of these two issues that Berkeley worked through the bylaws and introduced the tradition of a direct referendum initiated by the membership. This is what's called the "questions of importance." So what brought about the vote over the Chicago meeting, the 1971 issue, was that in ACM's own [constitution or bylaws], if any 30 members advances a referendum and they want a membership vote on it, then they have to power to [require this]. So it actually wasn't just the president or the council's decision. The membership could force the Council to [distribute a referendum].

GALLER: 30 members in an organization with--

AKERA: With 8,000 members,⁶ I know. Yes.

⁵ Edmund Berkeley, *Giant Brains: Or, Machines that Think* (New York: Wiley, 1949).

GALLER: Now 86,000.

AKERA: That's right. I don't know how the constitution has changed since that date. But it was a democratic tradition that was ingrained into... that Berkeley himself drew into the design of the organization's charter early on.

GALLER: Yes. Right now it seems strange that \$2 to \$6 would seem so different.

AKERA: Yes, because under the Oettinger administration, I think the dues were raised from something like \$12 to \$25. But it did happen, and I think within your own administration, you found out that to run everything that Dr. Oettinger and you decided to start, the membership dues had to go to \$40, which you didn't do, [if it was all to be preserved]. I'll ask about that in a second.

But in a sense, it seems to me that this was one way in which Berkeley's early work left a kind of organizational legacy, that certain things survived in the makeup of the organization. Do you think that this is right? Or do you think that I might be overplaying this part of things?

GALLER: No. Clearly the "questions of importance" did exist, but I was never aware of that, so it's a question of, was it his legacy? Not a conscious legacy necessarily, but it's a part of the [organization's] history, certainly.

AKERA: I'm sure you're aware of Lawrence Lessig's work. He's a constitutional scholar [and so-called expert on cyber-law]. Lessig emphasizes how once we write something down in "code" or in a constitution, it tends to have an underlying influence on an organization. Indeed, even after you forget about the origins of it, it continues to dictate actions.

But I think the "questions of importance" is more of a minor issue here. It brought certain democratic traditions into the framework of ACM, which perhaps still survives to this day. But I think the more significant contribution [Berkeley made to the organization's character had to do with this] desire to keep ACM a very inclusive organization. From the outset. Now, this [particular] history is very important in the context [of your administration], because at the very beginning [of ACM], everybody who became interested in digital computing [began working] together. So [ACM represented] manufacturers, applied mathematicians, research mathematicians interested in using computers, electronics engineers—there was a whole array of different people, [though this was], granted, sort of slanted [towards] the academic side.

GALLER: Right, but the goal was always to look at this "interesting phenomenon," I guess.

AKERA: Yes. It seems to me just in reading [the early letters] and also in speaking with Dr. Oettinger as well that ACM, as part of its own identity, really tended to default to the idea that it should be inclusive as opposed to exclusive.

⁶ This number is incorrect. By the late '60s, ACM had on the order of 26,000 members, as recounted later in this transcript.

GALLER: They didn't have any choice! People were becoming programmers without needing us, so we didn't have any choice. We either watch them from a distance, or try to include them and say, as we talked before, we can do them some good, and they can do us good. And if we can grow bigger, we'll have more clout in Washington or whatever.

AKERA: Exactly, because I think one of the underlying questions is really, was it inevitable for the ACM to go in the direction that it did? Or were there specific choices at the time, whether in terms of the professional and/or disciplinary development of the field? The reason it's a very difficult question is that because, if you compare, for instance, the American Medical Association (which Dr. Oettinger actually did make a comparison against in his published writings at the time)... Dr Oettinger says, on the one hand, that a discipline can close down and try to make very strategic decisions about who to include and who to exclude, regulate the curriculum, regulate the credentialing. That tends to enhance the status of the field. And of course, that's a track that many professions follow. But professions can be very different from disciplines, and academic commitments can bring in a different array of priorities. What do you think was the character of ACM at the time that made it make a specific set of choices, particularly to be more inclusive?

GALLER: I really think that it was out of our control. I really think that because the computer became so ubiquitous in applications, without needing us. A person didn't have to go in to ACM to make a living in computing. We couldn't do it. My daughter, by the way, who's a lawyer now. When she was in law school, as her thesis project-- You know, before law school, she was an undergrad at Harvard. She did a thesis on whether the computing industry was ready for licensing. She decided no, you can't. There are too many people-- it's too broad a field and it isn't going to work.

AKERA: Exactly.

GALLER: We could have closed in as an academic discipline.

AKERA: As computer science.

GALLER: Yes. We could have done that, and we would have lost, I think, half the members, right. Those academic departments that really were just computer science, and didn't have a connection with [their academic] computing centers. We talked about [this] before. I think they found themselves having a problem.

AKERA: My reading as a historian—and I'm acting [more as] as a historian [here than an oral history interviewer]—it seems to me that there was a combination of factors. One was that ACM itself was already a [certain kind of] organization, so this was in a sense a matter of legacy. You [already had] the voices of the people representing business data processing [interests within the fold of the ACM], and [for any] organization it's very difficult to ignore [such inside] voices. You could for a time... and I believe Samuel Williams [one of the earlier ACM presidents], for one, did try to pull ACM back into a more academic orientation. He's the one who had the run-in with Berkeley and Berkeley left [ACM] as a consequence. So there's a specific history there.

But because of the larger inclusive history of the organization, there were people that you couldn't simply sideline or ignore. In fact, both Dr. Oettinger and yourself very much extended an open arm to the data processing people. Even within ACM, you say, "We want to create a very strong SIG on business data processing." You just mentioned yourself that at the time, SIGPLAN was the most important, prestigious group. But in terms of growing numbers, I think the business SIG, SIGBDP, really did start to burgeon during this period and become more important in the history of ACM as time went on. So in this sense, I think part of what happened was slated in the makeup of the organization itself. If you take this administrative sense that says, "I'm going to please the membership," as opposed to one that says, "I'm going to protect computer science as a discipline," yes, ACM's course was determined by circumstance. I think that both yourself and Dr. Oettinger made a choice, [what may have seemed like an] inevitable choice, that really said, "We have to respect the will of the membership."

GALLER: That is not inconsistent with my general view about society.

AKERA: No, no. The other thought is that [all this] has to do with intellectual [makeup of computing, as a discipline.] In other words, just like how at Michigan, it was very difficult to maintain the distinction between faculty and staff. It wasn't that there wasn't any difference, but it was a continuous shade of gray. You had people doing real esoteric research coming out of the abstract mathematics tradition. Then you had people doing systems programming. But some [of the work in systems programming and high-level languages] were very esoteric topics that really did become legitimate [areas for] academic [inquiry]—programming languages, virtual memory, and a whole slate of other topics. But then you have the systems programmers, those related to SHARE and other organizations, who really legitimately felt that they too were contributing to the advancement of the field. [Perhaps] it wasn't academic. [But it mattered.]

GALLER: Right. They weren't contributing to computer science. They were contributing to computing.

AKERA: Yes. Now, ACM, in a sense, was important for all of these groups.

GALLER: Right.

AKERA: And then stretching all the way out to the business data processing side where you dealt with more business accounting related issues; things that, from an academic computer science point of view seemed like it should belong in the business school. But for ACM, this was all within the strand of what ACM could represent. Given that this was the intellectual landscape of the field, it was very difficult to create clear demarcations of [what to include and not include]-- Not that medicine didn't have some of these issues either, but [medical professionals made some aggressive decisions about] what was going to be "normal" medicine and what was going to be [in the sidelines].

GALLER: I think this is one reason why it was a problem to establish computer science as a discipline at a university.

AKERA: [In the university itself,] yes.

GALLER: Right? The physicists never sent their students to take computing courses. They saw it as, “anybody can program.”

AKERA: Yes. And it’s a service function, anyway.

GALLER: It’s a service function. That’s right. But our department here, I think, recognized that by saying, “We will, in fact, establish strong links to other departments.” Other than electrical engineering. They shut down that part.

AKERA: In fact, there is a very unique history at Michigan. If I understand it correctly, computing at Michigan was, in some respects, much more fragmented than at the other top research universities across the country.

GALLER: At first. Electrical [engineering], business, and mathematics is where [computing occurred]..., yes.

AKERA: That’s not necessarily a negative thing. I think [this was part of what gave computing at Michigan its] unique character. There was the kind of work that...

GALLER: Every university grew according to the particular people who were there.

AKERA: That’s right. There was no single model of a computer science department. We’re simplifying it a bit here, but computer science as a discipline was tremendously varied from university to university, and [the differences] really had to do with the [history and makeup of each] institution. It’s a very complex interaction between institutional makeup, the different pressures of how much to focus on research versus education, etc...

GALLER: That’s why Curriculum 68, by the way, was very important, because it helped define computer science a little bit better.

AKERA: As I mentioned before, my strategy for today is to run one whole session that can stand as a self-contained interview. So I’d like to return to this issue tomorrow, if I may, because I think it’s important.⁷

GALLER: Sure.

AKERA: I want to make sure that we get through the whole period of ACM in today’s session.

⁷ The interview did not follow this format. However, I was able to write to Dr. Galler, who sent in this note regarding ACM’s work on Curriculum 68:

“I believe that the ACM Curriculum activity, especially Curriculum 68, was very important. For the first time, it gave real guidance to large and small schools as to what to teach and in what order. It also helped to define Computer Science as a discipline. I believe that it advanced the field in this regard by several years.”

Now, this is a highly related question to our current conversation, because both as vice president and as president, you spoke or wrote several times about the sense of “alienation” among the membership. Your vice president’s letters about this abstract person, the nameless face in the ACM organization, you were sort of trying to invite them in. And elsewhere, again, you repeat that theme and say, “This is really your organization. It’s still a very dynamic field.” First, can you tell us more about this? What were your concerns at the time? What were you trying to accomplish?

GALLER: I think I saw people around me who didn’t need ACM or didn’t want to get involved or whatever, and I thought that we could do good for everybody. I wanted the organization to be meaningful to them, and I wanted to draw them in. I don’t know if it was alienation or just non-interest. Did I use the word “alienation”?

AKERA: No... I think that’s my word. I have to be honest about that! But it’s my reading of the situation.

GALLER: But I think I also saw that something was happening in society. 1968, you have the riots. It was *us* against *them*.

AKERA: A tremendous sort of anti-establishmentarianism coming to the fore.

GALLER: Yes.

AKERA: Tell us more what you mean by “us versus them” and what that meant for ACM.

GALLER: I think we’ve seen a long trend. For example, in industry, where people are less loyal to the company, and the company’s less loyal to the people. Then you have the “me-generation.” All of these things that, I think, [foster] less [of a] feeling of obligation and responsibility in society.

AKERA: You didn’t want ACM to be that kind of organization.

GALLER: I did not want ACM to do that. I felt it was a place to educate people and to form a family, because here was a new kind of phenomenon, we were all in it, it’s wonderful.

AKERA: It’s still a dynamic field. It’s still a young field.

GALLER: Yes.

AKERA: And you don’t want it to act like it’s an old, stodgy...

GALLER: That’s right.

AKERA: Now, were you successful?

GALLER: Who knows? [laughs]

AKERA: It's tough to say, because ACM, as you mentioned, by this point, had 8,000, 9,000 members? Is that correct?

GALLER: When I was president? I remember 26,000, and now I think it's somewhere, depending on whether you count student members or whatever, around 80,000, or 85,000.

AKERA: Was this [sense of alienation] partly an inevitable direction [for ACM]? The sheer size of the organization—once you have 25,000 people, can you really maintain that sense of engagement on the part of the individual?

GALLER: That's one reason I was a strong [advocate of] chapters, one reason why I was strong on the lectureship. That is, to have ties between the local feeling and the national feeling.

AKERA: In other words, computing was a field where networks [of all kinds—disciplinary networks, social networks, ties to industry and so on] were all very important. Isn't that right?

GALLER: Yes. If we were going to share programs, if we were going to cooperate or were going to educate each other, we needed to communicate.

AKERA: Was there a specific concern that some of these business data processing people who were coming in—the regular programmers—didn't share in this culture, and that they would miss out if they didn't get inculcated into this academic culture of exchange?

GALLER: I don't remember thinking that explicitly. I think I thought more just about everybody.

AKERA: A more sense of general inclusion.

GALLER: I think so.

AKERA: Actually, one additional question on this line. Was there ever any sense within the organization that there was declining intrigue with digital computers? That's what brought you into the field to start with.

GALLER: Intrigue? You mean an excitement sort of thing?

AKERA: Yes.

GALLER: I don't know if we ever talked about it, but I think everybody felt it.

AKERA: The decline, or that it was still very exciting?

GALLER: Oh, no, I think it was always exciting. I don't think that declined. There were always new frontiers.

AKERA: So that can't be the explanation for the alienation.

GALLER: I don't think so. No.

AKERA: My words, of course!

GALLER: Everything was always changing and was always challenging.

AKERA: But there was a sense that you wanted to help convey that excitement to the new generation of people coming in?

GALLER: I sure did. I tried to do it with my teaching, for example.

AKERA: Actually, this is a question that's been asked many times, many ways, but what was the relationship between your commitments as an educator and your commitment as a researcher?

GALLER: I had a half-time appointment in each. I did both, right. I always had large lecture classes with TAs and so on, and I tried to convey the excitement.

AKERA: But it wasn't just about learning an established body of knowledge. It was really opening a door into a realm that was still very dynamic.

GALLER: Yes. I always gave them challenging assignments. I always tried to think of something that they had not seen before, but they should be able to think about.

AKERA: So despite all of your work on the research side, you also took education very seriously.

GALLER: I did. I think most of the guys did, yes.

AKERA: Can you tell us a little bit more about that side of your work. because we haven't talked about it so far. What was your motive behind teaching?

GALLER: I taught all levels. I taught a lot of low-level introductory courses because I enjoyed the "Ah-ha!" in their eyes when they began to see it. I created a course for non-majors, which two of my kids took, because I felt that even people not going into computing ought to know about it.

AKERA: In fact, this was the basis for the Ford Foundation Project, right?

GALLER: Yes. Of course, that was strictly [for] engineering [majors].

AKERA: It wasn't meant for computer science majors.

GALLER: That's right, but I also created this course in LS&A for non-majors. I also created the very highest-level course for our best programming students, a graduate course where we made the whole class one team on a whole project, partly to give them what they might see in industry, and partly to see what we could accomplish. I don't know if you've come across the

whole student registration system at the University of Michigan. It was a project of my course. It was called CRISP.

AKERA: Did your students get very excited about that?

GALLER: Sure. It was very interesting. "Computer Registration" we called it, "In Spite of Problems" (CRISP). The official name was "Involving Student Participation." But I'll tell you an interesting thing there. I invited the head of the [administrative] data processing part of the university to be in our course so that what we developed could be consistent with their system, and maybe if it was useful, they could use it. He sent a person with specific instructions to sabotage the whole project, who later became a friend of mine and told me that. That was the kind of tension we had here. I didn't feel that way, but he didn't want us to encroach on him. Now later on, when we showed it was good and we ran a whole semester's worth of data and duplicated exactly what they [were doing manually], I took a portable acoustic terminal to the vice president's office. He brought people there and I demonstrated [the system], and he said to them, "Do it." And that's how it happened. But there was that tension, that he told this guy to specifically sabotage it.

But this class was very nice. In fact, I think we reported on that particular application at the 1971 IFIPS conference in Ljubljana because we felt it was important to have this kind of experience for students who, when they left, would go out into industry and work as teams.

AKERA: Just a possible connection back to ACM. Were you at all involved with the Committee on Education?

GALLER: Not formerly. Bill Atchison headed up that thing from Georgia Tech. I encouraged it, but I never got directly involved.

Part II(b)—The ACM Organization⁸

AKERA: Great. Thank you. What I would like to do is to focus now on some specific aspects of the ACM organization, including its SIGs and SICs, which is where I would like to start. Can you tell us something about the general growth of the special interest groups and special interest committees during this period? I believe that the ACM national organization, and as president, you chose to very specifically support their growth.

GALLER: Right, but we had a big fight over Bylaw 7. Jean Sammet, I think, was head of the SIGs' board⁹ at the time, and we became very good friends even though there was a tremendous controversy. I don't remember what Bylaw 7 says now, but it had to do with the relationship [between the SIGs and the national organization, and] I think [it was] partly [about] money. Did the National have responsibility to give money to the SIGs? Or if they began to make money, did they have the responsibility to give some back to the national organization. Later on, when SIGGRAPH began to explode and become very rich, it became a real question of, "How come some of that money isn't coming into the National?"

But I encouraged the growth of these things. Partly, I was beginning to see that the national computer conferences were going to run into trouble. They were getting bigger and bigger--

AKERA: They were your revenue source.

GALLER: They were big revenue sources, right.

AKERA: Because that's where the trade shows were, where the manufacturers gravitated towards, and that, in turn, raised some revenues that were simply passed back to the contributing organizations.

GALLER: That's right.

AKERA: ACM and IEEE.

GALLER: Right. But it was becoming a little clearer somewhere along the way that these were going to be in trouble, that the general conference was too general. People wanted more of a niche conference.

⁸ During this segment of the interview, I had also intended to ask about the ACM central office, and its staff. I asked Dr. Galler to relate anything about this afterwards, and he sent the following:

"Myrtle Kellington was a wonderful person. When I started the *Annals [of the History of Computing]*, she was the first Managing Editor, and she was the one who knew how to run a journal. That was later, but she was very helpful during my time in office, also. Don Madden was also very good. He was at the center of the controversy over who had the power, the central office or the SIGs and the Boards. As I said, the spark that set it off and symbolized the tension was the color of the cover of the CACM. But Don was good. I also appreciated Mark Mandelbaum on the publications, but I don't recall if he was there during my time in office or came later."

⁹ Committee on Special Interest and Groups and Committees.

AKERA: It would only be a jobs fair, just like the Mathematical Society meeting?

GALLER: Right. But they wanted a graphics conference, or they wanted a committee.

AKERA: They also wanted their own journals as well.

GALLER: And one of their journals, right. It was clear that we needed to support special interest groups, so I did. I encouraged it and set up-- I think the SIG Board may have been established during my time.

AKERA: Yes, either your time or right before, I think, because the Committee on Special Interest Groups [and Committees] was established right around this time.

GALLER: Right. In fact, the board structure was coming in at that time, and I had a lot of problems with the Publications Board.

AKERA: Can you tell me something of the board structure? This isn't something I know about. There is something I don't know here.

