

An Interview with
THOMAS GALLIE
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Conducted by William Aspray

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Thomas Gallie Interview
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Abstract

Gallie focuses on his experiences as a limited term program officer in the Office of Computing Activities of the National Science Foundation (NSF). He discusses his own work and that of Milt Rose, Arthur Melmed, and Kent Curtis related to the support of computer-assisted instruction. He describes the impact of Don Bitzer and the PLATO system, the process of proposal evaluation, grants related to the use of computers in the classroom, and NSF's Regional Computing Program.

THOMAS GALLIE INTERVIEW

DATE: 7 November 1990

INTERVIEWER: William Aspray

LOCATION: Durham, NC

ASPRAV: Let's begin by having you briefly tell me about your own background, starting, say, with your college education and your early career before you came to the Foundation.

GALLIE: I was trained in mathematics, getting a Ph.D. in pure mathematics at Rice University in 1954. I was not seduced by a computer until late in... by graduate education, and I went to work for the Humble Oil Company, which is a subsidiary of what's now Exxon, between getting my Ph.D. and coming to Duke in the summer. And that's when I first got into computing with a remarkable group the Ratchford, Peaceland, Douglas group that used punch card machinery to solve partial differential equations of oil flow.

ASPRAV: I have met Donald Peaceland.

GALLIE: He's a fine fellow, I think. I really enjoyed working with Don. And then I came to Duke for a year. My wife said I wasn't making enough money, went back to Humble and worked there with the same group. At that time they had acquired the number two model of the Bendix G-15 computer. So I programmed that machine and solved partial differential equations numerically. Then I came back to Duke in 1956. As a mathematician I worked on getting NSF funding for the first computer at Duke. The first proposal to NSF from Duke came the year before I got there and was unsuccessful. I had an unbroken record for decades of writing proposals that were successful one of my few claims to something I guess I am proud of that. [laugh]

ASPRAV: The first grant had been a facilities grant, is that right?

GALLIE: Yes, it was. We got an IBM 650. The 1401 came later than that. Then I worked for a while running the computing laboratory at Duke, had a sabbatical leave in Zurich in 1962 as a guest of Heinz Rudishauser [?] at the ETH [?], and that was just a wonderful year. I came back and the computing center at Duke had fallen into financial problems in my absence. I was good at getting people to use the computer and to pay for it. So I came back and got the money flowing in again.

ASPRAY: Was there a charge back arrangement at the time?

GALLIE: Yes.

ASPRAY: And was it only used by the university, or was it used by outsiders as well?

GALLIE: I don't recall selling any outside time. I sold time to the parapsychology laboratory, which is associated in people's time with Duke, but at that time it was an outside agency. And basically, it ran on grants and university money. We gave free time to people that didn't have a grant. And then I grew tired of that sort of administrative work and concentrated on teaching and research. I had a nice summer a visiting professor in Caracas [?], Venezuela. Then in 1968-69 I went to NSF as a section head and that's what we will talk about, and maybe that's where you want to stop.

ASPRAY: How was it that you ended up going to the Foundation?

GALLIE: Milt Rose was head of the Office of Computing Activities and he had been a friend of mine. We worked on similar mathematical problems, and of course I had been in constant touch with the Foundation over the prior years as a client. Milt was the guy that I talked to and somehow or another at a meeting or someplace, maybe Milt suggested that there was a possibility of my being a rotator. And so that seemed to me like an interesting thing to do

and hopefully useful both to the Foundation, and also, it occurred to me it would be useful to do, to have somebody who understood how these things go. Our negotiations were very simple and so on, and I went to Washington.

ASPRAY: What were your duties as a program officer?

GALLIE: I had two people working for me John Lehmann, who I think is still there, and Richard Belemenos, who I think is now dead. He was a rotator from the University of New Hampshire. And our responsibilities primarily had to do with support of the use of computers in education, in teaching subjects other than computer science. Getting the computer into the curriculum was the main thing. There were some odds and ends. Milt was very enthusiastic about computer-assisted instruction, and the support of that was primarily the responsibility of Arthur Melned, who was another section head. But Milt kept urging me to get interested in that and see whether I felt that we should support CAI out of my sections. I remember the year I was there I had about \$6 million to spend.

ASPRAY: If I remember correctly, Melned was in the position that was the joint position between the education department and the Foundation?

GALLIE: No, there were three sections under Rose. Kent Curtis, who was primarily involved with facilities. Melned's section had a title something like "Special Projects." And he was putting a lot of money into computer-assisted instruction I mean a lot of money for those days. [laugh] Lyndon Johnson made a speech and came up in this speech with the idea of linking Africa and third world countries with the developed countries through satellite communication, I believe, and there were supposed to be computers involved in that. And the computer aspects were given to Melned, who was very capable, a very fine person, a very good friend. I am not without prejudice. Arthur sort of took everything else. I had been trying to remember where research of what we now call computer science fell in this, and do you know, I think it just wasn't terribly important at that time. And maybe I supported some of those things. There weren't many proposals. People who were doing solid research in computer areas were probably either thought of themselves as electrical engineers, or they thought of themselves as mathematicians. And

also, in all honesty, the amount of really high quality research in computer science at that time seems to me to have been fairly low. When I took my sabbatical to go to Zurich in 1962, which was a few years earlier I was working on compiler construction and I went to the Air Force AFOSR and got funding with relatively little difficulty. I think everywhere you went in those days, if you were doing good work in the computer area there was lots of money. The problem was not money; it was people who were interested in doing research in the computer area. And so I just have a complete blank as to whether I funded any good stuff. I remember the chairman of the computer science department at Stanford, and this will tell you the shape of my memory now. George Forsythe came into my office one day and we had a chat. And he said, well, that he thought maybe he could throw one or two of their less important projects to us. [laughter] But the fact is there was good work going on at Stanford and it wasn't a question of Stanford competing to get funding, it was a question of the funding agencies competing to get Stanford, because there was so little good work in computer science going on at that time. I guess I would really be embarrassed to have something like that appear. I don't care. [laugh] That's the truth. The truth is what I just said. That's the way it was. And so, our office was not putting very much of its energy into funding computer science research. That was just not a problem. Let me make one comment. I thought a little bit about this before you came in, and one of the things that I remember happened at that time and is related to my history as a client at NSF looking for money to fund facilities is that in that year of 1969, as I recall, the facilities program, which was run at that time by Kent Curtis, was phased out. And I thought it was very important. It certainly made a tremendous difference here at Duke to get these grants to help us getting our first computer and to upgrade. Without those grants Duke University would not have been persuaded to put their money into computing. But it probably was appropriate in 1969 that the facilities program was phased out. Kent was spending something, if I remember, of the order of \$12 million dollars, something like that, a year. And what struck me at the time was that the universities were spending, by the best accounts that I knew of at the time, and I talked with my colleagues there about this. The universities were spending something like \$500 million half a billion a year on computer facilities. And so that \$12 million from NSF was a very small part of the pie. And so, in other words, by that time, the money that they could put in had no longer had this huge leverage effect that it did in the earlier years. So the role that NSF sought to play was to put their money where it made a big difference, at the cutting edge where the universities simply wouldn't go into a new area if there wasn't money from

NSF. And by that time facilities were no longer such an issue. Now, I will circle back again. CAI was an area that Milt Rose wanted to help and he wanted me to look at CAI proposals that perhaps didn't fit Arthur Melned's program. So I went around the country and I looked at CAI projects most of them. I did not follow Milt's lead. I could not develop enthusiasm for these projects. I looked at CAI demos here, there and the other place, and I said, "My God, I wouldn't sit in front as a terminal that's as stupid as these are." The stuff they had at that time, by and large, was just an insult to an American college student or a high school student. I could see that some day this was going to be great. The one thing that changed that really worked that I got enthusiastic about was listening to Don Bitzer from Illinois. I did not see PLATO in action. Some years later I participated in taking a planeload of Duke faculty up to Urbana. We spent a day there, including the dean of Arts and Science and the dean of Medical School. And Bitzer's demonstration (I can't remember the year)... but at least by that time PLATO was a very, very impressive system. That is to say it no longer was an insult to the student [laugh] to play the game. But the thing that impressed me about Bitzer when I listened to him in 1969, I think it was (it was a good conference in CAI in Austin that I was allowed to attend), and Bitzer was the only person in the country that I know of at that time who had the courage and intelligence to talk in a forthright way about what it would cost to deliver CAI, and what the cost had to be to compete with human labor. As I remember, when he looked at what high schools pay for instructional activity, and he came to a conclusion something like this, if I remember way, way, way back then, that you had to be able deliver CAI at something like a dollar an hour. If you could do that then you were economically able to compete with human instruction. But if it was going to cost you \$10.00 an hour for a student to sit at a terminal, forget it. It's research. You're not delivering a product. He was not delivering that, but he had numbers. He had plans, and it depending on having something like 10,000 terminals. If you divide your development costs and your overhead and all that by 10,000 then he got the PLATO system down to a dollar an hour. Well, of course, the way it worked out was I don't believe he ever got [laugh] the 10,000 terminals out there. He got a thousand, which is an order of magnitude difference. But at any rate, Bitzer saw that that was a real problem; the economics is a real problem, and he had the courage to talk about it and put some numbers up on the board, and you could believe him or not. Nobody else was doing it at that time. You understand all this, I am sure, but the contrast, let's say, and good CAI at that time was, say, training airline pilots. You know, if you're simulating a flight trainer, first of all, the salary that you're paying