GALLER: Well, we had committees, and then it became, again, clear that there were areas in the organization that needed another level of structure, and so we invented the boards. I think it was [during] my time [as president].

AKERA: Okay. No, this is good. I just kind of found it.

GALLER: So for example, the Publications Board, how much responsibility should they have? How autonomous should they be, right? What decisions should they make? We had a tremendous battle with Don Madden, who was executive secretary at the time. The color of the cover of the *Communications*, this was the issue. Should he be able to change it by himself? Or is it the prerogative of the Publications Board? Aaron Finerman was the chairman of that. We had several very weird meetings just over who had the power [to change the cover].

AKERA: It really was based on larger issues, I think.

GALLER: Yes, sure, but this one was the issue. I think it was at that time that the Board finally won. The executive director would run the office and do a lot of things, but the volunteer boards had the decision [making authority].

AKERA: What was the final composition of the board? This was a publications board? ACM's editorial board?

GALLER: No, the Publications Board established policy. There was an editorial board, I think, for each publication. But the editor-in-chiefs were the Publications Board, as I recall.

AKERA: I think that's right. This is what my recollections of the published accounts say.¹⁰ There was a point when every last editor associated with a publication, so there were perhaps eight editors with the *Communications*, and they were all members of ACM's *Publications Committee*. That was far too unwieldy because there were too many people, and there was a specific decision made...

GALLER: ...and as we get more publications, you see...

AKERA: ...right. So at a certain point this decision was made that there would be an editorial board with just the editor-in-chiefs...

GALLER: I think so.

AKERA: Plus certain representatives from the council or something like that, where it was decided that this would be the Publications Board?

GALLER: Right.

AKERA: They had executive authority.

GALLER: Right. At that time, we said—I saw it again in one of the letters—that there should be somebody from the council in each board for back-and-forth communications.

AKERA: That's right, an official council liaison.

GALLER: Yes.

AKERA: Actually, that was in reference to the special interest groups and committees at the time, although it may have been extended afterwards.

But this raises the general issue of governance. ACM was established principally with a geographic representation. In other words, the ACM Council consisted of, at that time of your tenure, representatives from each of ten regions, with one being Europe, I guess, plus several members-at-large. Then there were the officers, who constituted the executive committee.

GALLER: Right.

AKERA: It seems that as the SIGs in particular became more powerful, and then you also now had the editorial board, that creates a tension where ACM has a geographical representation, but these disciplinary SIGs are not officially represented.

GALLER: But they were added to the Council then, I think.

¹⁰ The reference here is to Franz Alt, "Fifteen Years ACM," *Communications of the ACM* **30** (1987): 850-59. Originally published in the *Communications* in 1962. However, this would have placed the origins of the Publications Committee (not yet a board) well before Galler's tenure. There may have been an official shift from "committee" to "board," and a larger reorganization of ACM, as Galler recounts here and above.

AKERA: Do you know when?

GALLER: Maybe back during my time. When we set up the boards, I think we put them on the Council.

AKERA: My sense is it happened afterwards, but I haven't looked at the records closely. I think the first step was the decision to create an official liaison, Council liaison. Each of the SIGs were assigned somebody on the council to be their liaison, and then I imagine over time that then shifted to the idea that the SIGs had representation...

GALLER: Not the SIGs, but the SIG Board came to the Council. Again, there was the intermediate--

AKERA: The Publications Board, the SIG Board, and then each of those entities would have one representative or two on the Council?

GALLER: That's right.

AKERA: Okay. I didn't know about these details. This is wonderful.

GALLER: I think it happened right about my time.

AKERA: That's sounds right, yes. The official liaison was different. The idea was that each of the SIGs would have some direct voice on the Council because somebody acted as their ombudsperson, in a sense. But I think this was a still a compromise because officially on the books, ACM's governance is still based on the notion of regional representation. If I'm correct, the regional aspect of ACM was not something that really took off very much within ACM. Is that correct? The chapters were important, but the regions or sections really weren't part of the administrative structure?

GALLER: I think that's right. I don't think they ever became... It was just a mechanism for getting a small enough number on the Council.

AKERA: Yes. So would it have been possible to change the organization at this point? If they said they were going to take one representative from each of the SIGs and to redefine the Council, was this proposed?

GALLER: I don't know. See, the problem is, not everybody wanted to join a SIG. If the SIGs covered the organization, then you could do that. Everybody would be represented then in some way.

AKERA: Whereas the geographic representation guaranteed this—the same kind of principle as a congressional district.

GALLER: Right. And some people joined more than one SIG, so it was not that clear.

AKERA: Just to follow on that, what was ACM's relationship with the local chapters? This also seems to be something that you promoted during your tenure.

GALLER: Yes. I always felt that the average guy in the organization was out there doing work, and would have the closest contact with the chapter, and therefore we ought to support the chapters. I was, I think, one of the founders of the lectureship series, and I was one of the first lecturers to go out on it because I felt that was important. I think a lot of people in the organization thought of the chapters as second-class compared to the SIGs. I tried to encourage chapters to be as important, as much as I could.

AKERA: What you're saying, really, is that local chapters was the easiest way for typical programmers to become involved with the ACM, and to develop a sense that being involved could make a difference in their own career. And that it would also help their education, their learning, their continuing education process.

GALLER: Right. Of course, that's the way I came up through ACM.

AKERA: Yes, as we spoke about earlier.

GALLER: Right.

AKERA: I've forgotten to ask about what the lectureship series itself was about. Can you remind us, what was this new initiative, and how was it set up?

GALLER: The idea was that we have a lot of expertise in our membership, and if we could send people around-- The chapters probably had local people who could give talks, but if we could bring the nationally known people to them, we could encourage membership of the chapters. So we would recruit [volunteers] and pay their expenses. I don't think we ever paid a lecturer, but we paid [their] expenses.

AKERA: These people just volunteered their own time.

GALLER: That's right.

AKERA: You paid for their travel expenses. I believe some of the local chapters or universities might have gotten involved as well to pay for... you know, take them out to dinner.

GALLER: That's right.

AKERA: It was really a multi-way agreement, but one that really brought very prominent individuals, including yourself, Dr. Perlis, and others, to local chapters.

GALLER: As much as possible.

AKERA: All kinds of very local chapters. Kansas City...

GALLER: Oh, yes. Sometimes there'd be only ten people at the meeting.

AKERA: What are some of the places you spoke at?

GALLER: I hardly remember, but it was all over. Whenever I arrived somewhere, I'd have dinner with the officers of the chapter. I would always say to them, "What pitch do you want me to make to your members? What problems do you have? How can I be helpful?"

AKERA: There's a very curious sort of connection here. You mentioned that you were sympathetic to unions, although you were never directly involved. This practice of sending a national representative to local meetings is something that came out of the union tradition. Was there any connection here?

GALLER: I didn't know that.

AKERA: Okay. [laughs] I know it was done, and it was sort of a recruiting mechanism. It seemed very striking that this very established tradition, and working class tradition at that, found its way inside ACM.

GALLER: I was not aware of that.

AKERA: They may have had totally separate origins. But just to note the similarity.

GALLER: But I think it is interesting that people were willing to volunteer. It was, again, part of the culture of "We're all in this together and we want to educate people and help."

AKERA: I actually have an academic article out on SHARE, as an organization, and the theme of the paper itself is about volunteerism. SHARE contributed, I think, to a voluntary ethos within the computing field. They felt voluntarism to be absolutely necessary for the well-being of the organization and the field. I was wondering if you could comment. Was the sense of volunteerism an important aspect of the field, and of ACM during this period?

GALLER: I think it's related to the fact that we shared programs all over the place. I wrote a letter to the *Communications* once, which people have quoted back to me, objecting to people starting to charge for programs, because we had all shared everything, and I thought [charging for programs] was changing the culture. It was inevitable. It was a change. A new model of business. But it was a change, and I liked things the way it was. Everybody was in it. Everybody was contributing. Nobody at that time depended on [programming] for their livelihood. They were running computers and so on, but everybody benefited from sharing everything. It all changed.¹¹

¹¹ This comment undoubtedly relates to Dr. Galler's later involvement with the Software Patent Institute. Proponents of the free software movement would cite this letter in the *Communications* back to Galler, challenging the direction that he took with regards to software patents. But as the remarks here show, Galler apparently came to see open academic exchanges as but one viable model for software development, and that there was at least a place for software development based on a more proprietary model.

AKERA: It seems to me that the volunteering, in many ways, goes beyond simply the utilitarian ideal. Can you speak about this a little more? It must have gone beyond just the idea of sharing programs because this was useful.

GALLER: Right. Well, I think we all thought that we were helping society. I really think we saw that there were benefits to this wonderful machine. I don't know if we ever made it that explicit, but that was part of the excitement. Look at what we could do in medicine, what we would be able to do to help people see again, or to replace a knee. My gosh, these are things we could help with, with computers involved.

AKERA: And if we could develop the field rapidly, those effects would be that much more greater?

GALLER: Yes. Even otherwise, it was so exciting to see all the new things we could do, even within computing. Just from having a young man feed one deck at a time into the computer, to make it suddenly so that it could: call for the next job without him, and so on. These were good ideas.

AKERA: Then, that multiple people could use the same computer at the same time?

GALLER: Right, time-sharing and everything else. "Here's a good idea. Let's try it. It works!" And so on.

AKERA: It wasn't just about technical accomplishments. These were really accomplishments that [you felt] were meaningful to society at large.

GALLER: Right, but also personal. It was [all of the above].

AKERA: You can't separate these two things. Personal excitement comes from the fact that it's having all these impacts, right?

GALLER: That's right. The idea that someone would want to use your program is fantastic.

AKERA: Now is this consistent with the shift you made from abstract mathematics to the excitement of programming?

GALLER: I think so. As I said, mathematics is a very lonely occupation. It really wasn't the kind of person I was.

AKERA: So you really came into your own as you discovered this whole world of programming and of the kind of efficacy you could have, the effect that your work had in the world.

GALLER: I think so. The best decision I ever made was to go into computing.

AKERA: In a sense, was the interest in appealing to data processing, the larger crowd. Was that part of that same ideal, which said, "I want to have that impact"? "I want to make sure that I'm involved in all the different aspects of computing"?

GALLER: I don't know that I ever thought of myself as having impact.

AKERA: Okay. But it was just the more general excitement-- You know that there's a connection there, but that's not what's driving your actions.

GALLER: Any time anyone uses something I did, it was wonderful. I didn't do it for that reason, and suddenly, they thought something good of me or my work.

AKERA: So that was when people decided to use MAD at their computing facility?

GALLER: To use my operating system, to use MAD, to use my literature.

AKERA: To have some of that end up in FORTRAN, as IBM wrote it.

GALLER: That's right. You came across an idea, and they took some of the ideas from that and used them. Right. What a compliment. What an honor.

AKERA: [Your work in] virtual memory, which had, of course, influenced IBM's designs, if I'm correct?

GALLER: Yes, to see it adopted by IBM.

AKERA: And really end up everywhere.

GALLER: Get everywhere partly based on our success. It's wonderful. But we didn't do it to have an impact on IBM; therefore, the fact that they chose to do it was even more of an honor.

AKERA: Going back to the ACM organization, we've been speaking about the Council at various points. I wonder if we could focus on the Council a little bit more and tell me a bit about what the dynamic was like within the Council itself. Do any individuals stand out in your memory? Who were they, what did they do, what did they complain about, and whatever else?

GALLER: Herb Grosch, of course—a troublemaker all the way through. In some ways, he was a nice guy, but he was a troublemaker. I can't think of anything specific, except...well, I once had a real serious run-in with him, but I can't remember the detail right now. He's one of the ones I pounded the gavel on quite a bit. But generally, everybody was pretty helpful. I ran the meetings with quite an iron fist. I developed a methodology that people are not going to interrupt each other. If they want to speak, they raise their hand, and I put them on the list. I call people in the order on the list. It worked.

AKERA: Hence the paper mache gavel that you received?

GALLER: Well, when they didn't cooperate that way, I would gavel them. See, I used an ashtray for a while, and then they brought me a gavel. [laughter] I ran a strict meeting, and I was very gratified people would come up to me afterwards and say, "It was a good meeting. We got our business done." Again, I played "the role," as I said before.

AKERA: In fact, I think you stated in your recollections that these meetings were very lively. They were not dull administrative affairs; they were very many issues to discuss.

GALLER: They were orderly, but lively. People participated, and I encouraged it.

AKERA: Do you recall what any of the issues were at the time? Any of the issues that might have unfolded.

GALLER: Of course, we had the political business. There were budget issues.

AKERA: I'm going to ask about that in a second, but that's a big issue, isn't it?

GALLER: It was. It was heart-wrenching at the time. Suddenly, we discovered we have no money. So we were doing too much. Most of the discussions-- Well, we had this thing I mentioned before about the opening up of the artificial intelligence SIG to people not in the elite. Well, we had a range of issues that kept coming up.

AKERA: It sounds like this was part of the growing pains of the organization, right?

GALLER: Right.

AKERA: Constantly new issues. There's a lot of committees being created during this period, which I think is a symptom of organizations undergoing change. And really trying to make a lot of decisions. Publications.

GALLER: Yes, and dealing with AFIPS because AFIPS was starting to get a lot of money. There was one bitter argument where in the minutes of one of the meetings, there was a decision to distribute, I never remember whether it was \$100,000 or \$400,000. But the following meeting, people remembered it differently. There was a big argument as to whether the minutes were right or whatever it was and so on. There was a lot of money involved. So there were some strong feelings about that, because the people in the main organizations didn't want to share with all the other organizations.¹²

AKERA: ...the other organizations that otherwise could have become AFIPS members. I'm going to ask about AFIPS in a second. Just staying with the internal conflicts for a second, did you have any staunch allies? Specific people that tended to back you up a lot and really were very helpful on the council?

GALLER: Yes, Jean Sammet and Aaron Finerman in particular. One of the times when I had a real strong problem with Herb Grosch, I went to argue with him, and I took Jean along as a witness. Subsequently, at the Council meeting, it was good that Jean was able to back me up as

¹² During Galler's administration, there was apparently a change in the AFIPS constitution, as endorsed by Galler and the other ACM representatives to AFIPS, which made it easier for other organizations to become affiliated with AFIPS, but where the revenues from the Spring and Fall Joint Computer Conferences would continue to be disbursed among the organizations that created these conferences (IEEE and ACM). See Galler, "The AFIPS Constitution," President's letter to the ACM membership, *Communications of the ACM* **12** (1969): 188.

to what had been said. You know, that sort of thing. And Aaron, of course, was my best friend. I brought him to Michigan, you remember, and he's the one who got me into the *Annals [of the History of Computing]* businesses. So that was a strong friendship. I really can't think of anybody who I wouldn't call a friend of mine. Everybody was good.

AKERA: That's what Dr. Oettinger said as well. There were heated issues that came up, but nonetheless, this was at the same time, a very congenial group. The sense that everybody was working together for a common cause. There were some disagreements, but it remained a common cause.

GALLER: Yes.

AKERA: For instance, I noticed that Richard Canning ran opposite you. But when the decision came up, I forget whether it was the ACM delegates to AFIPS or whatever, you chose to include him as a delegate...

GALLER: It was in one of the letters.

AKERA: Yes, and the two of you let another person become a delegate. I think it was Don Madden.

GALLER: Yes, to AFIPS.

AKERA: Yes, I guess it was AFIPS. Yes, become the official ACM reps to AFIPS. So as much as people would represent different point of views, you also worked together.

GALLER: Oh, sure.

AKERA: That's great. Now, let me ask this about publications and editorial boards. What were some of the issues, other than the color of the cover of the *Communications*?

GALLER: Right. The big issue was who would make the decisions, right? If you had to allocate money, money meant--

AKERA: So it really was about allocation issues? Money allocation issues?

GALLER: Yes, a lot of it was there. Which were the important ones? Who should get them? Which ones should all the members get?

AKERA: Right. "Which were the important ones?" meaning which publication?

GALLER: Yes, which publication.

AKERA: In fact, tied to the issue of "which publications are automatically sent as a benefit of membership," and which ones...

GALLER: ...that was really, "Who are we?" Right?

AKERA: Because in other words... please, go ahead and proceed.

GALLER: In other words, as you started to say, was this an academic organization that should send a journal to everybody whether they liked it or not? Or could they opt out of that and choose something else? It came down to money. Money and who are we. I think we settled it okay.

AKERA: How did you settle it?

GALLER: I was reminded by reading these letters. Everything became optional.

[Tape 2B begins]

GALLER: I was reminded by reading my letter to the membership at the time that the solution was pretty ingenious, that everybody got the *Communications*, because we needed something that we could communicate to everybody with. And then we gave a credit, which meant that they could choose one other publication. Now, as remarked there, there were people who said, "Well, the *Journal* will go out of business." But we felt that there were enough people who would want it, and of course libraries subscribed and paid for a lot of it, and so on.

AKERA: So you gave a seven-dollar credit and priced the *Journal* at seven dollars, the *ACM Computing Surveys* at seven dollars, I believe--

GALLER: Yes, we made them sort of coequal in terms of [price]--

AKERA: Yes, and the *Computing Reviews* was priced at \$12.50, only because it was a monthly publication and cost more to produce.

GALLER: It cost more, right. And we felt that that was something important for people and they'd be willing to pay more. Right.

AKERA: Now, actually, on the original decision—what we discussed here was the final outcome, which I think really helped settle things—but if I recall, the original decision was to replace the *Journal of the ACM* with the *Computing Surveys*. Is that right?

GALLER: I don't remember about the replacement.

AKERA: And I believe the council itself approved this. And this was to say that all the members were now going to receive the *Surveys* because that was more important to the aggregate membership. There were more people in the general programming side who presented complaints that most members simply couldn't read the *Journal* or even the *Computing Reviews*. What was decided first was that the *Journal* would be priced at three dollars so that...

GALLER: ...it'd be easy for people to choose to get it.

AKERA: ...to get it as well, which meant that that ensured the survival of the *Journal* and that the council itself then offered to continue subsidizing the *Journal*, or to do whatever was necessary to make sure that it stayed alive until it fully carried itself.

GALLER: I really don't remember those discussions.

AKERA: I think what happened was that there was this initial compromise, and then the budgetary problems cropped up, and then you realized that you couldn't do that, and you had to have a more radical solution.

Now that we have the topic on the table, perhaps you could tell us about the financial crisis that ACM experienced. In particular, and in building on the Oettinger interview, it seems that Tony Oettinger really launched a very wide array of new membership services, which you inherited. You had to deal with the consequences of the expansionist program that Oettinger put in place.