the pilot while he's being trained is in no way comparable to U.S. high schools, and secondly, you're saving him putting a Boeing 747 into a nosedive and so on that's a very expensive thing. So the cost of the CAI is immaterial in flight trainers, but in the classroom it's not immaterial and Bitzer saw that. But at any rate, so that's one of the things that I might have done and didn't because I didn't see the proposals out there. I think I did fund a few, but I mostly left that to Milt. I think he made good use of his money, and I can't be specific about that. I just had a lot of confidence. He's a hard headed, smart guy, and it was appropriate for NSF to move computer-assisted instruction along at that time. It's just that I couldn't develop any enthusiasm for it. Many years later, when I was chairman of the computer science at Duke, I tried to hire faculty members who worked in CAI. I couldn't find anybody in the country that wasn't already nailed down in Bitzer's shop or some place like that that seemed to me to be doing good academic research. And I finally just gave up. Fred Brooks at Chapel Hill did move heavily into that area. But let me say that Fred Brooks is a person who has had a very, very big influence on my life and whom I admire over everybody that I ever worked with on a professional basis. It was not too many years after that in the 1970s sometimes they had an open house over at Chapel Hill. They had lots of students who did develop CAI projects. And I had this same feeling that I had had when I was working at the Foundation. I spent the night going from one project to another, and I had the feeling, "My God, this is clever work this student has done, but to subject anybody to being trained by these materials, to take their time and sit in front of a dumb computer." I mean, that's what I saw there; this computer is dumb at this work compared to the kind of humans that you expect to encounter in an educational environment. So there's some real prejudices of mine. There is good work. Computer-assisted instruction is coming. It has a role to play. The computer can be intelligent. It can be an intelligent instructor, certainly, in drill and practice and that sort of thing. But there are two things that have to be there. One is the computer system has got to be intelligent enough so it doesn't deaden the mind of the student, and secondly, it's got to be delivered at a cost that compares with hiring a human to do the same thing. Human beings are useful as teachers. [laugh]

ASPRAY: At the Foundation at the time there was a strong push from the president's office the president's Science Advisory Committee for computer-aided instruction or computers in education?

GALLIE: Yes.

ASPRAY: Did you feel that you had that weight sitting above you when you were out looking at these? That you had to develop something in this area?

GALLIE: Well, let me make a distinction. Computers in education was my business. I came in there fired with enthusiasm. I had been working at Duke to get economists and physicists and mathematicians and biologists and so forth to use computers in the classroom, or as a laboratory tool for their students and so forth. So that's what I did there. I funded a lot of projects. They tend to slip away from my mind. I suppose there may even have been a conflict of interest. We made a very good grant to the folks over at the University of North Carolina in statistics. I followed that for some years afterwards, and they really did good work in developing statistical materials not as in CAI where the computer is the teacher, but where the computer is the tool. The student uses the computer to simulate a situation, to try out statistical measures this sort of thing. So that was my business, and I made lots of grants in that area. And it's very hard work to develop new curricular materials. It gets you no where academically. You know, it kills your academic career to take your time away from research and develop new curricular materials and using new tools like the computer. To answer your question, was I doing that because President Johnson wanted it? No, because that's why I went there. I thought this was a very useful thing and it should be done, that the NSF could play a role because the universities sure as heck were not interested in funding curriculum development. And so we had projects in many, many areas in art, music, physics. You name it. There were projects and there were people at that time who I thought were doing very good work, but I did not feel that I as overwhelmed by strong proposals. I felt there was a fair sort of balance between proposal pressure and the money that we had. If I had had twice as much money I would have had to go to lower class proposals. I am remembering now some other things that I did do, and I forget what label was put on this. Milt Rose gave us a lot of latitude. And I made one large facilities grant that sticks in my mind. I am not going to name the institution. It was very innovative. It involved a network of computers, multi-media, t.v. computers, etc. And the proposal came to me, because there was a curriculum aspect in

there, but it was really a big hardware project. And I sort of knew at the time that it was premature and it would never fly, and as well as I know it didn't, but it was a good university one of the Ivy League schools, not too far from your institution. And so that was funding the hardware rather than the curriculum thing. It was just a premature grant.

ASPRAY: Let me talk about your tactics for just a moment. Did you use conferences as a tool for trying to spread the word in a particular subject area?

GALLIE: We did fund conferences on the computer in the curriculum. I was sort of passive in that. When somebody came in and said, "Hey, I want to have a conference of this sort," I was very happy to fund it but I didn't go out and ask anybody, "Hey, why don't you do that?"

ASPRAY: And do you think those conferences were successful in some measure?

GALLIE: Yes, because doing this kind of work required a lot of energy and enthusiasm and time. The great thing about these conferences was that one met people from other disciplines and found other people who were going through the same thing. And it wasn't, I think, so much a matter of picking up techniques or information or that sort of thing, but just the encouragement of finding other people that had the enthusiasm and the courage to ignore their own career advancement and do what they thought was important for their discipline and their institution. When I speak about what it does to a person's career I think of one of my visits to the University California at Irvine, which was created with the notion of using the computer heavily in the educational process. My judgement of what happened there was they hired a lot of people who believed in this and who threw themselves into it; when it came time to award tenure they didn't have the research qualifications and they left. I mean, they didn't leave voluntarily; they were booted out. [laugh] That was the reality of the thing, and so I was supporting people around the country. If they were young people; if they were older people many of them had tenure and enjoyed doing that, and their salaries were already at a level that they could afford the luxury of teaching. If I sound cynical, I don't think I am cynical; I think I'm just realistic. It's the way the system works. [laugh]

ASPRAY: Lots of people understand that. Were the grants that you were awarding small, large, varying sizes?

GALLIE: That facilities grant may have been one of the largest; it was probably about two or three hundred thousand. That was probably the largest. A typical grant might have been \$60,000 something like that. It would pay some salaries; it would pay some students; it would pay for a little computer time. And it gave the P.I. the sanction of the National Science Foundation. It said, "The National Science Foundation thinks the work you are doing is good; it's worth support." And that's very significant in the politics of the university scene.

ASPRAY: Were there kinds of institutions that you were particularly looking to support, whether it was those few places that had already been innovative leaders in development of computers or computer systems time sharing systems, for example? Or was there geographical distribution, or was there distribution over different types of institutions four-year colleges, technical schools, and so on?

GALLIE: They were all sorts of institutions. I have mentioned that Stanford seemed to think we hardly merited their attention. I may have caught Forsythe on a bad day. In fact, I did make grants to Stanford. I had a proposal from Harvard, which pleading that the computer atmosphere there was not good that they had to go over to even find somebody to tell them how to compute. When I sent this out for review one of my reviewers called this a welfare project and the grant was not made. But, you know, we made grants to prestigious institutions and others that were not. And one of the real shocks to me was that the representatives of the Bureau of the Budget.

ASPRAY: Office of Management and Budget?

GALLIE: It's now OMB, but then it was Bureau of the Budget. I didn't realize what power those guys had. And they came in and met with us and they looked at our grants, and they picked a grant we had made to some Christian college I forget what it was no research, etc., etc., but they were doing good work, I thought, in this area of

curriculum development. And these guys said, "What? What are you making a grant to these guys for?" [laugh] I was shocked that they were looking over our shoulders at that level. Obviously it's easier to make a grant to MIT than to Podunk Technical Institute, but we tried to sniff out people who were doing good work and make the grants wherever the chips fell. That's my impression, that it was a great variety. We were aware that the Congress wanted geographical distribution. We worked, with encouragement from the Congress... we worked very hard with the school system of the District of Columbia. We practically wrote a proposal for those guys; we wanted so bad to make a grant to them. They were very, very inept at seeking money. Well, we consciously tried for diversity in these various ways, such as geographic diversity stopping short of making a grant solely for those reasons. There had to be some merit in the proposal. [laugh] And the guys I worked with, we worked together and I had the highest respect for Rose and Melned and Curtis and Belleminos, Lehmann. These were fine, conscientious, honorable people, and maybe no geniuses in the crowd, but we felt as though we were doing good. [laugh] We were going to make the country a better place by virtue of these grants we made, so we were cognizant of the political pressures, and also we had some feeling of fairness. It wasn't fair to make grants only where you felt sure, because of the reputation of the investigator, that somehow or another he couldn't screw up too badly. [laugh]

ASPRAY: Oh, the DARPA models. [laugh]

TAPE 1/SIDE 2

GALLIE: I've given you a lot of opinions and not too many facts.

ASPRAY: Well, that's exactly what one wants in an interview. I mean, you try to understand motivations, reasons for doing things rather than getting factual information in interviews. You look to the documentary evidence for the facts.