GALLER: I think that's right. I didn't really remember it. I must have suppressed that, but it's coming back through reading my old letters and so on. All I remember is a meeting in February some year, maybe '70, which was really very painful, just because we realized that we've got to do something.

AKERA: Can you tell us specifically what happened, how you got notified?

GALLER: No. I don't remember, I'm sorry, any details.

AKERA: The ACM office, of course, was handling the daily affairs, and it's the Executive Director who then reported on the financial... was it...

GALLER: Madden.

AKERA: Madden, yes, who then reported to you that, "Wait, the budget projections are showing that we're going to be in major deficit by the end of the year given all the programs."

GALLER: Yes, I think that's right. I don't remember; did we call a special meeting on the budget?

AKERA: I believe it was. It had to be an emergency meeting of the Council. I think you met separately with the Executive Committee first, and then--

GALLER: Sure, right.

AKERA: Can you tell us something about the painful nature of this?. Whatever you can--

GALLER: I think I'm suppressing it all. What I remember is from reading my old letters to the membership, but it was a traumatic time. But again, everybody was in it together. We just had to make hard decisions.

AKERA: In other words, it seems, just from your letters to the membership, that once the financial crisis hit, everybody really tried to hold on to their particular part of the pie, and hence the phrase, “What’s yours?”¹³ Everybody wanted to preserve their part of the new initiatives, or the established programs, and realized that they couldn’t. Ultimately, that wasn’t possible. That would have meant increasing the membership dues to \$40, which by doing so you would have lost many of the regular members who couldn’t afford to pay this. They were just the regular programmers who weren’t making enough money.

GALLER: Right. I don’t remember any aspect of who’s to blame. I think whatever disagreements there were, were on what to do about it.

AKERA: Yes. It was just sort of an organization trying to deal with this situation [that had to be dealt with]. Do you recall any of the specific compromises that were made, or in fact, some of the difficult decisions that had to be made?

GALLER: Only what I’ve read. I’m sure you know more than I do by now.

AKERA: Only from reading it, and trying to memorize it all, I suppose! But I guess just for the record, some of the decisions were that you had to close the new reference service that you just opened up. ACM had some reference documents, and this was the precursor to the central library, I guess. You had also hired a coordinator for the national conferences and the national lectureship series, and that now had to go back to a voluntary function. There were some other changes, I forget the details, but there were some specific cuts within the ACM central office that had to happen. Separately, then, there was the compromise about the publications, really, the decision that, you know, “We’ll just do the seven-dollar credit. That’s what we can afford.” Oh, and then the other most important piece: part of what caused the fiscal crisis was the fact that the lectureship series was not as well attended as the Council had hoped. And there was also the new national workshops; I forget what exactly they were called. But the attendance wasn’t what the ACM had hoped for, and as a consequence, the budget forecast was simply wrong. It didn’t match...

GALLER: They must have been the workshops, because there was no revenue attached to the national lectureships.

AKERA: That’s right. It must be just the workshops. Well, except I think that it must be simply the cost of the lectureships, because one of the-- No, you’re right, it is just the workshop. And the concrete decision was made to offer the workshops only in the biggest cities, where you’re most likely to get a sizable audience. Then the Council passed a specific resolution, it was a reaffirmation, really, saying that all of these activities should in principle be no-loss centers--whatever that phrase was.

GALLER: Cost centers.

AKERA: Not necessarily cost centers. They can’t be cost centers. They didn’t have to make profits, but they had to be able to make all of the revenues they need to keep the operation going.

¹³ Galler, “‘What’s Yours?’,” *Communications of the ACM* **12** (1969): 359.

GALLER: Yes, in that sense, right.

AKERA: Yes. And I think that was the governing decision that then made it possible to develop a compromise and say, “Well, if these publications have to fit within a budget, then what is the final compromise we have to come up with?”

But associated with all this is an issue that we’ve been talking about throughout this interview, which has to do with the willingness of programmers to take on this continuing education, training, and a professional development function. In this respect, by the end of either your tenure, or some years afterwards and perhaps in hindsight, did you feel that the ACM had overstretched itself, and that it was trying to really offer education to a group that really wasn’t ready to be brought in to ACM in that way?

GALLER: I guess I don’t remember thinking...

AKERA: It was still a very good mission. This is a tough question, but it’s related to the budget, and I think there was a kind of disappointment.

GALLER: See, if the workshops didn’t work out, it was maybe the wrong mechanism, not because I blame the people.

AKERA: No, and on a larger scale, it’s sort of understandable. These are people with full-time jobs. If they don’t have to, they don’t necessarily want to sign up and pay for a course, especially if their employers aren’t paying, and they are paying for their own continuing education.

GALLER: And if they don’t see that this workshop is something that will benefit them, right?

AKERA: Yes. So this really took some time to develop, I think, in other fields. For example, in our K-12 education, teachers are mandated by the state-- you have to go through continuous retraining, and then there’s a very concrete, regulatory state mechanism for enforcing that.

GALLER: Right. We have nothing like that. It was purely voluntary.

AKERA: That’s right, and especially because computer science itself did not professionalize with that kind of model.

GALLER: Right. And employers probably weren’t that motivated to pay for their people because they’re doing the job, and employers didn’t understand what they were doing anyway.

AKERA: I think that was some of the challenges that ACM faced, and the only way around it was to more explicitly take on these professional constraint models, which ACM as an organization was unwilling to do.

But one of the issues of this sort that did come up was where ACM was going to take a stand, and was going to try to put a cap on some of the “fly by night” operations.

GALLER: Yes, accreditation.

AKERA: Yes. Well, some of the accreditation... Can you tell us something more about this, and how you became involved?

GALLER: The name LaSalle comes to mind, that there was some sort of school that advertised, "We'll give you a degree," or whatever, in programming, yes. And we felt that it was a scam, and that's when we began to pay attention to, one: ethical guidelines, and also: accreditation.

AKERA: Now, how far did you get on that? How far did ACM get as an organization on the issues of accreditation?

GALLER: Well, we put out ethical guidelines—which, by the way, is different from a code of ethics. We recognized that difference. And later on, I think ACM, three years later, got a code. We thought it was useful. By the way, I looked at ethical codes from some engineering and other organizations; I was appalled by some of them.

AKERA: Some are self-interested.

GALLER: Very self-interested, yes.

AKERA: About preserving the profession.

GALLER: "You will not compete with somebody else in our..."

AKERA: A fellow member.

GALLER: Yes. So that was one thing that came out of it, I think.

AKERA: So there really were certain academic values, and also, more basic than that, underlying social values and commitments about improving society that went against the grain of more traditional models of protecting a profession?

GALLER: Yes. And the accreditation thing was not so much that we wanted to license our members, because we didn't think we could do that, but we wanted to help members know that if they went to a school, that it was a real thing.

AKERA: So you really had the members first and foremost in your mind. And people who were going into programming, and you didn't want them to be misled by all of these workshops that were showing up all over the place.

GALLER: Right. We were not trying to drive people out of business who were doing a real job.

AKERA: Now, did you ever get any complaints that ACM was stepping in and running these workshops, whereas other private companies were also trying to offer computer classes at the time. A sort of reverse concern?

GALLER: I don't think so. We never really did much that others were trying to do. I don't think so.

AKERA: So ACM didn't push for certificates or whatever-- I imagine, computer science faculty members didn't push for this...

GALLER: Right, but the CDP, I think, Certificate of Data Processing... I never thought it was very important and never really-- I don't know that anyone's ever going to...

AKERA: Who issued this?

GALLER: Somebody.

AKERA: But not ACM?

GALLER: Not ACM. It was a separate thing.

AKERA: Was there anything ACM ever issued? They never came up with an actual accreditation process, but it came up with some kind of guidelines?

GALLER: Well, yes, but as far as these fly-by-night schools, I think somehow we had a committee or whatever, but I think they cooperated with state accreditation-type [entities].

AKERA: So there was some active work on the political front.

GALLER: There was, yes.

AKERA: Now, why did ACM choose to issue professional guidelines as opposed to a code of ethics?

GALLER: Well, the argument was made that if you have a code and somebody gets fired for whistle blowing or whatever it is, you're going to have to pay a salary or whatever. You are responsible for the guy who says, "I followed your code," so we couldn't afford that.

AKERA: So there were broad liability issues probably going beyond this as well. So it was explicitly something that came up in conversation?

GALLER: Oh yes.

AKERA: Now, was there any dissent within the organization? Or once ACM discovered the legal ramifications, did people sort of gravitate to the 'guidelines' approach?

GALLER: I'm not even sure everybody thought we needed guidelines, so we just did it. Nobody objected to it.

AKERA: So whichever committee came up with it--

GALLER: Yes. We just did it. Right, right.

AKERA: Good, good. That covers a lot of ground.

[pause in recording]

AKERA: Dr. Galler, I'd like to pick up where we left off and actually move just a couple steps backwards and go back to the issue of the ACM's local chapters. One thing I wanted to ask was whether there were any particularly active local chapters at the time. In particular, I'm thinking of the Los Angeles chapters or the West Coast activities and whether in some sense they were more active than some of the other chapters around the country.

GALLER: I don't really remember that that well. Of course, there was a lot of early non-ACM activity on the West Coast, the [computer] clubs and things. There was a lot of communication on the West Coast, which was very important in developing-- well, maybe I was thinking later, about the personal computer and things like this.

AKERA: I'm thinking in an earlier era. I'd like to focus on the period of the mainframes.

GALLER: I just don't recall any particular chapters.

AKERA: Paul Armer, for instance, came from the West Coast; rather, southern California, where the aviation industry was very influential in the early use of computers. And I think some of the earliest work in systems programming—not the research based in universities, but coming from the industrial sector—really took off first in California. Just sort of going back, were the California contingent-- representatives to ACM particularly active in ACM at the time?

GALLER: Nothing geographical comes to mind in that sense. There were people who were active and so on, but I never thought of them as coming from a particular place, nor do I recall any tensions.

AKERA: Just sort of going through your mind, the various names, the people that were involved in the Council, in the editorial board--

GALLER: Yes, like Paul Armer was always active, sure.

AKERA: What was the composition? How many folks were from the East Coast, and how many from the West Coast?

GALLER: Well first, as I say, I never thought of them--

AKERA: Yes, but to push this...

GALLER: Well, I think George Glaser, for example, was San Francisco. McKinsey and so on. Armer, of course. But we'd also have people from the East Coast and the Boston area.

AKERA: Absolutely. Because ACM definitely starts as more of-- in fact, its original name is the *Eastern Association of Computing Machinery*, although “Eastern” was dropped early on. This wasn’t in order to be exclusive; it was simply that because of the cost of transportation—this was before air flight became real common—it was felt that... In fact, this really is part of the reason why ACM had a regional orientation to start with in its constitution and bylaws. So absolutely, there were many eastern representatives. There were representatives from everywhere across the country built into the very structure of ACM. Nonetheless, if you also think about individuals such as Richard Canning--

GALLER: Right, he was also California.

AKERA: Who is Donn Parker? Where was he from?

GALLER: I’m not sure where he’s from. I always associate him with the West Coast, with SRI.

AKERA: Yes, that’s what I mean. So at least there was a substantial number of West Coast individuals active within ACM. Now, was there any difference in the character of the West Coast as opposed to East Coast representatives in terms of what their background was, what kind of technical work within ACM they tended to get involved in?

GALLER: It’s interesting. I would have to go down a list, because I always thought of them as individuals, and I would have to start thinking who was from the west to answer that question. But I never thought that way.

AKERA: Sure, and that’s your sense of how you looked at the field and its individuals back at the time that you were president?

GALLER: Sure, right. I mean, we were always aware. I think we were more aware of academics versus industrial. Not that it made a big difference, but we were aware of it.

AKERA: Aware that there were different types of participants and that you’re cooperating together?

GALLER: Yes, right. But the fact that somebody came from UCLA, he was an academic. If he came from Georgia Tech, he was an academic. If he came from Westinghouse, okay. But where they were geographically never entered into anything.

AKERA: Now, it strikes me that that is in fact part of academic culture, that once you create a disciplinary or professional organization, it’s not about their ‘location’-- at some level, you’re always aware of their affiliation, but the first thing is that you treat them as individual scholars or as individual researchers, whatever.

GALLER: Right, or you might think of a university as sort of a top-level university, but not where the university’s located, for example.

AKERA: I would love to get into some of this. This wasn’t one of the questions I asked, but--

GALLER: Well, it would be an interesting question to investigate, because you have better communication among the people on the West Coast, among that group, but--

AKERA: That's right, especially going back to the tradition of SHARE again, which, again, is a national organization, but had its roots within the West Coast installations.

GALLER: Yes, but I never thought of that either, because, actually, SHARE was very closely tied to IBM, which was east.

AKERA: Yes, that's right. No, this is good. This is all stuff for historians to sort out afterwards, too, I think.

GALLER: Well, there are some interesting questions here.

AKERA: Yesterday we spoke about the difference between the academics (during the origin of the field) and the much larger number of programmers that were sort of entering into the field and profession. It seems to me that if you were to look inside ACM as an organization, you would see other gradations of, again, not necessarily a hierarchy, but differences in people's backgrounds. Can you comment on this a little bit? I mean, given that there were both industrial representatives and academics involved, what tended to be some of the differences in their interests or backgrounds or attitude towards computing?

GALLER: Well, I think some of these differences affected the SIGs, for example, whether they were more research-oriented, or more application-oriented. I think this came to a head, sort of-- I keep remembering this artificial intelligence thing where the elite tried to keep others out, and they were heavily into AI research, and actually later there was a split in the AI community between research, and starting companies, and so on. But I think that would have been the main thing that--

AKERA: In fact, was that something—speaking specifically about SIG AI—were they particularly concerned about certain people from industry corrupting the academic purity of the field at the time?

GALLER: No, I don't think it was industry. I think it was people who weren't doing the research but maybe had been interested in learning about it and so on, and getting involved.

AKERA: So they didn't want to water down the "quality"—in their perspective—"quality" of the conversations within their SIG meetings?

GALLER: Yes, I'm sure that was the kind of thing.

AKERA: So they really saw it as a very exciting—the most advanced aspect of computer science research—and wanted to use ACM meetings to really define their research agenda and not have to explain things to new members?¹⁴

¹⁴ I didn't make the connection during the interview, but the concern here was apparently with novices, such as amateur astronomers and their relationship to those who carry out research in astronomy.

GALLER: Yes, I think that's right. Yes.

AKERA: Now, did you yourself take a position in this debate? I know you mentioned this yesterday.

GALLER: Yes, well, my position was, since part of our mission was to educate people, the way to educate newcomers is to bring them into the community of old-comers, so I wanted to be as inclusive at every level of ACM. Chapters, SIGs, and so on.

AKERA: Yes. Now, artificial intelligence did of course become quite a serious sub-field of computer science, if not the governing field, in some ways. I assume the SIG was still forced to open its meetings to all members?

GALLER: Yes.

AKERA: Now, once that happened, what happened to that SIG? Being involved in computer science, I imagine you know many of these top AI researchers, as individuals. Did they continue to use ACM and its SIG AI as their means of communication, or did they create a separate organization, or separate means of interacting as just academic researchers?

GALLER: I think it became more like the other SIGs, but they also started to form companies.

AKERA: So once it became more corporate, some of the blurred boundaries became more important [even within this field].

GALLER: Right. And I think they had many forms of communication outside ACM.

AKERA: Now, what is the leading journal in artificial intelligence. Or at least was in the early '70s?

GALLER: I don't even know.

AKERA: Okay. And I was wondering whether that would have been an ACM publication.

GALLER: I don't know. I was never directly involved. That was not my field. I tried to keep up with what they were doing. They had many cycles of success and failure and hyperbole and so on.

AKERA: Now, it strikes me that the SIGs themselves were almost like a pressure release valve for the organization. That as it grew more diverse, individuals with different kinds of academic or professional and industrial orientation could create their own groups to really sort of focus on their own area of interest.

GALLER: That's right, and then they began to have their own conferences and so on, and as that developed, of course, the national conferences fell into, not disrepute, but stopped being offered.

AKERA: Became less relevant in the perception of individual members.

GALLER: That's right.

AKERA: Now, when did that transition happen? This is going outside your tenure, I understand, but when did the national meetings start becoming less popular, and also the joint computer conferences?

GALLER: I would think by the late '70s they were already declining.

AKERA: Now, did one or the other decline first as far as the JCC or the [ACM national meetings]?

GALLER: Well, the joint computer conferences, its first year, was east and west and so on, and then there was spring and fall, but then it became one national. We couldn't sustain two. And finally, that disappeared.

AKERA: Now, did that disappear first, or did the ACM national meeting disappear first?

GALLER: I think the AFIPS national one, which was big and top-heavy, I think, disappeared first. Then the ACM...

AKERA: ...continued to meet in annual, national meetings just because you were a professional society.

GALLER: Right. But then there was a different one, which was more oriented toward jobs and things.

AKERA: Which was...?

GALLER: I don't remember. There was a subsidiary ACM conference.

AKERA: Oh, so it was run by ACM?

GALLER: Yes.

AKERA: But specifically for the purpose of jobs and--

GALLER: I think so.

AKERA: Now, where did the trade shows migrate to, given that...

GALLER: Well, that went over to Comdex. Comdex became the big one.

AKERA: And that really was run more by the industrial sponsors and was really about showing off equipment and software packages. So that became more of, itself, a kind of role specialization within the field.

GALLER: Right. One interesting anecdote about the national computer conferences—it was interesting that AFIPS was running it. The exhibitors, the vendors, were putting more and more money into flashy exhibits and dancing girls and everything else, and finally a group came to us at the AFIPS board and said, “Tell us we can’t do that. We need you to tell us not to do it,” because it was getting very expensive, and if they all did it, nobody won.

AKERA: So it was too expensive even for the industry at that point.

GALLER: For the industry, especially for smaller companies.

AKERA: And was that a majority position? Did you get consensus on that?

GALLER: Oh, on the AFIPS board, yes. I’m not sure that all the vendors would have agreed, but we began ourselves to feel it was getting out of hand.

AKERA: And that it was totally overshadowing the technical program, and as a consequence, that the meetings didn’t serve an academic function.

GALLER: Right. The technical program got worse and worse, fewer papers and things like that; the exhibits were growing; and that was part of why the conference itself finally collapsed.

AKERA: So [perhaps the vendors] themselves had an intuition about that. Of course, they [just] moved to Comdex.

Going back to the SIGs and the SICs at the time, were there any other SIGs that were particularly active that you can recall?

GALLER: Well, programming languages, graphics. I think the social implications became more and more important, and business data processing.

AKERA: You mentioned that SIGPLAN [Programming Languages] was the most important--

GALLER: It was. I think as graphics began to get bigger and get more money, because their conferences really attracted people, I think programming languages got less important.

AKERA: Perhaps more esoteric-- it wasn’t esoteric, but it was an academic field in many ways.

GALLER: Yes. And languages began to settle down some. I mean, there wasn’t that big push--

AKERA: The dynamism of the early-- just to figure out the basic issues of computer languages.

GALLER: Yes. SIGOPS (operating systems) got to be important. They were doing interesting work on operating systems.

AKERA: Now, in a second, I'll ask you to speak about several of these. But with regards to SIGOPS, who were the members of SIGOPS? Who did they tend to be?

GALLER: I think there was certainly a mixture of academic and industry.

AKERA: And for industry, possibly a large number of systems administrators who were responsible for getting their systems up and running? Is that it?

GALLER: Maybe. I don't really remember. Again, I was not directly involved particularly, but I used to read their newsletter and found a lot of interesting things there. But at this point, I'm not aware who was doing it.

AKERA: It is hard to know who is in the individual membership. As organizations get larger, it's harder to keep track of things in both directions, right, which you've spoken about already.

Given that, could you tell us about some of these special interest groups, just what kind of work they did during this period? Not to say just during your time as president, but spanning a couple years on either side. SIGGRAPH, what made SIGGRAPH such a dynamic entity at the time?

GALLER: Well, of course, as storage got cheaper, people could spend more storage and speed to take advantage of graphics. It really blossomed with movies and commercials and things like this. People saw that very, very sophisticated graphics could be accomplished, animation and everything else.

AKERA: There were a lot of very new techniques to develop, it sounds like, including three-dimensional graphics. Now, in the '68-'70 timeframe, I imagine the technology was still fairly rudimentary. You're beginning to develop the graphical systems that work with real-time scientific data.

GALLER: Yes, the weather people needed a way to present all that data they were presenting so that people could understand it. They were running on the main, big supercomputers, especially the supercomputer centers, and you could almost trace a line there to Netscape and Mosaic and so on, where they needed to present things on the screen. So that was an important development.

AKERA: So really just using the bandwidth of visual communications to be able to process information in a much different way than just tables and charts and that sort of thing.

GALLER: Right.

AKERA: Now, if I recall correctly, the University of Michigan itself was involved in some of this work; particularly, Frank Westervelt, is that correct? He did do some work in this area?

GALLER: Yes, but more operating system stuff that he was involved in. He was in mechanical engineering. Yes, he was at [Michigan's] Computing Center also, and he was one involved with all the operating system stuff.

AKERA: Okay, so not so much the graphics, but in that case, in SIGOPS?

GALLER: I think that's right. Bert Herzog was more in graphics.

AKERA: Yes, I never followed this link, but I did come across a reference that said that Westervelt received one of their early ARPA contracts to do some work on computer graphics.

GALLER: Yes, in the ConComp Project. That was partly graphics. They were really almost more interested in cooperation among networked computers.

AKERA: The machines, okay. So sort of extending real-time, high-speed response--

GALLER: Right, and graphics was one of the things they were trying to communicate.

AKERA: Was one of the elements. So who was the person at Michigan that became active in graphics?

GALLER: Bert Herzog. In fact, he still lives in Ann Arbor, but he is in the process of moving to Arizona.

AKERA: That would be a good choice!¹⁵ Now, was he involved with ACM at the time?

GALLER: Not that I recall. I mean, he may have been, but he was not one of the Council-type people.

AKERA: Okay. What about the SIG Business Data Processing? What were they doing?

GALLER: I think Canning was involved in that.

AKERA: Yes, I think that's right. What were the issues they were facing?

GALLER: Well, I think they were involved with building databases and data management systems, and to the extent that they were looking at it as important systems and so on, it was more ACM oriented as opposed to data processing management, DPMA. So they were sort of in the intersection of the two organizations, but I think the SIG BDP was trying to take a more engineering type view of what they were doing.

AKERA: Right, and, I imagine, also systems programming, that to get these systems running, to use more advanced computer programming techniques and concepts to really make business systems efficient?

GALLER: I'm sure they were, right.

AKERA: Now, just to do this historically, this would have been at the time that IBM was releasing its major System/360 systems, and of course, as a consequence, there's a tremendous

¹⁵ The interview took place in winter, in Michigan. Actually, it was a very nice, sunny day.

growth in the use of computers within the corporate sector in the United States. So would that have influenced [SIG BDP's activities]...?

GALLER: I think so. Another interesting thing that was happening right at that time, 1965, when the 360 system came out, and this was to combine scientific and business computing. Remember, they had the 704 line and the 705 line. IBM didn't want to maintain two separate lines. So in '65 there was a big push to bring people together and to use the same systems and so on, and I think they had a lot to do with it.

AKERA: So in part, the SIG BDP had to work with [IBM on] that merger to make sure that these new [computers and] operating systems remained responsive to the kinds of needs that they had.

GALLER: I think so, but you really ought to talk to those people.

AKERA: Yes, of course. This is just to capture your perceptions on these issues. And then, finally, perhaps, the SIC², Special Interest Committee on the Social Implications of Computing. So what did that group do during this period?

GALLER: I think they were concerned with issues like bringing women into the field and probably minorities, although I don't remember. I don't think privacy was that much of an issue yet at that time. I can't recall.

AKERA: Now, of course, there was the area you yourself became very involved in with intellectual property rights, but that might be outside the realm of the social implications group.

GALLER: I think so. You know, intellectual property rights didn't really become an issue until you could copyright and patent things, and that was 1980 and '81. So in the period we're talking about, everything was exchanged freely and so there wasn't much about that.

AKERA: Right. Now, the one other possible issue is about workplace automation and job loss—those kinds of issues. Was that discussed within either that special interest committee or within ACM at large?

GALLER: I don't think that much. When I first got into computing, I used to be very concerned about this question, and I remember looking at a lot of government documents. There was a lot of concern that there would be job loss, and I think people began to realize, yes, there's job loss, but there are more jobs created, just different ones. And there is the problem with the person who's laid off who doesn't have the education to participate in the increase. That may have been part of what the committee was worried about. I don't really recall.

AKERA: Sure, because it really translates into a retraining issue, and our economic structure isn't set up to do so. Now, did ACM ever engage in any educational activities, working with an educational committee to address this issue--

GALLER: A retraining committee?

AKERA: Yes, so -- because in many ways, that would be at a different level than programmer training. I know that ACM was very involved in programmer training, but did it ever --

GALLER: I don't think so. I don't recall if that ever came up as a recognizable problem.

AKERA: Or at least something ACM could address?

GALLER: Yes, right. We probably should have. But I think people tended to think more in terms of a net increase, and not worry so much about those people, which is unfortunate.

AKERA: Yes, but I think it is in the nature of our economic system, in part. I think one place where ACM was involved, though, was in secondary education. That its work was not limited just to the collegiate level, or post-graduate and graduate development.

GALLER: First of all, that's a function of individual people who say, "This is important. I will get involved." And if someone is involved, then they can convince others that this is important.

AKERA: Yes. It seems a lot of that work was in fact done at the level of committees or local chapters.

GALLER: I guess so. But I remember there were a few people who were very active, and I tried to support that.

AKERA: About high school education—to make sure that some ACM individuals went into the high schools and talked about the appeal of computing. I think this was as much about the sense of dearth of programmers, that there were these programmer shortages and you needed more people to be involved, and you might as well recruit early to get them. You know, it follows the same rhetoric as about getting US students more interested in science and engineering, or in mathematics, and I think some of those initiatives carried over into computing, in particular, just because there were very dire programmer shortages throughout this period.

GALLER: Right. And I'm pleased to see another article in the paper yesterday about jobs being created, especially in Silicon Valley.

AKERA: That's right. Okay, let me move on just a little bit. So this is a thesis that Dr. Oettinger had, and I'd love to have you comment on it: He said, especially with regards to ACM's publications as well as the work on the ethical guidelines for the ACM, that he felt some of this work was addressing genuine concerns about technical manpower and professional standards. But he also felt that it was definitely part of an effort to bring more credential to the field. That it was really about establishing computer science as a discipline. And in his view, the *Computing Reviews*, the *ACM Journal*, which, of course starts earlier, was all about this. Is that a fair characterization? Or were these all addressing [specific technical concerns?]

GALLER: I'm not sure I understand the distinction he's making. Say it again.

AKERA: Okay. He actually stated this fairly strongly. The particular issue was whether or not to distribute the *Journal* to all of the membership. And as we mentioned yesterday, many

members felt they couldn't read the *Journal*. They couldn't follow the *Journal* or the *Computing Reviews*. Some even complained they couldn't follow the *Communications*. Yet there was the academic contingent within the ACM that really wanted to help build up computer science as a discipline back at their university, and such.

GALLER: Oh, and saw the publications as necessary to establish computer science as a discipline?

AKERA: That's right. And also, that backtracking would be very bad. To say that ACM no longer publishes a journal that all of the members would have to have would in some sense say that computing was not really a true academic science or discipline, right? That was his thesis, that with ACM, these people needed to push this because computer science was not yet established well enough as a discipline.

GALLER: I'm not that cynical. I think Oettinger is perhaps more attuned to the politics of things because he comes from an East Coast university. We were trying to establish computer science as a discipline, and we probably pointed to the publications that we had and so on. But I would not argue—I'm sure I didn't think this at the time—that the publications had to be supported because we needed them for that purpose. We had them. This was who we are. No, my view was that the publications were a way to make the people who are doing the work in the field more productive and more understanding.

AKERA: It was a genuine mechanism of technical communication, which, of course, it always is at one level. One doesn't preclude the other.

GALLER: Right. But I do not remember ever feeling that we needed the publications to help us establish computer science. We didn't deserve to be a scientific discipline if we couldn't argue that the work we were doing was worth doing.

AKERA: I am not at all surprised that that was your attitude at the time. Do you think there were people inside ACM that might have fit Oettinger's characterization?

GALLER: Well, there always might have been, but nobody ever--

AKERA: You didn't feel it at the time.

GALLER: I didn't feel it and I don't think anybody argued that to me. I don't recall anything like that at all.

AKERA: That's good. That's very good. Wonderful. Now, let me get to, just because we mentioned it yesterday, the ACM Lectureship Committee. You were involved in that from fairly early on. Can you tell us a little bit more about what this lectureship committee was, how it grew, and what its purpose was?

GALLER: I hardly remember that. We had a good idea that we should do it. I remember I was one of the very early individuals pushing the idea. I don't remember who else was involved at the time. It was just something that was good and we did it. I think we always had support from

the Council, and ACM bore a lot of the expense. I think the idea was we'll get the lecturer to the site, and then they cover the local expenses.

AKERA: So you were just one of several members who were very active in making this happen, and sustaining it?

GALLER: I guess so. I don't remember if there were others. I always thought I was--

AKERA: Were you the one that created it?

GALLER: I think I was. I recall that I was the main one, but there must have been other people. I don't know. Was there a committee? Do you have any idea?

AKERA: There was a lectureship committee.

GALLER: And do you have any names on the committee?

AKERA: I don't have that with me today, but yes.

GALLER: I don't want to insult the other members involved.

AKERA: No, we will acknowledge them if we can.¹⁶

GALLER: Sure, yes.

AKERA: Now, during your tenure as president, or I guess it was under Dr. Oettinger's administration, the decision was made to hire somebody to be the lectureship coordinator, and then under your...

GALLER: ...we eliminated it for budget reasons.

AKERA: You had to do it for budget reasons, yes, and had to turn this back into a voluntary function.

GALLER: Let me just point out that the decision to hire somebody reflects the importance that the organization felt about it.

AKERA: That's right, and really the scale that it had grown too. There were some 50 people on the lecture circuit, I believe, all of whom had to be coordinated and reimbursed for their travel.

GALLER: Right, and all of whom were volunteers. This shows not only that the organization felt it was important, but that the experts we were drawing on felt it was important and worth doing.

¹⁶ From the records I had available, other ACM members who might have been involved are J. Daniel Couger and Robert F. Rosin, who were the co-chairs of the Lectureship Series Committee as of September 1968. "ACM Committees and Chairmen," *Communications of the ACM* **11** (1968): 726-727.

AKERA: When you had to fold the scheduling back into a voluntary function of an ACM committee, did this hurt the program, or did you find a way to keep it going?

GALLER: I don't recall that it hurt it. Maybe it didn't grow as fast.

AKERA: Or some people had to volunteer and work a little harder. You had to recruit some people to do it.

GALLER: Right. It's still going, I think, isn't it?

AKERA: I think so, yes. I asked this in the wrong order. Let me just ask this. Since we're talking again about the fiscal crisis within ACM at the time, I'd like to just sort of come back to the general issue, and bring that conversation to a closure.

Was there anything else that sort of got hurt, or had to be curtailed as a consequence of the [budget cuts]--

[Tape 3A begins]

AKERA: You were saying?

GALLER: Yes, about the budget. I think cutting back some of the publications and cutting back some of the staff and just generally making everybody aware that there was a problem and that we better keep an eye on it. I think [that] is what happened.

AKERA: There were some new principles established that really helped you maintain that balance, in a sense.

GALLER: Right.

AKERA: Related to that, my understanding is that you had to change some of the budgetary procedures. Dr. Oettinger mentioned that he helped introduce new accounting practices into ACM. That the treasurer of ACM used to carry the entire account of ACM in his back pocket, and that when he became President of the ACM, that he really worked very closely with the treasurer at the time, Walter Hoffman, to introduce modern corporate accounting practices. I guess it wasn't just a double entry thing, but that you maintained information on anticipated income and anticipated expenditures, and forecast what the balance would be at the end of the year. This allowed you to maintain a current account balance, which, of course, gives you no absolute foresight. But this apparently wasn't enough. Were there any specific changes that you had to introduce, in order to bring these numbers into line?

GALLER: I don't recall it. Hoffman, of course, was an academic. The budget had not gotten big enough to really require attention in that way.

AKERA: Hire a professional accountant and whatever?

GALLER: Right. We realized that we had to do something, and it was better, but I don't remember any specific changes.

AKERA: When you say he was an academic, he was an academic in computing, not an academic in the business school or such?

GALLER: Right. I might mention that he died around that time, maybe a little later. There were at least a thousand people at his funeral—he was a very popular person, he was really nice. He was at Wayne State, so I was able to go.

AKERA: Oh, I see. What was his field?

GALLER: I don't recall right now.

AKERA: Okay. From the historical record, what I found is that one change that was made was really in how you went about negotiating the budget with the Council. It had been more of the practice where the executive committee simply brought the budget forward during the Council meeting and approved it on the spot. While there were no contentious issues; it seemed all straightforward. But as the funds became tight and different groups had different interests, I think you changed the procedures so that an early draft of the budget was circulated through the Council and discussed prior to the meeting. I can imagine that behind the scenes, you spent some time speaking with individuals just to make sure that it was going to be acceptable as opposed to US Congress, where you can't pass the budget even when you come to the final meeting,

GALLER: I don't recall that, but I'm not surprised. This would have been my way of working with the Council: not to look for rubber stamps. Look to make sure that people understood and participated, yes.

AKERA: So really speaking one-on-one with individuals.

GALLER: As needed, yes.

AKERA: And building consensus, before that.

GALLER: Building consensus and making sure that...yes. You hear now that Congress got the budget bill, 800 pages, just this week with four hours to look at it. That's not my way of doing things!

AKERA: That's very good. I'm very glad that this change happened for ACM.

Part II(d)— Computer Time-Sharing Systems Research

AKERA The other topic I'd like to interleave into here, then, is about contemporary developments in computer time-sharing systems. The connection I want—I may change the order in the transcript afterwards—is that this ties in with the issue of the development of computer science as a field, and of the various SIGs which were expanding within ACM. In a sense, I'm also interested in establishing something about the intellectual landscape of computing at the time. I'll ask the broader question separately, but I know that during this period, time-sharing was one of those topics that was of ascending importance in computing. Can you start us off by going to the beginning and telling us how time-sharing became an important issue, and then how Michigan became involved in that work?

GALLER: It was interesting to me that a lot of it started at MIT. On the one hand, MIT; and on the other hand, the West Coast [industrial groups]. Rand, for example, developed an early, small time-sharing system. But the MIT people saw that there needed to be human interaction. The interesting thing was [that] a little later, when we were getting involved and we talked to what must have been 20 different manufacturers about providing a machine where we could do, for example, dynamic address translation, I'd say 18 out of 20 didn't know what we were talking about, and didn't really care. The most they thought of human interaction was transaction processing, which was the machine telling a person what to do.

AKERA: If I may comment, what this suggests then is that despite the prestige that MIT's Research Laboratory for Electronics had, and I believe IPTO was becoming active at this time, their work and perspectives were not widely known in the computer industry. It really was, at that time, still sort of an academic conversation among the people involved in the proto-computer science.

GALLER: Like AI—the AI people were pushing this kind of thing.

AKERA: And some industrial contractors, but more in the nature of BBN and others who very much had very strong academic ties.

GALLER: Right. As I said, I know the people at RAND with JOSS and so on were getting into this, but I don't know that they influenced the manufacturers of machines very much.

AKERA: So the computer manufacturers were not fully up to date on computer time-sharing or the general principle of human-computer interaction.

GALLER: Right. When we talked to some vendor who came in and we said, "Here's what we'd like to do," and they said, "Why would you want to do that?" we said, "Okay, we're through talking to you." It really happened that way.

AKERA: I believe it, for sure.

GALLER: I think we learned about [time-sharing] from IBM. We were always interested in operating systems and efficiency and so on. We moved from a batch stream to multiprocessing

to try to use the computer more efficiently. But I think we were pushed into it by the MIT people, to make the process [(computer operations)] more human-efficient, and that meant not just multiprocessing, but time-sharing, which is different.

AKERA: In fact, the main motive there, if I understand it, is that instead of just simply increasing computer productivity, if you began thinking in terms of a programmer's productivity—and this was of course when the programmer shortage was becoming quite important, so that programmer time, in many ways, was more important than the computer time—then you wanted to have a machine that could directly interact with the user so that they could debug [a program] online. They could do...

GALLER: Right. If you're going to use a machine right, an expensive machine, you can't have one user because the machine is sitting idle while the person's thinking. You better merge it so many people can be doing it at the same time.

AKERA: That really was the major difference between multiprogramming as opposed to computer time-sharing. Is that correct?

GALLER: Right. Interesting thought. I'm not sure we thought of it as computer productivity. We thought of it as people doing more of what they wanted to do. They wanted to interact. They wanted debugging—instead of putting in a card deck and waiting five hours or overnight, you want to do it.

AKERA: So especially in running a computing center. Weren't you Acting Director at some time?

GALLER: I was only Acting Director for one term.

AKERA: Which was when?

GALLER: Bartels was on leave. I know it was a fall term because he was in Germany. It was Oktoberfest, and we tried to reach him. Well, it was when I got tenure, so that would be '66, approximately.

AKERA: So that would have been at a time when you were speaking very actively about computer time-sharing systems.

GALLER: Right, and the big debate with IBM over the operating system for the 360.

AKERA: Exactly. I remember that from the other interview/transcript.

GALLER: Of course, we were moving toward the model 67, which came out in '67. So it's right in that time period.

AKERA: That's right. So in that sense, [your work on time-sharing systems] might have been tied to your awareness of the Computing Center's needs. And even before you were Acting Director, you were of course very involved with the Computing Center. So it was user driven, as

opposed to an abstract model of economic efficiency. It really was the users saying, “I want to be able to use the computer in this particular way.”

GALLER: I’m not sure that many users were saying it. We thought that we heard from MIT and so on that people ought to be able to do this, and I think we educated our users to want this because it was so good. A lot of people didn’t have that much imagination: “This is how you use a computer. That’s how you use a computer.”

AKERA: They’re not computer experts, in that sense.

GALLER: Right. We told them, “Put your card deck here, and we’re going to give it back to you. We’re going to be among the best in the country. You can count on that,” and they were satisfied. But we wanted to give them more.

AKERA: Going back to the intellectual history side, you mentioned the MIT group. Just to establish that it was especially the faculty within their Research Laboratory for Electronics that did the [early] time-sharing work.

GALLER: And the ARPA group. I’m not sure--

AKERA: I think Project MAC comes a little bit later. They’re the outgrowth of the RLE group.

GALLER: Yes, but it was that group of [Fernando] Corbato, and Jack Dennis, and Jerry Saltzer.

AKERA: So what was the relationship between MIT and Michigan? Not focusing the controversy—I don’t need to dig that up here—but just initially, to what extent was the initiative at Michigan influenced by the earliest publications or the conversations initiated by MIT?

GALLER: It was the [collegial] conversations, and we liked their point of view. They knew we had operating system expertise, so they were interested in drawing us into their ideas for MULTICS and General Electric and so on. They suggested that we work together on this.

AKERA: So there was even an explicit invitation for direct collaboration, where they had this man-machine interface idea, and you had significant operating system expertise?

GALLER: Right. But they had a propriety arrangement with General Electric. It was growing very secret, which we didn’t like. We were more of an open, “publish, make it available,” like we did with MAD. Tell people about it, and everything else.

AKERA: In other words, as an academic project and as an academic, personally, this kind of direct tie-in with a manufacturer was something that you were uncomfortable with.

GALLER: Yes. We never had it. I mean we got computers from the manufacturer. We talked to them about things. But the idea that when we did it, it would be propriety and secret... Well, then we began to think: if we got into this project, we would be second-class to MIT. No matter how it was, they were in charge. We didn’t want to work that way, either.

AKERA: Why was the arrangement proposed that way? You were both research groups in computing. Why was it that MIT had, or felt they had a status where they could call the shots?

GALLER: I'm not sure they felt that. We thought, since they were inviting us to join them, that it would eventually evolve that way.

AKERA: Because they would hold the primary contract with ARPA, perhaps?

GALLER: Yes. And they had already started this research going and everything else. So we said, "No, we've got our own ideas about lots of things." We've not talked about virtual storage yet. We simply said to them, "We think we'll..."

AKERA: ...do it as a separate thing.

GALLER: As a separate thing. We don't like the secret aspect, and so on.

AKERA: Good. It's very much true that virtual storage is an important component of this history, but I want to flesh out first all of the technical components of time-sharing. Establish the entire amalgam of different components, of which operating system, [virtual storage, etc., were a part]. What was MIT's area of expertise? What did they bring to the time-sharing initiative, intellectually?

GALLER: Jack Dennis in particular. They had taken the IBM 7094 and modified it. They called it the Kluge. They were interested in processing jobs fast, like we were, and trying to work user interaction into it. They used MAD on that system because it was so fast that they could run a job for somebody and then run a job for somebody else and so... so they were already looking into multi-user access.

AKERA: There is a reference somewhere to a key MIT publication.¹⁷ Maybe it was by Jack Dennis. Not the one creating a vision for time-sharing, but rather the one that I think relates to the issue of dynamic relocation hardware. I think the particular [statement that you gave in your earlier interview] was that both MIT, with Project MAC, and your group at Michigan started with the same article, and that the implementation of the idea was more or less obvious. So this article didn't spell out the detailed design, I think, but...

GALLER: ...[set out] some of the requirements.

AKERA: Yes. Do you recall what specific article that would have been, and the author?

GALLER: I think the information is probably in our *Journal* article. We published an article in the *ACM Journal* about some of our software ideas, how we would do that. There's a footnote crediting Jack Dennis for some of the ideas. That's probably pointing to that article. I know we

¹⁷ From my records, this would have been a key paper written by Jack Dennis on the idea of segmentation. The document is referenced in Bruce Arden to Robert C.F. Bartels, 9 August 1965. University of Michigan, Computing Center, Box 5/MAC Project Controversy. Bentley Historical Library, University of Michigan, Ann Arbor, Mich.

credited Dennis. Whether we credited a particular article or not, I think we might have. If so, that's probably it.

AKERA: My recollection (and again, I don't have my research notes before me, so I may be incorrect in this), but I think it had something to do with the idea of paging. So it was related to virtual memory. The key ideas originated with...it might have been with the 7094, it might have been with the TX series or whatever, but something about paging that then suggested that certain hardware changes were necessary in order to do it efficiently. But then those details were left out.

GALLER: I think that's right. It was interesting that we later diverged from the specification of the [MIT's] architecture.

AKERA: Yes. This is actually very much worth establishing for the historical record. Is it correct that the hardware design that the two groups came up with was different?

GALLER: Yes.

AKERA: Can you describe what that difference was? Or at least talk about it in general terms.

GALLER: Okay. First, I wanted to mention that we worked with Gerrit Blaauw, who was a wonderful architect from IBM. Incidentally, his son is now on the faculty at Michigan.

Now, the difference between them, as I recall, [was that] there wasn't a [common] definition of a segment. MIT thought of each segment as separate. The addressing wrapped around the-- when you got up to the highest address in a segment, that was it. We thought of the whole space as one space, and we could go from one segment to the next through the addressing structure. So it just led to a different way virtual storage was used.

AKERA: That also translated into a difference in hardware, how you wired those particular capabilities?

GALLER: That's right.

AKERA: I see. I think you mentioned yesterday after the interview that this then translated into a difference in hardware for General Electric versus IBM. Is that correct?

GALLER: Yes, that's right. The DAT box—dynamic address translation box—which is where the translation from a virtual address to a real address took place. That was different because of the fact that they had a maximum size of an address and so on. At some point, they used two registers and the overflow from the first register into the second one. Did something quite different from what we did with it.

AKERA: Just to push your analysis of this a little bit, the MIT side (and I haven't talked to anybody there), but one of the things they've claimed more generally is that Project MAC had other very specific objectives. Down the line, they wanted to talk about multiple processors running alongside multiple memory banks. That they envisioned a more complicated structure

somewhere down the road for memory management, and as a consequence, this also introduced constraints that may not have applied to other time-sharing projects. Is that possible? Is there anything in there where they might have chosen their particular hardware implementation for their own reasons? Or does that not make sense from what you know...?

GALLER: I don't recall that. We also had interesting ideas about multiprocessors. The 360/67 that we had come up with could have up to four processors, all sharing the storage, which had not been done before. I'm not sure that that influenced the (dynamic relocation) hardware.

AKERA: Could it have made a difference [in the hardware]?

GALLER: Not of the dynamic address translation part, necessarily.

AKERA: Is the claim—not the original claim, per se, but was one approach better than the other? Or were they simply just two different implementations of one basic idea?

GALLER: One thing they spent a lot more time on was security. They had their different rings and so on. I think partly because everything was secret with General Electric and partly because they were far more involved with government contracts and everything, security was much more important. We had an open environment at the University, so it was much less important to us. I mean, it should have been and eventually was more important, but it didn't influence our [design]...

AKERA: But in some sense, the institutional environment affected the design of the hardware, in terms of what approach you chose [to take].

GALLER: Right. Yes, that starts [with], "How do you define the problem you're solving?" Theirs included the security part. Our definition of the problem we're solving, I don't recall did.

AKERA: Which also goes back to the difference in the operating system designs that we spoke about earlier.

GALLER: Right.

AKERA: That's good. You say that Project MAC was sort of secretive in some ways, but they were an academic project. And didn't they publish fairly widely?

GALLER: They published so much more than we did that everybody knew about MULTICS, and that [became] the standard research time-sharing system, whatever it was. We thought ours was very good; we just never blew our horn very much. Like the extensible languages [facility], we didn't publish anything on that for ten years after we did it.

AKERA: You actually sort of got criticized a little bit for that.

GALLER: Exactly. John Reynolds from Argonne really gave it to me because the field should have known about this before.

AKERA: Actually, if I could ask a question about that. What we're speaking about is an extensible language facility that was built into MAD.

GALLER: Right, which we called at the time the "definition facility."

AKERA: Yes, which turned out to be a rather important topic in programming languages. Can you tell us why that was important?

GALLER: Well, let's go back a moment. Why were there 200 languages in Jean Sammet's books?¹⁸ People were inventing languages because they wanted a language more suitable for the class of problems they were solving. The definition facility was intended to say, if there's something that would be helpful to you for your class of problems, define it into the language in an orderly way—don't create another language.

AKERA: So another way, that then, in turn, bolsters the ability to have a more standard language at the core.

GALLER: It was certainly intended to do that. Westervelt, for example, developed a whole series—might call them macros—but they're definitions, to add matrix capability to the MAD language. We had no matrix [capability, originally]. He started with a variable type called matrix, and developed an algebra for that, which looked like it was naturally in the language. We had a way of defining, for example, matrix addition. It was just another operator in the language, and so on. Bob Rosin added a whole complement of things for string operation and so on.

AKERA: The basic principle of extensible languages—did that also introduce something new at the level of theoretical computer science?

GALLER: I think eventually it did. We didn't think of it that way, necessarily. One thing I'll mention is we tried to convince the PL/1 people to put an extensibility thing in, and we ran into an interesting roadblock. I met with the IBM team that was defining PL/1. I gave one talk and somebody said, "Why are you interested in doing this? This is an IBM language." Which, to me, was a ridiculous question. But the roadblock we ran into was that within IBM they had a rule that the people defining the language could not specify anything that would imply how it was to be implemented, and they thought that our proposal for extensibility violated this. The most they did was let you put some things in the language, but required a preprocessor, which changed it all back to standard PL/1, so from then on it didn't affect the implementation.

AKERA: Which, I imagine, had consequences for computational efficiency.

GALLER: Yes, for the computational efficiency, and for the ability to really define some things in the language that you might want to have a later effect—not just translate into existing things, but affect run-time or whatever.

¹⁸ Jean Sammet, *Programming Languages: History and Fundamentals* (Englewood Cliffs, N.J.: Prentice-Hall, 1969).

AKERA: I imagine IBM had its own reasons for having such rules having to do with maintaining the code. You still get a proliferation of variations of the language, which I imagine IBM might have felt uncomfortable with. In a way, that's very different from the Unix operating system where they all very much welcomed this continual evolution of the [system, and its command] language.

GALLER: Right. But I think it was largely that the implementation, the structure, and the organization was: this team does this, and this team does this. I think they were beginning to feel things were getting complicated.

AKERA: Certainly, IBM was feeling that at the time, especially on the software side.

GALLER: Right. This is a little bit of an aside, but when they did PL/1, they had to kill COBOL and FORTRAN and bring everybody to PL/1. Like combining the two streams of hardware into the 360, they were going to combine the two [major] streams of [programming] languages.

AKERA: Just for the historical record, that did not happen?

GALLER: Well, there was a big, knockdown, drag-out fight at SHARE, and IBM learned that they were not about to kill COBOL and FORTRAN.

AKERA: They really couldn't assert their will; that really the users had...

GALLER: That's right. I remember a meeting where Watts Humphrey was the point man for IBM, and he came in and talked about all of this, and he got it.

AKERA: All this, I think, is relevant to establishing the general configuration of computing and computer science as a discipline at this time. I very much appreciate all of these comments, and hope to tie it back into the ACM.

But returning again back to time-sharing, and particularly virtual memory, which is what we were just beginning to speak about, can you tell us a little bit more about the development of virtual memory? Both separate from and integrated with the time-sharing effort.

GALLER: Some of the early ideas came from the Atlas computer in England. They actually switched among users, but they didn't have a two-level scheme, and it was not very efficient. But they had the idea of swapping and so on. Burroughs, also on the B5000, had a kind of a segmentation thing. Again, it was only, sort of, half the problem.

AKERA: I imagine most of these are simply software solutions, so that in terms of efficiency, the dynamic relocation hardware was not available in any of these systems until the earliest...

GALLER: I think that's right, although the Atlas had a very sophisticated user-switching mechanism in hardware, saving the state of this user and bringing back the state of the machine.

AKERA: This is all meant to make those transitions as efficient as possible, as quick as possible?

GALLER: Right, but that was not really virtual storage, in a sense. So people had ideas and pieces of it. There were the MIT people who sort of envisioned the whole thing--

AKERA: Or at least wrote about it first.

GALLER: Or talked to us about it. As much as they were willing to talk, and then there was a whole controversy of whether we took their ideas and didn't give them credit and so on. We thought we gave credit to Jack Dennis in that article because we felt that what we took from them was what he had told us.

AKERA: This is also an aside, but as a historian of technology, we tend very much to downplay priority disputes because most ideas happen because of the circumstances surrounding them. Similar ideas are floating around and things come together at different places. You know, simultaneous invention is something we talk about, and it's a very frequent phenomenon. Nonetheless, there are intellectual lineages, and of course, to the participants, these are very important issues because this is about their academic reputations, and contributions.

GALLER: That's right. So we worked with IBM, and as I said, with Gerrit Blaauw in particular. They proposed some things that we shot down, and then we proposed some things they shot down. It really was a good collaboration. We had some very good people on this—not only Westervelt, but Mike Alexander, who is still with us and so on.

AKERA: He first worked on LTS (Lincoln Terminal System),¹⁹ putting LTS on Michigan's computer, and then transforming it into MTS eventually (Michigan Terminal System).

GALLER: That's right. Yes. LTS was a very nice, multitasking thing.

AKERA: The Lincoln Terminal System developed by Lincoln Laboratories.

GALLER: Not terminal system, but Lincoln Multiprocessing System, Multi-programming System—LMS, something like that.

AKERA: Hmm... but in any event, it was MIT's Lincoln Laboratories, which was separate from Project MAC.

GALLER: That's right. In fact, when IBM finally formed this group of the inner six important customers, Lincoln Labs was one of them. And GM and Princeton.

AKERA: In fact, I should probably ask you to spell out that history a little bit. But before going there, I think it is worth noting for the historical record (and you may not be familiar with this),

¹⁹ This was from the Lincoln Laboratories. I believe Lincoln Laboratories was one of the sites that adopted MAD, at least for experimental purposes, and hence they remained in touch with Michigan, even after Galler and Arden chose to go their own way and worked independently of MIT's Robert Fano, Fernando Corbato, and Project MAC.

but IBM did have very extensive conversations with MIT about the design of computer time-sharing systems, of which virtual memory and dynamic relocation hardware were very much part of the conversations. So one of the possibilities is that some of the knowledge that became embedded in the Michigan system, in the IBM hardware, may have come not through your group at Michigan, but through the history of conversations between MIT and IBM.

GALLER: Yes. We know that they had a falling out at some point, which is why they [MIT] went to GE. I guess we were never really aware of that other avenue of communication. We certainly didn't take credit for everything. We just worked with IBM, and they came with ideas and we came with ideas.

AKERA: As much as the initial group at IBM evaluated the suggestions that Robert Fano, at MIT, advanced to them, IBM had quite a bit of internal discussion about what MIT was asking for. As a consequence, I think they did understand what the technical changes were that MIT asked for. That information was very broadly disseminated within the organization. I don't know the specific history and all of the connections, but I believe Gerrit Blaauw may have been one of the participants in that conversation.

GALLER: He probably was. But as I recall, he was a hardware architect type person; we were software people. As I recall, when we began to talk to them, we realized that they had not thought through the software implications of all of this. That's why we published our article, saying, "If you're going to do this kind of thing, there are some interesting software issues."

AKERA: Indeed, there was a lot of confusion within IBM, and they [probably] did not see the software side. [In speaking with MIT, there were definitely those within IBM who] couldn't understand initially why you needed the dynamic allocation hardware because they didn't know enough about operating system software to spell out [the implications]-- I think that's absolutely correct.

GALLER: Right.

AKERA: Perhaps more for the historical record, could you fill us in on the history, starting with the falling out at Project MAC with IBM, and then how Michigan came into the picture? How did that sequence of events happen?

GALLER: I'm not sure who contacted whom, now that I think of it. Well, we had been talking to various vendors, and--

AKERA: Even before Project MAC's falling out. Is that right?

GALLER: I think so. We wanted to get involved.

AKERA: MIT received funding from ARPA IPTO under J. C. R. Licklider, and they held a series of meetings, particularly a summer study, in which IBM, General Electric, and other manufacturers were invited. At that point, Robert Fano proposed certain hardware changes, and General Electric turned out to be more responsive than IBM. IBM thought that their solution was adequate, and then was, in a sense, surprised [by MIT's decision. Actually,] by the time the

decision was made they knew how the decision was going to go, but they were very frustrated that MIT chose to work with General Electric rather than IBM, with whom they had a long-term relationship. Now, Michigan also had an established relationship with IBM going back to the very deep educational discount that IBM provided on Michigan's leased 704 and 709 and 7090 computers. So there was already a precedent for working between Michigan and IBM, not so much at a detailed technical level, but at least in terms of the education discounts on the machines.

GALLER: Well, more than that though, because I was already doing operating system [development] on the 701 and 704 through GM, and interacting with IBM people at SHARE.²⁰ For example, I pointed you to what we published as an anecdote just in the last year in the annals about relocation bits. If you look at that, what I'm discussing there is an IBM proposal for a whole new structure of relocation bits. So I was interacting with IBM people all the time, really. When they had a falling out with MIT, they probably came to us and said, "Would you like to work with us?" They wanted our contract. Whatever we were going to do, they wanted it on an IBM machine.

AKERA: My sense from the actual historical, IBM documents of this period...

GALLER: ...Which I have not seen. I hope to see it someday.

AKERA: Exactly. Well, actually you saw some of them originally... You wrote some of them! Well, not the ones on the IBM side. But these are actually some of your own papers. I found some of these documents in the records of the University of Michigan Computing Center.²¹ But in any case, my understanding is that Michigan itself carried out a major long-range computing needs study, sort of modeled after [the one carried out at MIT], in which it became obvious that computer time-sharing was also the way for Michigan to go.

GALLER: Yes, there was a specific study.

AKERA: In fact, it was carried, I believe, by Donald Katz, who we mentioned yesterday in the context of the Ford Foundation Project.

GALLER: Right. That [study] was deliberately made bigger than the computing center. We wanted, and of course our friends wanted the campus to be aware and educated that this was a good way to go.

AKERA: I think it was in that context that you had independently decided to approach IBM, partly knowing that IBM had had this falling out with MIT. So there was a window of opportunity to really do unique computer time-sharing research. Of course, this [was apparently] when you were also in conversation with, and had been invited to join the MIT group, or collaborate with them.

²⁰ In fact, IBM helped broker the arrangement with GM, giving GM a discount for Michigan's use of the machine to develop its systems programs.

²¹ There were also other papers referred to in documents at the IBM Archives, made available to the interviewer courtesy of IBM.

GALLER: When we decided not to, then we said, “Okay, let’s work with IBM.”

AKERA: I don’t have definite knowledge of this, but I think that was the first contact, the letter that you and Bruce Arden sent to IBM...

GALLER: Right. But I think at that time it was when we were talking to all the other vendors and finding they didn’t have any idea.

AKERA: Yes, and please elaborate. I’m sort of just setting up the question...

GALLER: As I said, we talked to MIT, but I know we invited other people in. It must have been right about that time.

AKERA: I think that’s right. In other words, you promised to the campus community that you’d go into time-sharing research, and then you were actually beginning to do the early phases of that research. I believe it was actually funded by the General Funds of the University.

GALLER: I think so.

AKERA: As a consequence, you did some technical work, but in the process you had to approach various manufacturers to see if anybody was willing to do the hardware changes that were required. IBM was one of the obvious people to approach. I think you might have had some extra hope that that would [work with you]...

GALLER: Right, especially knowing that they had broken up with MIT. They were ripe for someone-- Of course, we were able to offer our expertise in operating systems. We’ll take advantage of whatever we can get you to do. Let’s put some of this in the hardware to make the software easier to do.

AKERA: That’s good. Now, can you tell us how that history unfolded then? You had mentioned a core group of six, and but you [were the ones that] originally approached IBM. What happened next?

GALLER: Yes, that was a little later. We talked about the inner six business first, but that came later. That was only after Michigan-- we had already ordered a machine with virtual storage capability. So the question of the development of that, we worked with Blaauw and his team to define the hardware. Meanwhile, we were writing to the software requirements to know how to take advantage of the hardware. That was useful because they had mentioned a “W” register. I remember we were able to shoot that down because it didn’t help our--

AKERA: ...had negative consequences?

GALLER: Yes, negative consequences and whatever. So we did finally agree on the hardware.

AKERA: Do you remember the actual dates during which this work took place?

GALLER: I was on sabbatical in '65-'66. I think it was before I left. Of course, we didn't know about the 360 until they announced it.

AKERA: They sort of pre-announced it to a certain select group of people. They didn't let you know too much before the official announcement was made...

GALLER: Yes, but I'm not sure we were in that group. I don't really recall exactly when.

AKERA: Actually, Michigan was among those that were told about the system 360 before its official announcement, but they couldn't release that knowledge until fairly close to the...

GALLER: Right.

AKERA: So it's possible that the initial conversations took place a little more in the abstract as opposed to in the context of the 360 series. But eventually you knew that it would be, in fact, the 360 model, 66M.

GALLER: Yes, that's right. We never really knew whether "M" was "Modified" or "Michigan." [chuckles] We did work on the software at the time, and as I said, we can get a better idea of the date from the *ACM Journal* article. I can look that up. Then they said they would do the 67, and I we said, "Okay, and we'll do the operating system."

AKERA: And IBM was comfortable with that decision at that point. They felt that you had the software operating system expertise.

GALLER: That's right. And it was a machine for Michigan, so if the software didn't work, it was our problem. But once they began to tell people about it, there were two developments. One is a lot of universities suddenly said, "We want that." Then some industrial firms said—GM in particular, and I, again, was telling GM what we were going to get—and they said, "We want it, except we want the operating system to do this or that." They weren't asking for different hardware, but they wanted the operating system. So IBM finally said, "Well, we'd better do an operating system TSS, which will have things that other people want." GM, Lincoln Labs--

AKERA: ...that was different from what Michigan was doing?

GALLER: Right. So that began to grow, and we said, "Fine, we'll use TSS if and when it's good. Meanwhile we'll do MTS, because one: we think we can do it faster, and two: it'll be more tailored to our work."

AKERA: I imagine there were local pressures to get a time-sharing system up and running fairly quickly.

GALLER: Not that much. It was more our own interest.

AKERA: Oh okay, you just wanted to get it running quickly as part of your research.

GALLER: Right. Then I went on sabbatical. We also had dreams of a more elaborate MAD, MAD/1. So there was a group defining MAD/1 and trying to implement it and so on, because with this new computer, we wanted to provide MAD on the new system for people. MAD had been in total use. Hardly anybody used FORTRAN any more.

AKERA: On the Michigan campus.

GALLER: On the Michigan campus. So we felt an obligation to provide a MAD. We should have provided a MAD. We shouldn't have gone to MAD/1 because MAD/1 never got off the ground. One day, we realized finally it's not going to work, and we had to tell people they've got to use FORTRAN. They were not happy.

AKERA: Not happy about that. [laughs] I didn't know that.

GALLER: As a matter of fact though, Don Boettner with Mike Alexander, were the original guys. Don did implement GOM, Good Old MAD, on the 360, and in fact, there are some parts of MTS written in GOM. So it lives. Somebody else finally did it for the PC.

AKERA: Oh, good. I'm glad to hear it!

GALLER: And so on. There are people in Ann Arbor who still use it.

AKERA: That's wonderful. That tells me then that there was a very active program in [systems programming] research within the computing center at Michigan.

GALLER: Yes, absolutely.

AKERA: Also, all of these developments in time-sharing, the work you were doing and Alexander and Boettner were doing happened just as you became the Vice President of ACM, and soon after, the president of ACM. Did any of this work that you were doing at Michigan sort of come into the conversations within ACM itself?

GALLER: I don't think so.

AKERA: No?

GALLER: No, not really. ACM was ACM.

AKERA: I'm trying to make this connection. You're making it harder!

GALLER: I know.

AKERA: But didn't time-sharing emerge as a major topic of conversation within ACM? That's the sense that I got. Maybe a little bit later.

GALLER: Yes, I think so. It was beginning to permeate all of computing, of course, but what was going on at Michigan, I think, never really got that much recognition. We didn't publish that much.

AKERA: See, I was wondering whether part of the reason you became president is that they knew of the kind of work you were doing, and that that reputation helped carry...

GALLER: I can't claim that.

AKERA: Can't claim that, okay. No, that's good. I think it is very important for the historical record to note that the Michigan research effort was not necessarily publication-oriented, that you wanted to do it primarily for what was needed at Michigan. Once the systems were developed, including MAD, you tried to publicize it elsewhere and get other people to adopt it.

GALLER: We offered it to a lot of people. Yes, MTS was broadened. Well, MTS...

AKERA: That is the time-sharing system, just for the record, right?

GALLER: Right. Now, that had a broader distribution. I guess it was in '66 when I was in the Netherlands on sabbatical. I was invited to give a series of lectures in England in the spring of '66 on MTS, on time-sharing. That's when I talked about it at Newcastle, and they became one of the MTS major sites.

AKERA: You placed some emphasis on Newcastle in the other oral history transcript. Was that the one site that really took up MTS and really made it their operating system? Did other universities also make MTS its major time-sharing operating system?

GALLER: Yes. Newcastle was [important] because of my visit.

AKERA: Oh, okay. That's why it's important.

GALLER: That's why it came up. Probably British Columbia contributed more to the development of MTS. You see, what happened was Alexander and the others formed, I won't call it a "loose" group. It wasn't totally organized. But they had workshops every 18 months, of all the MTS installations. Parceled out the work and cooperated in a beautiful way. I was never directly involved in that. In fact, Mike met his wife because she was a programmer in Canada, and then they met at these workshops. So, Newcastle was only important in that sense. It may have contributed some, but they were not that [significant, technically]...

[Tape 3B begins]

GALLER: You were talking about when the MTS became available.

AKERA: Right. When MTS was made available in 1967, shortly after the system 360/67 was delivered to Michigan, it wasn't a completed system. I imagine it was necessary for other universities to help in continuing to develop MTS. Is that correct?

GALLER: They did. I don't remember who did what, but I know about British Columbia in particular. But others also contributed a large part.

AKERA: Currently, many different groups work on Linux. But to turn it backwards, it's not that Linux was a precedent for that, but rather that this really was something that was very much already within the culture of systems programming and operating systems development at the time.

GALLER: Right. I don't know if in the Linux developments there's any kind of a central group that is telling people what they should be doing and cooperating that much. My impression is that people do things and then share them.

AKERA: Whereas MTS, there was a little bit more of central coordination, which we already spoke about.

GALLER: Right.

AKERA: But it was definitely an academic collaboration with various other universities. Maybe some industrial research labs?

GALLER: There were one or two: a place in Brazil and whatever.

AKERA: You claimed already that you thought MTS was a very good system. Can you flush that out and tell us more about it?

GALLER: My smile won't show up on the tape. MTS was a very good system. It had a lot of nice, innovative ideas. It was efficient. It could accommodate user suggestions and things like this. One tiny little thing, for example, which I miss now in other systems, is if you had a file and you wanted, in reading that file, to continue with another file, you just put something in the last line of this one that said, "Continue with this," and it just went on and did it. That's a very convenient thing to have. You can turn on or off whether it followed that pointer. But there are lots of little things that we...

AKERA: ... so there were a lot of very practical, very meaningful features built into the operating system?

GALLER: That's right.

AKERA: I think that sort of comes out of a grassroots, user-driven kind of operating system development strategy.

GALLER: And a willingness to listen to people, the end users, just as I did in MAD. The famous example is that Rosin came in one day and said, "I'm doing a fancy thing. How about normal mode, that everything should be statement-labeled instead of integer?" I said, "Sure, come back tomorrow." By tomorrow, I had done it because I listened to the suggestion and I knew how to do it. We always had this open feeling about MTS.

AKERA: Can you tell us a bit about why you feel MTS was successful, and the IBM time-sharing system, TSS, was not successful? Maybe “not successful” is not quite right, but we know that it had a lot of difficulty.

GALLER: It wasn’t successful. They stopped all development after 11 places were using it, and said, “No more.” In fact, there was Black Monday when IBM announced simultaneously to 120 customers that the 360/67 was no longer available as a standard product, and TSS would not be offered with it.

AKERA: That’s right. They stated in April ’67 that IBM’s main computer time-sharing computer is no longer going to offered as a standard item. It would be an experimental system available only to academic installations. Actually, they stated that they would take no more orders for a while, and that the time-sharing software: that was the one that was going to be offered only as an experimental system, would be offered freely, but they offered no promise of support.

GALLER: They lost I don’t know how many orders that day.

AKERA: I think the 120 is actually the number of orders they lost. [chuckles]

GALLER: I think that’s right. A lot of those went to order Cray and the [CDC] 6600 system that was being offered at the time.

AKERA: Going back to the technical question, why do you think it was that IBM was not able to develop an effective time-sharing system?

GALLER: First of all, we offered them MTS, and they didn’t want to touch it because it was separate from MVS or whatever they were doing at the time.

AKERA: VMS?

GALLER: Yes, I guess VMS.

AKERA: So it couldn’t be integrated within their... Hmm... VMS is different.

GALLER: No, no, wait a minute, VMS is different. VMS was later. VMS was the bootleg system that gave them the ability to simulate several different machines on virtual machine systems or whatever. But I think MVS or whatever the standard system was. MTS was not built on top of that, and so they decided not to do anything with it. Now, TSS was built on top of that, which partly led to inefficiencies, but also tried to build in things that other potential big customers wanted. And that’s where the Inner Six came in. IBM set up this little group. I don’t know if I can name all six, but it included Michigan, GM, Princeton, Lincoln Labs... whatever. Each of these wanted optimization for their class of problems. I remember Lincoln Labs wanted the upper two bits in some register to have special properties because of the data they were bringing in from Hawaii.

AKERA: I think that eventually got struck down.

GALLER: I think it got struck down, but that's the kind of thing that happened. So it just grew. They tried to offer everything to everyone, like Microsoft Word, right?

AKERA: So this really overloaded their operating system development capabilities?

GALLER: I think that's right. And [the system] fell of its own weight.

AKERA: Just for the historical record, TSS did eventually run and was then re-offered as a supported system some time later.

GALLER: I think so. The interesting thing was when I heard later that they wanted to bid on some big contracts, the only system they had that they could bid for that contract was TSS. I don't know if they got it or not, but it ran. People did use it.

AKERA: As was the nature of computer time-sharing systems. It really came down to how robust the system was, how often it crashed, how convenient it was, and most importantly, how efficient it was.

GALLER: Right. We felt that it never caught up to MTS, for our needs. It was never good enough.

AKERA: Why not Michigan?

GALLER: We told them, "When TSS is really ready, we'll drop MTS."

AKERA: And use it instead?

GALLER: We had a number of meetings over the year.

AKERA: Stayed with MTS for a long time?

GALLER: We stayed with MTS for 30 years. We didn't expect it, but we had a celebration of 30 years.

AKERA: Wonderful. Am I also correct that by the end of 1968, MTS was, in fact, the first large-scale computer time-sharing system to enter operation in the United States. Would that be correct?

GALLER: MULTICS was there.

AKERA: MULTICS wasn't there. Not in '68, I don't think.

GALLER: It may have been.

AKERA: MULTICS did come online, but I think MIT and Project MAC actually had a very hard time getting their system online. They stayed with CTSS for much longer. They didn't

even start using the GE 635 initially, even after it was delivered, because they were developing time-sharing system concepts using the 7094 and the CTSS-compatible operating systems. They didn't really shift over to the MULTICS development until late '67 or '68, I thought.

GALLER: I don't know how many other places used MULTICS.

AKERA: Eventually, MULTICS began to be used. If you buy the GE system, you tended to use MULTICS. But IBM sales actually still overtook General Electric, for time-sharing hardware. So you don't specifically remember making the claim, or feeling that MTS was the first time-sharing system that actually worked.

GALLER: No, I don't ever remember that. I freely claimed that MTS was the best one around, but I don't remember a "first" claim.

AKERA: It's hard to make a "first" claim because various types of time-sharing systems were already around. But I think Michigan's system really [may have been the first 'efficient' system], because you were the only ones that had both the operating system expertise and the relocation hardware necessary to [get] a [large,] time-sharing system up and running, early on.

GALLER: Right. [Now,] MTS began on a machine without relocation hardware. We got a 360/50 and they got it working. Very few simultaneous people on it.

AKERA: And that's borrowing from the work that was done at Lincoln Laboratories?

GALLER: Yes, [but] just multiprogramming and so on. But suddenly, when the relocation hardware came in, zoom, it went up from--

AKERA: The efficiencies went up tremendously.

GALLER: Absolutely, which demonstrated that we were right.

AKERA: I imagine that the system that was developed—MTS was developed on the 360/50—was designed with this in mind.

GALLER: [For] An interim machine, absolutely. You may know about this: There was a SHARE meeting, or a National Computer Conference meeting—I forget which—where IBM talked about discontinuing TSS and so on. I stood up and made what turned out to be a pretty important speech, saying their software has problems, but we are using the hardware, and it is good, and is working.

I was told later by Walter Carlson that that was very important in getting [those] inside IBM to adopt it. To make the 155 into a 158 and a 168 and so on. And eventually [put virtual storage] into every machine. They saw success for the hardware. They did not adopt MTS, but they did move [their systems] in the direction of virtual storage. Walter Carlson, by the way, came through here once and told us that one of the reasons he comes to talk to people at Michigan is because he learns things that IBM will eventually do, five years later. [laughter]

AKERA: That's wonderful. By the way, was Walter Carlson was involved with ACM as well?

GALLER: He was vice president with me.

AKERA: That's what I thought. I'm sorry. I just wanted to make that connection. But he was with IBM?

GALLER: He was some sort of marketing vice president for IBM.

Part II(e): Other Developments and Their Relevance to ACM

AKERA: All right. Let me try to bring the conversation back to ACM, and [to bring this part of the conversation] to a close.

What we've been talking about is all very important. Unfortunately, the connection [with ACM] wasn't as strong as I thought it might be, but I think the readers and listeners will appreciate this part of the history being recorded as well. Can you tell me, then, really, a broader perspective on what was happening in computing at the time of your presidency?

GALLER: I think the biggest thing that was happening, remember again, the 360 system was something fairly new in the business world. I think the growth of applications in the business world was one of the very big developments. So that was part of the trend of academia-toward-industry within ACM. Everything was growing in that way.

AKERA: But I imagine this also raised new academic agendas based on the needs of the business data processing community—for instance, the work on databases. Did that take off during this period as well? Or begin to?

GALLER: Yes, I think so. My son's work in databases for his PhD came later, at the end of the '70s. But it was beginning. I believe that computer science people were very slow to look at the business world for problems to be solved. COBOL, for example. Computer science departments are so arrogant they never touched COBOL, which led to the business schools building up their own activities.

AKERA: Academic subjects. On computer languages, and systems programming, and such. Is that right? Not just teaching students.

GALLER: You mean in the business school?

AKERA: Yes, in the business school.

GALLER: Not that much computer science and stuff, but they began to feel the need to teach COBOL to their people and develop database ideas because they were having databases that were different kinds of databases from scientific [applications]. The scientists were talking about matrices and image [processing] and things like this. Business had different needs with data.

AKERA: In particular, relational databases?

GALLER: That's right. Did you know that Ted Codd, who started relational databases, was a PhD from our department? I was on his committee.

AKERA: What year was his PhD?

GALLER: Oh, I don't know. Early '70s.

AKERA: So this gets at the sense of the intellectual [landscape at the time]-- There was also the whole artificial intelligence contingent. I think partly what you're saying is that the academic computer scientists started to define some of their research agendas at this point—computer languages, operating systems, artificial intelligence.

GALLER: Yes.

AKERA: What were some of the other [important] academic areas at the time?

GALLER: Well, there was always theory. The question of what can be proved and so on. How do you know an algorithm works? There were questions of architecture.

AKERA: Computer architecture or software architecture?

GALLER: Computer architecture. There are always questions of the boundary between hardware and software.

AKERA: Yes. Microprogramming may be...

GALLER: Yes. All of these things were fomenting about at this time.

AKERA: Was ACM an active forum for conversation of these topics?

GALLER: I think so.

AKERA: There were some topics that were handled more by other organizations. Architecture, for instance.

GALLER: Of course, IEEE Computer Society got into architecture from the hardware side more, and so there was a lot of overlap.

AKERA: Meeting in the middle kind of thing?

GALLER: Yes.

AKERA: Yes, I can imagine that dynamic.

GALLER: That was part of why we were able to cooperate. We had some overlap and interests, which is good. The whole idea of what the boundary should be between hardware and software needed study, and...

AKERA: This was very much of the nature of computing, as a field, I guess. It sort of crosses over into all of all these areas, and you need to treat it holistically if you really want to advance the field.

GALLER: Right. I think I mentioned to you that Perlis often started out a conference with some idea, which then permeated a conference. One idea he had—that he articulated—was that the

time to standardize on something was when nobody cares about it anymore. In other words, don't standardize while people are still experimenting and doing things. We see this in terms of what gets built into the hardware because, well, standardizing, in a sense, is a way of fixing it so it doesn't change anymore. When you put it in the hardware, it doesn't change very often. I thought of that remark because the boundary between software and hardware—things move into the hardware when you don't need to change them a lot.

AKERA: Yes, and it becomes stable.

GALLER: Yes. If you want to change it, you keep it in the software so you can. Of course, there are developments in hardware: Microprogramming, for example—and nanoprogramming, which lets you change the microprogramming—where people build into the hardware the ability to change. That makes the boundary even more fuzzy. So these are ideas that were important at the time.

AKERA: In conjunction with all of this—of the intellectual development of computer science and computing as a field—do you feel that ACM made the right choices as far as which way to take the organization? Did it do so, in emphasizing SIGs, and maintaining the national organization at some level. And the relations it [chose to build] with others, like the IEEE Computer Society, AFIPS, business data processing...?

GALLER: I think ACM did it right. I was, myself, a little sad to see the later presidents coming from industry. I was a little sad to see it, but I knew it was inevitable, and they did a good job. It was changing, but I saw that it was inevitable. Probably the right thing to change the emphasis of some things because that's the way the field was going. If we wanted to continue to attract people and bring people together and communicate, it was okay.

AKERA: Did that leave a void? Did that leave computer science without an obvious disciplinary society, as opposed to a professional society that catered to the needs of industry?

GALLER: I don't know where else people would go. They still publish in ACM.

AKERA: Did the SIGs sort of serve that function so that at least within the SIGs, computer scientists with a specific interest could continue to find a place?

GALLER: I think they have. Right. I, myself, got almost totally inactive, except when I was drawn in-- Just recently, I served for five years on the Fellowship Committee. Otherwise, I'm quite inactive.

AKERA: I believe you also served on the Turing Prize Committee, I think?

GALLER: Oh, yes. I was on the Turing Award Committee for some time. I chaired that. The standard treatment of ACM, in particular, award committees, is you serve for, like, five years, and the fourth year you serve as chair, and then you're past chair for a year, and you go off. I just went off now from the Fellowship Committee. In this way I can help, but otherwise I'm really quite inactive.

AKERA: Can I ask specifically what happened after your term as president? Did you maintain involvement in any of ACM's offices or committees, and for how long? And then what happened?

GALLER: Of course, past presidents serve on the Council for another two years, I think. But after that, I think I got really inactive.

AKERA: So you really stepped out fairly quickly then.

GALLER: Yes. I think I was still doing research, but it was not ACM-related.

AKERA: In some sense, that's part of a tradition of a society president. Isn't that right?

GALLER: I guess.

AKERA: Once you finish, you sort of don't meddle too much in the [organization's affairs].

GALLER: I think that's good.

AKERA: But at least you were involved with some of the prize committees and such afterwards.

GALLER: Right. When I'm invited to help, I try to help, yes.

AKERA: Was there anything else you did for ACM?

GALLER: I don't recall.

AKERA: That's great. Actually, I'm not sure which order to ask this, so maybe this question [is out of order]. But there were other organizations active at the time. Did you then become involved with some of the other computing-related organizations?

GALLER: No, I never-- Remember that IEEE was for engineers—I never thought of myself as an engineer.

AKERA: How about AFIPS?

GALLER: I was involved with AFIPS when I was...

AKERA: ...was president because you were an ex officio representative to AFIPS.

GALLER: Right. I think I served, for example-- well, I did chair a committee on electronic funds transfer for AFIPS.

AKERA: Because I know that AFIPS, up to that time, really didn't do very much, but then there was a major constitutional change that allowed AFIPS itself to create committees and draw from a much larger membership in order to do certain things.

GALLER: Right. The idea, as I mentioned in one of my letters, was that AFIPS shouldn't compete with the individual member organizations. But AFIPS could play a role in doing things that they couldn't do themselves, or weren't interested in doing, and that's where the History Committee came into being, because [neither ACM nor IEEE was] doing any history.

AKERA: Actually, let me ask about your involvement with the history of computing later.

The electronic funds transfer, so that was one of the new AFIPS committees?

GALLER: Yes. I had no expertise, but we--

AKERA: ...but it was a subject whose concerns went across the member societies, and therefore AFIPS did a study.

GALLER: Right.

AKERA: So that was really to help the banking industry develop a standard of protocol for electronic funds transfer?

GALLER: Right. I learned a lot.

AKERA: That's wonderful. Let me leave the question of your involvement with history, then, just noting that that was also one of the other activities.

GALLER: Sure.

AKERA: The final question on ACM is that, having been president, you would have been aware of what ACM continued to do afterwards. Can you tell us a little bit about the history of ACM after your departure? What happened to the organization? How did it evolve?

GALLER: One thing I was pleased to see was growth. Of course, after 2001, the bubble burst and so on and people were not entering the field as rapidly. It had shrunk some. But I think it's still seen as the major organization. The public policy activities become more important and more visible, and I'm glad to see that. We talked earlier—not to be lobbying, but to point out where...

AKERA: ...to be the expert.

GALLER: ...experts on the technology. Electronic voting is a prime example of that, and I'm very pleased to see that ACM is active in that way

AKERA: Do you feel that you were successful? Your goal was to keep ACM a very open organization so that it could keep drawing in new members. Was that something that then really did happen?

GALLER: It did happen. I can't claim all the credit. I did it, yes. But I think in my time, we sort of set the attitude. I don't know that anyone ever argued otherwise, necessarily. I think the

arguments as to what ACM should be were in the early days, and by the time I was there, it was on its way.

AKERA: Yes, and you sort of helped propel it along in that direction. [Sustain the] momentum.

GALLER: Right.

AKERA: That was, in fact, the final question I was going to ask, which is to say, what do you regard as being the most important contribution to the organization?

GALLER: I didn't feel like a great innovator. I felt more like a caretaker. But looking back, things were done. Maybe perpetuating the attitude of inclusiveness and being welcoming to the applications the businesspeople and so on, to make it a welcoming organization—I think maybe that's what I did.

AKERA: That's wonderful. I think that was a very important service for the association.

Dr. Bernard Galler

Oral History by Atsushi Akera

Part III: Subsequent Life and Career (Recorded on day two, January 19, 2006)

AKERA: With this then, I would like to turn to the final phase of the interview, which has to do with your subsequent career. Again, the major emphasis of this interview is on the middle part, on ACM, and that is where most of the transcript will be. But for the benefit of the ACM members, we'd love to know more about what happened after you were president and what the rest of your career looked like. Can you tell us some general things? I might ask some specific questions.

GALLER: I continued employment at the University of Michigan until I retired in 1994. In '84, we merged our department from LS&A into Engineering. I've already mentioned that I was not that comfortable with the culture there, so I maintained my role as managing the computer science program with LS&A and counseling students and so on. I believe I had a nice career at the University. I paid a lot of attention to the treatment of teaching assistants. For example, I ran one study within the department of how many teaching assistants each type of course needed, and tried to make sure that they were allocated according to that function and so on.

AKERA: So really, you continued your interest in the curriculum, and making sure that the university was treating its students well, including at the undergraduate level.

GALLER: Yes, I tried to do that. Absolutely. One thing that always bothered me was that in the College of Engineering, teaching assistant funds had to be shared with visiting professors and so on, so there was always a tension. It was run at the department level. In LS&A, there was a college-level allocation, so they could take funds away from one department where they didn't need to use this and give them to another one. So CS was able to grow in that sense with appropriate funding. That was my university career. I felt satisfied, but I retired at 65 because I was already interested in other things and so on.

AKERA: Let me ask some specific questions. I want to flesh out this part of the interview. I think you've done some very wonderful things here at Michigan, and I want to give you a chance to spell that out. One is, going back, and this actually overlaps with your tenure as ACM president, but it has to do with the origins of computer science as a department at Michigan. Of course, it was first called Communication Sciences and then became Computer and Communication Sciences within the College of Liberal Arts and Science.

GALLER: Literature, Science, and the Arts.

AKERA: Thank you. LSA at Michigan. Can you tell us about the origins of CS, and CCS?

GALLER: It actually predates my participation. I think it was in the late '50s that Arthur Burks from Philosophy and Gordon Peterson from Linguistics established an interdisciplinary program called something like "Language Arts and Models" or something. It became a degree-granting program. John Holland got his PhD in that program, originally from the psychology department. But it involved pharmacology, electrical engineering, mathematics, psychology—a range of different areas. Somehow, I got involved in the early '60s or whatever and I joined it.

AKERA: Of course, you had a joint appointment between mathematics and the Computing Center.

GALLER: I was still in mathematics, but I joined this program without any appointment to it.

AKERA: But of course, you were faculty at Michigan and you were very active in computing and programming research, so it would have been a natural match.

GALLER: It was a natural thing to do, right. But we never saw ourselves as straight computer science. In 1965, we said to the University, "We think we should be a department, but we're not standard computer science. We'd like to be a department in the graduate school." They said, "No, we don't have departments [in the graduate school]. Choose a college." Somehow, we chose LS&A.

AKERA: Did Dr. Burks belong to LS&A because he was a philosopher...?

GALLER: Yes, philosophy is LSA. Right.

AKERA: How about linguistics?

GALLER: Linguistics is also LSA. So we settled on LS&A and called it Communication Sciences.

AKERA: That was in 1965?

GALLER: '65, yes. I think Peterson was the first chairman, but some people are saying Burks was. I don't remember.

AKERA: It may come up again today, I believe, as you're honoring Dr. Burks.¹

GALLER: Maybe. I'm not asked to talk today. I don't have to say anything. I think today they really want people to meet this wonderful old man. I'm not important there. But we didn't call it Communication Sciences very long because Communication Sciences at Michigan State was rather in the journalism tradition, and we needed to distinguish ourselves, so we changed to Computer and Communication Sciences, CCS. It grew, and we put out some very fine PhDs covering all kinds of interesting interdisciplinary topics.

AKERA: Was this simply a graduate program? Or was it also an undergraduate degree program?

¹ There was an event honoring Dr. Burks that was being held later during that day.

GALLER: It was a [initially a] graduate program. I think what made it a department was offering an undergraduate degree as well. Before that, the courses were all offered to graduates. Well, mathematics or engineering or whatever. So I think it was a graduate program. I don't remember that distinction. It grew and continued as quite successful. We have some wonderful PhDs—for example, Ted Codd with relational databases. John Holland had a whole series of students with genetic algorithms -There's a book here somewhere by John Koza, one of the students.

- But the whole field of genetic evolution and so on. Peterson died, and some of his people who were involved left. But we stayed that way. Hank Swain from Pharmacology was involved right up to the last-- In '84, we finally felt that we needed to get, for example, personal computers for people and LS&A--

AKERA: Actually, if I can add a point.

GALLER: Yes.

AKERA: In other words, about computing at the time. So there was this significant department surrounding Computer And Communication Sciences within LS&A. But at the University of Michigan, computing was also fragmented. There were computing activities going on in other schools. Where else was computing being done at the time?

GALLER: Business had their own. In fact, they got a whole series of Burroughs machines and everything was really quite separate.

AKERA: Was that pretty much an undergraduate program, to teach business data processing?

GALLER: I think so, yes.

AKERA: But was there some research done there was well, either in programming or databases or such?

GALLER: Not much. I don't think there was very much.

AKERA: On the other hand, computer science-type faculty were hired into the business school. Is that correct?

GALLER: Gradually, but not really for that purpose.

AKERA: So who taught the course?

GALLER: Two of our former PhDs, Dennis Severance and Tom Schriber, were the important ones.

AKERA: So they were hired as instructors, as opposed to research faculty originally?

GALLER: I don't recall. They were hired as faculty, but what the expectations were, I'm not sure.

AKERA: It's actually a fairly common phenomenon across the universities, because many other schools need someone to teach to their programming courses. And yet, because of the demands of their field, they were often given research appointments so that they continued to do productive research within these other, different schools. But that tended, in turn, to affect some of their research agendas so that businesses could pose interesting problems to people with a programming research background.

GALLER: I know that they did work on database types of problems.

AKERA: Yes, eventually.

GALLER: Right. You talk about a research appointment. We don't have anything like that. Faculty is faculty. They're expected to teach and to do research. Now, we have research scientists who are not full-fledged faculty. Part of the philosophy of Michigan is, you don't have faculty who don't teach.

AKERA: So teaching and research are seen as very much integrated, and that they ought to be.

GALLER: Yes. Of course, Engineering had computer engineering within Electrical Engineering. Then there was a graduate program called CICE—Computer, Information, and Control Engineering—that involved aerospace people for control, and that type of stuff.

AKERA: At least part of that program had very much an aerospace focus and interest that drove its research agenda on how to advance computer technology.

GALLER: Right. Remember, the Aerospace Department here is very important. A number of astronauts came from our department.

AKERA: That's right. Now, is there a slippage between hardware and software in the case of the CSE side? I'm sorry, not CSE. What was it? The group in the College of Engineering...

GALLER: It was Electrical. They had more requirements in circuit design and things like this. They included a couple of programming courses, but then went off into circuit architecture. We had a couple courses of that stuff and emphasized software.

AKERA: So is it true then that most people who wanted to learn how to program—most undergraduates—would have been eventually taking courses in the LS&A College?

GALLER: Right. Later, when we merged, the two core sequences became almost essentially identical.

AKERA: Can you tell us about that transition? Why was it felt that it was necessary to bring together the groups in LS&A and the College of Engineering?

GALLER: We had talked about it for 20 years, “Someday, maybe we should do this.” But we still had these different orientations. As I started to say before, the LS&A College didn’t have the funding to provide personal computers, which weren’t needed before with this wonderful MTS mainframe system, but things were changing.

AKERA: So the field itself was changing in a way that both the students’ hardware needs, lab space and things, was such that it really drove a change in the departmental structure.

GALLER: Yes.

AKERA: What specifically happened?

GALLER: We merged into Engineering. Now, we thought we were equals combining. They thought they were bailing us out. And that had some effects later on in terms of hiring and so on. But it worked out to be a pretty successful merger.

AKERA: If I recall, there was, in fact, a committee with four representatives from each side.

GALLER: Three on each one, I think, and I was on there.

AKERA: And you really negotiated terms that would be fair to the faculty as well as the students?

GALLER: That’s right. Including a transfer of funding for TAs from LS&A to Engineering. A one-time transfer, and that’s where the problems started because Engineering did not augment that very well and made it compete for other interests. Even though the courses were growing, I hard to fight hard to get more TAs for some of the courses.

AKERA: Although many aspects of the merger did work, one place where the students got shortchanged was that there wasn’t enough allocation of teaching assistants?

GALLER: Right. Then there was the other difference in the cultures about the measurement of success in research that I mentioned before. Much more pressure to bring in outside grants as opposed to doing research.

AKERA: Is it also true then that certain aspects of computer science that were developed under LS&A basically went by the wayside?

GALLER: All of the interdisciplinary stuff dropped out because the emphasis was on the accreditation through ABET.

AKERA: At the teaching level.

GALLER: At the teaching, and at...

AKERA: ABET accredits at the research level?

GALLER: No, I think they review the teaching--

AKERA: They focus on the curriculum. Is that right?

GALLER: That's right. But you don't hire people whose interests are in psychology.

AKERA: So it really affected faculty hiring.

GALLER: It affected it greatly.

AKERA: The program, as a whole, had to narrow down to what ABET defined as the proper curriculum for computer science.

GALLER: That's right. Eventually, John Holland pulled back and has a...he may still have a zero-time appointment, but he may not even have that anymore. He may have a full-time appointment in psychology. Certainly, we have no relationship at all with the people who were from other schools and stuff. No longer.

AKERA: That's right. Those joint appointments and such really went by the wayside.

GALLER: They withered, yes.

AKERA: It really changed then the nature of the research being done on computing at Michigan.

GALLER: Right.

AKERA: Although I imagine some of these other faculty members continue to do research.

GALLER: Right.

AKERA: But it really doesn't bring in the new blood. It doesn't allow you to expand into these other areas.

GALLER: That's right. In fact, one aspect of that was the formation of the School of Information.

AKERA: Which happened when?

GALLER: Maybe eight, ten years ago.

AKERA: '93. That would be just right.

GALLER: Yes, something like that. People who had interests that were on the periphery of computer science felt they had to form their own separate college. Or school, whatever.

AKERA: Great. Can you tell us a bit about your research throughout this period? You remained an active member of the faculty in terms of research as well. Where did you find your research going after your work on time-sharing systems and such?

GALLER: I'm not sure what research I did. I did some work with extensible languages. But, I don't know, I really didn't do a whole lot of research after that.

AKERA: Were you involved still with the Computing Center? Or did you tend to do more research through this new department in Computer and Communication Sciences? Not research, but work of whatever kind.

GALLER: I'm not sure I really differentiated it. I was involved in it.

AKERA: That's fine, and if something comes up-- I know that later on, you became involved in various transportation research.

GALLER: Yes, the intelligent vehicle stuff. I forgot about that. Right. Yes, that was an interest for about six or seven years.

AKERA: Were you actually funded for that? I'm sorry, I just wanted to establish the connection, if there was one.

GALLER: I don't recall. See, my interest was never big grants and things. In a way, that reflects why we never became very important at ARPA. Michigan was not the big grant type place. Big science and stuff.

AKERA: Just a focus on what the current intellectual agenda was, and finding a space to do interesting work?

GALLER: What people wanted to do, yes. If there was a grant available to support what we wanted to do, fine. But other places did what the grant money [led them to].

AKERA: Yes. MIT in particular?

GALLER: MIT and Pennsylvania, I remember, and so on.

AKERA: I think that, in a sense, this is reflective of the academic culture at the University of Michigan. Is that right? Especially in the LS&A.

GALLER: Especially in LS&A, and I think perhaps in the Midwest more than each coast. We were very different from the two coasts. There's a lot less politics and a lot less involvement in big science and things like that. I think we're a great university, but...

AKERA: ...it's almost an older approach to research, which is one that Harvard also follows in many ways. And giving tremendous autonomy to the faculty, where you're free to set your own research agenda. It's not really driven by external funding.

GALLER: That's right. Very decentralized.

AKERA: But that is different with the College of Engineering at Michigan, as well, because they did go after federal funding, and the money.

GALLER: That's right, big research centers and things like that. As I keep saying, I was never comfortable in that culture.

AKERA: The College of Engineering does, in fact, expand at Michigan in a way that LS&A did not necessarily do so.

GALLER: Very much so.

AKERA: In the '50s, '60s etc.

GALLER: That's right. Under Dudstadt and others. Very much expansion.

AKERA: Based on federal grant money, for the most part.

GALLER: Yes, to a large extent, and some industry.

AKERA: Based on state and industrial as well?

GALLER: Right.

AKERA: Regional industries, particularly?

GALLER: Yes. Automotive, for example.

AKERA: But then the aerospace, as you mentioned as well.

GALLER: Yes. But Michigan has grown to [producing] a large number of PhDs and so on.

AKERA: Now on the administrative side of your career. I understand you have also served as an Associate Dean. You were also Department Chair for a while. Is that correct?

GALLER: Right. That's the wrong order, but that's okay.

AKERA: I didn't actually get the dates. Could you give us that succession as well, and maybe [an account of] how you became involved?

GALLER: Bruce Arden was chairman from '71 to '73, I think. Then he left to go to Princeton, and I became chairman to '75. At that time, I was asked to be an Associate Dean in LS&A. That was a wonderful experience.

AKERA: What was it an Associate Dean of? Or was it general...?

GALLER: Well, for long-range planning. I got involved in a lot of faculty promotion things and so on, but I had the job of looking around to see... In fact, we did eliminate a couple of departments in the process. One was dissolved and one was merged into something else. But for me, the personal benefit of being an associate dean was to move up above the department level and suddenly meet people and learn about the functions of all the other departments and the museums and the gardens and so on. It broadened my perspective of the University greatly.

AKERA: I imagine, especially in the liberal arts side, the LS&A side, that this breadth is quite extensive. That's all of the arts and sciences, right?

GALLER: That's right. And the role of museums and so on.

AKERA: How long did you remain in that role?

GALLER: That was four years.

AKERA: '75 to '79.

GALLER: '75 to '79.

[Tape 4A begins]

AKERA: We spoke about your administrative work and responsibility. Was there anything else about your work within the Michigan administration?

GALLER: No.

AKERA: And this was until '79?

GALLER: Right. Then I was involved in starting the merger and so on. But that was mostly it.

AKERA: That's quite a bit to do! That's wonderful. Actually, one of the things that you also mentioned was that following the merger, the College of Engineering was not necessarily your most favorite environment to work in. Which is why you chose to retire from the University of Michigan at the age of 65, which would have been in 1993. Is that correct?

GALLER: Right.

AKERA: However, my understanding is that you also became quite involved with, in fact, established an organization called the Software Patent Institute and served as its president. Is that correct?

GALLER: Right.

AKERA: Can you tell us a little bit about this organization, and what made you found it?

GALLER: I was made aware of the problem that the patent office was getting involved with software by a friend at Harvard, actually.

AKERA: Actually, can I make a connection? I think even during your time at ACM, you actually had some feelings or wrote about the issue of open disclosure. Maybe you can start there, sort of mention that.

GALLER: Right. Well, it has to do with the start of the software industry. In the early days, we freely exchanged software. Nobody really talked about proprietary rights. IBM gave away a lot of software and so on.

AKERA: So there was really an academic ideal, in a sense.

GALLER: It was an academic ideal. Our reputation and prestige came from people wanting to have and use our software. In 1980 it became possible to copyright software; in 1981 it became possible to patent software. Right about that time, a few people had started to market software.

AKERA: Package software.

GALLER: Marty Goetz, for example, was one of the very first to try to compete against some IBM software, which was given away free.

AKERA: That's a challenge!

GALLER: It was only because we began to have intellectual property protection that some of this became possible.

AKERA: Just a note for the record that there was a major change in U.S. copyright and patent and trademark laws that made this all possible.

GALLER: That's right. Copyright in 1980 and patent in 1981. I mean, a very specific history there. We saw the handwriting on the wall. I wrote a letter to the editor that's been quoted a number of times in the *Communications*. That letter in particular chastised some university people for beginning to charge for software. We recognized that there might be an industry, a business, and so on, but universities shouldn't do that. That was a flailing, like Don Quixote against the windmills.

AKERA: The last great stance.

GALLER: The last great stance, that's right. But I began to realize that it could be a very important industry, and I got quite interested in intellectual property.

AKERA: So your own attitude shifted somewhat, recognizing that industry had an important role in software development.

GALLER: Right. Well, and that the universities, if they developed some important software, it was probably proper to try to recover some of the cost of it. I grew in that sense. So in '91, I was

made aware of the problems of software patenting. '81, it became possible to patent software. By '91, there were patents, and it was becoming apparent that the patent office had no expertise whatsoever. In fact, I talked to the patent office people and discovered that they didn't think it was their business to know about software patents. Their business was machines.

AKERA: In other words, there's a major change in the law, but the administrative structure of the patent office itself did not change to handle such patents?

GALLER: That's right. In a technical sense, it wasn't a change in a law. It was a Supreme Court case that said one could now patent software, provided it was part of a process that was otherwise patentable. So we recognized there was a problem. The patent office didn't know anything. On purpose, they didn't have anybody who knew about software. So we said, "Okay, we'll start an organization." I decided to make it an institute outside the University. I didn't want to be constrained by University rules or second-class situations. So I said, "Okay, we'll start it outside the University. I want industrial support." The idea was to build a database. Two goals: Database of non-patent prior art, because [patent lawyers and the patent office staff] could look [up] old patents. But unlike chemistry, for example, where everything is patented and they have a history of chemistry, they had no history of software. In fact, very little about software was published. People were too busy writing programs.

AKERA: And yet, prior art, it counts within the patenting process?

GALLER: Oh, absolutely.

AKERA: It was essential to document, to record unpatented findings.

GALLER: That's right. Then to get people within the patent office to know what software is. One of the criteria for a patent is, is it new? Or is it useful? Also, is it obvious from what's known? Well, they didn't know anything, so nothing was obvious. Everything was wonderful. But we knew. We could tell. We, the computer science profession, could have advised them. I went to talk to them and said, "Let me set up a panel of a couple of hundred people from whom we could draw experts to advise you." They said, "No, we can't do that because each patent is secret until it's issued and we can't disclose it." So we said, "Okay, well then let us educate your people."

So we started this institute with the patent office's blessing. Jerry Goldberg there was very helpful. A number of industrial people, IBM and Apple, and Sun was there originally. We had a bunch of sponsors. I remember I asked for some industry support for setting up an original meeting to talk about the viability for this, and they said, "Okay, we'll give you \$5,000." I said, "You guys are so cheap! I need at least \$10,000." "Okay, we'll give you \$10,000." So we called the meeting. I had to be forceful with this to get it done. I called the meeting, and at the meeting, we decided that it would be a viable thing to do, that they would contribute support. It was interesting that one of the goals I set down was not only that the patent office should be able to interrogate this database we were going to set up, but the people anticipating filing for a patent could see if it had been done before. I said people who are suing for patents can look at it. And right away, there was an uproar. "You can't do that." So I said, "Okay, we're not going to do that." So they said, "Okay." Right about that time, somebody suggested-- There was a man in

Ann Arbor, a lawyer, who would be very useful in helping set it up. So I contacted Rollie Cole, and together, and we did this. Got IBM and others' support. We started it as a project within a nonprofit organization that was already in Ann Arbor, and eventually we split off and became a nonprofit ourselves.

AKERA: What were the reasons why industry chose to support this initiative? Why was this seen as being necessary, and desirable?

GALLER: They could see that there would be a proliferation of trivial patents coming to the patent office because they were willing to patent anything.

AKERA: And that hinders innovation because it makes it so that all the legal issues get in the way of...?

GALLER: Everybody's going to sue everybody on everything and so on. So they wanted a more intelligent patent process.

AKERA: So industry could benefit from the patents. But the value of the patents themselves depended on the patenting process being informed and orderly so that not everything has to be contested afterwards?

GALLER: That's right. At the same time, there was this organization that was firmly opposed to software patents. I had hoped they had a lot of contributions to [make to] our database from academia. But Stallman and his friends at MIT spread the word, "Don't cooperate with Galler."

AKERA: This is Richard Stallman with the Open Software Foundation?² I guess there are several different organizations...

GALLER: I forget what it's called, yes. Free Software [Foundation], or whatever. So we got almost nothing from academia.

AKERA: There was a major contentious issue within the computer science community about whether this was good or not?

GALLER: Right. My attitude was, "There is a patent system. It's going to happen. Let's try to make it work." They argued, "Well, if we don't cooperate, maybe it'll fall of its own weight." Well, the government patent system is not going to fall of its own weight, so I never did agree with them.

AKERA: Did you have supporters within the computer science community?

GALLER: I think so, but not to the extent that anybody contributed anything. So I depended on industrial support. Fortunately, I got it. And legal [contributors]. We got some law firms. Law firms didn't have a lot of money, so they became mostly associate members, but we had a couple of very important law firms who were on the board because they contributed \$10,000 a year.

² My error. This should have been a reference to the Free Software Foundation.

Now, IBM and Apple and some of the others in the early years gave us \$40,000 or \$30,000, whatever. It settled down to \$10,000. After a while, even they decided they couldn't afford that, so now it's down to \$2,000 a year.

AKERA: Oh, dear!

GALLER: No high-level activity, but continuing. The database is open. In the last year, we had to start charging a little bit. You can search the database, anybody can search on the Web, and get hits. But then if you want to see the full article, download it, you pay something for it.

AKERA: It seems that in many ways, this is a continuation of your emphasis on education and on...

GALLER: That's right. Making knowledge available and making it accessible. Yes, it's right in line with everything I was doing, I'm sure. Of course, we haven't talked about the *Annals*.

AKERA: Yes. We do have to talk about that! For the final, substantive conversation of this interview, I know that you became very involved in the history of computing. I wonder if you could tell us about that.

GALLER: Okay. Well, I guess I've always been interested in history. Partly it must have come from my parents, their experiences and so on. When AFIPS started to talk about a history committee, I got involved. Jean Sammet was, I think, chairing it.

AKERA: Who was very involved with the history of programming languages, herself.

GALLER: That's right. She published books on the history of languages. I was naturally drawn to that committee. There were two main developments: One ended up with Tomash and the Charles Babbage Institute--

AKERA: Erwin and Adele Tomash?

GALLER: Right. Let me talk about that for a moment. [Erwin] started the Institute and looked for a home. I tried to get our history department at the University of Michigan interested in it. It came down to Michigan and Minnesota, and they visited us and so on. But aside from Nick Steneck, who teaches the history of technology, our history department wasn't interested, and we lost. It was probably inevitable because Tomash was an alumnus of Minnesota. But in fact, they've treated the Institute very well. I was on the board of the Institute for a long time. I'm still on the board of the Charles Babbage Foundation.

Now, I was appointed by AFIPS to the board. AFIPS contributed \$50,000 a year for three years to the Institute. But there was a big argument. Tomash wanted a research organization; we wanted an archive ("we" being Jean and I and the history committee). There was quite a discussion. In fact, at some point, and I'm not exactly sure why, Jean and Tomash had such a big argument that Jean resigned from the activity, and she's never been involved again in that. She's been involved with the Computer History Museum now. I stayed with [the Babbage Institute board], although I quit for a year.

AKERA: Just to clarify for the records, in other words, there were two major initiatives in the history of computing at the time. There was the AFIPS history committee, which Jean Sammet took the lead on; and then the other one, an independent effort by Erwin and Adele Tomash, who created the Charles Babbage Foundation. Actually, at first there wasn't a distinction between the Foundation and the Institute, but at a certain point, when the Charles Babbage Institute was established at the University of Minnesota, the decision was made to create the Charles Babbage Foundation as a separate entity that could administer what happened at the Charles Babbage Institute.

GALLER: To administer, and to support. Now the Foundation has taken on a different character, which I'm not sure is the subject of this.

AKERA: No.

GALLER: Okay. I actually quit their board for a year in protest over their argument with Jean, and I went back and forth. So that was an important activity that I was involved in, and still am.

AKERA: So the Charles Babbage Institute went towards the direction of archives.

GALLER: Both archive and research. Finally, it compromised on doing both. And it's a very important organization, and it's doing good work. There are a lot of books.

AKERA: I can vouch for this in several different ways. [laughs]

GALLER: Developing the Tomash fellows, who have now-- there must be a dozen or so in the field, of which you are one.

AKERA: That's correct!

GALLER: Who are working historians in computer history and technology history, and it's a wonderful thing. I fully support it, and I'm still in it.

The other activity I was in was the AFIPS Publication Board, or whatever. Again, Jean Sammet and Aaron Finerman were very involved in that. In 1978, Finerman and I had an interesting conversation. I was recruiting him to be director of the Computing Center at Michigan; he was recruiting me to start a journal on the history of computing. We both won. We both did it, and I started the *Annals*. I had been a reviewer of manuscripts for various things, like computing reviews and others. I had no experience starting a publication, but we did it.

AKERA: So you became the first editor-in-chief of the...

GALLER: *Annals of the History of Computing*, which was an AFIPS publication at that time. Much later, it went through several different publishers, and now it's with IEEE.

AKERA: Really because AFIPS itself as an organization collapsed. There was a need to find another publisher. Can you tell me then about your work as editor-in-chief? The early history of the *Annals*?

GALLER: Yes. It was interesting. When you start a journal, you have to have something for the first issue. It turned out there was a latent supply. There were people who had written historical things and couldn't find a good place to publish them. So we somehow spread the word and...

AKERA: There were a lot of pioneers and also some early historians who really wanted to get...

GALLER: ...who really wanted to publish. That's right. Brian Randall in particular had a whole long thing ready to go, and he couldn't find a place, so it worked. We had a very good editor, Myrtle Kellington, who came over from ACM originally, and later, Mondy Dana. My role was to solicit papers, to solicit reviewers, to set the tone with the Board. We had all kinds of decisions to make. The appearance of the journal, the audience, the price, the level, the amount of editing to be done. Some authors appreciate some editing to improve their style, and others absolutely don't-- One man for whom English was a second language, when ~~Mundie~~ Mondy tried to help him, he got so angry he withdrew the article altogether. We had to learn how to do this. I once was invited to give a talk on contemporary history publication. It's complicated because you publish something, and you might-- In fact, we had this threat by Eckert, a libel suit if published the article by... [chuckles]

AKERA: ...by Arthur and Alice Burks.

GALLER: Yes. But it proved successful. It's now on Volume 27 or something. I stayed with it, I think, through Volume 9. There have been three or four editor-in-chiefs. We got an international board, which was very helpful, and they're wonderful people. Everybody was in it for the right reasons. It was just great.

AKERA: I have to say, as a historian of computing, I very much appreciate the work that you did in creating the *Annals*, and all the other historical work that you did.

GALLER: Thank you. I'll mention two letters I got from Don Knuth. The first one, when we first started, "You're crazy. It's not going to be worth doing," and so on. Four years later, I got a letter saying, "I read it from cover to cover. It's wonderful." [chuckles]

AKERA: That's wonderful. Actually, I was sort of classmates with Don Knuth's daughter, who was at the University of Pennsylvania, in a different field. I got to know her. Quite interesting. Wonderful.

Well, Dr. Galler, you've had a wonderful career and a quite distinguished. I know that in addition to serving as the chair of the Computer and Communication Sciences department here, you were also the president of the Software Patent Institute. You also received the Distinguished Service Award from the American Federation of Information Processing Societies, and also from ACM. I imagine that success can be measured in many different ways, amongst which there are, of course, your many graduate students that you have advised.

GALLER: I'm very proud. I have 20 PhDs. A few co-chaired, but mainly not. That's very satisfying. I'm very much in touch with most of those folks.

AKERA: That is wonderful. I think you've mentioned that you have some academic grandchildren at this point. Is that correct?

GALLER: There is a man on our faculty here whose adviser was a student of mine, yes.

AKERA: That is something. Just as a closing question then, I just wanted to ask what do you consider were your most important contributions both to the profession and to the development of computing as a discipline?

GALLER: We never really did talk much about extensible languages, but in fact, that was, I think, important.

AKERA: Actually, this is an opportunity for you to.

GALLER: Well, it was the facility of adding things to a language, but we didn't publish anything about it for ten years, and I was roundly criticized for that because it was important.

AKERA: It really did affect computing as a science, as a field, and made a real contribution.

GALLER: I think it did. My early work with operating systems was important to the University and to the field because we learned a lot.

I guess being president of ACM and contributing that way was important. It was only two years. You can't shake the world in two years, but these were turbulent times and we made ACM a better organization, I think, at the time.

AKERA: That's all wonderful. Dr. Galler, thank you very much for a very wonderful interview. I thank you on behalf of the ACM membership as well.

GALLER: Thank you. Let the record show I'm shaking his hand right now. [laughter]