GALLIE: Other areas of the Foundation would send us proposals that came in to them that had a computer aspect to it, and for example, from the education section, I got some proposals that they chose not to fund for one reason or another, couldn't fund, for institutes and this sort of thing that had a strong computer curriculum development. I remember, not in this regard, but I visited the public schools in the Denver, Boulder... in the Denver area. I visited a public school where they were doing incredibly good work using computers in the classroom, and they have had a lot of NSF support in that area. They have done a lot to bring the teachers up to speed using computers in the classroom. Anyway, so the thing that was administratively difficult was to get these proposals that other sections of the Foundation had chosen, for whatever reason, not to fund and we were given a shot at it. And I picked out some of those, and I seemed to remember vaguely that Milt Rose was away for a week or so and I remember making some grants in that area, and getting called on the carpet by some of the people higher up in the Foundation. I can't remember what exactly their objection was, but they were saying, "Why are you making a grant to these people?" I suppose my answer was, "Well, I liked the proposal." [laugh] "It sounded like good work to me." And I don't even remember what their objection was, but it seemed to me that in order to get a proposal funded through all the levels of the Foundation you had to work up the documentation to make a good justification. You had to have the good reviews there, which, as I think is no secret, the people in the Foundation... the Foundation staff have a lot of latitude in who they ask to make the reviews, and you can find out who are the people who will write a positive review. Very often, the more... It seemed to me the more established scientists often maybe had a sense of inner security that young assistant professors don't, and they didn't need to boost their egos by tearing a proposal apart. And you often would get these favorable reviews from very, very well-known people. The staff had to prepare the documentation for any proposal they wanted funded very carefully or somebody would stick the knife in you. [laugh] Another thing that I remember was on the on the other side of that coin is you couldn't just sit around month after month biting your fingernails and saying, "Which one shall I fund?" or "How much more documentation did you need?" The word in our office that we have is, "Well, if you can't spend your money we'll give it to somebody who can." [laugh] So I worked very hard that year at NSF. I thought I worked hard; I enjoyed it very much. And you had to document your case, and you had to move those proposals through and either accept them or reject them

in a reasonable length of time. And that's what you get paid for while you're there and I thought it worked fairly well.

I am sorry. What were you asking me? [laugh]

ASPRAY: I am not sure, but I do have some other questions. Can you go back and identify three or four grants that you made during your year that you thought resulted in particularly good work, or they met their objectives at least as well as the proposal asked for, and also people that I might talk to about those. We haven't decided exactly which projects we are going to go out in the field and talk to people about, but I would like some leads as to ones that I might investigate.

GALLIE: Well, one thing that you must be aware of is that I think in general the Foundation doesn't put much of its effort into following up these proposals. The quality control of the National Science Foundation, in my opinion, is that they make grants for short periods of time and then if you want more funding you come back with another proposal and that proposal has got to describe the work you have done. And if you can't document you have been doing good work then you don't get the grant. Well, I was in an area where it was all start-up stuff. There weren't people coming in for a second grant in the same area, so we knew that.

ASPRAY: Right.

GALLIE: And I only worked there a year, and I mentioned one that I did follow because it was near. The University of North Carolina statistics curriculum development thing, which I just thought was excellent. Unfortunately, the PI is dead, and I don't know anybody that you could follow up on that. In fact, George Nicholson was chairman of the department, and after he died the department shifted from a real interest in undergraduate education to being a purely graduate department that's what their charter was and focusing on research and Ph.D. dissertations and that stuff. Well, now, another reason that I can't answer your question very well is that the bulk of what I did was to support curriculum development. And that's an area in which tangible results are very hard to see. Eventually, perhaps, these things result in textbooks all right, then you have something that's permanent. I don't believe the Foundation

stayed in that business very long after I was there. I went to a meeting at the White House representing NSF there were other institutions there and some wise person there said that no educational experiment ever fails. And his argument was that what you are trying to do in education is give the student something that will be a benefit to him when he is 30, 40 years old not something that's going to be of benefit next year, although the student's parents are interested in "What job will Johnny get when he graduates?" But that's not what the professor is focusing on certainly not at Duke. We're looking for the long-range development of the student. And when Johnny is 35 years old there have been so many influences in his life, how can you say whether... Sometimes they will say, "This course or that at my undergraduate institution had a great effect on me, but the measurement of progress in education is very, very difficult, and that's what I was involved in there. And so it's very subjective what were the good grants that we made? I don't know. And maybe... that's one reason I only stayed one year. In the last analysis. I had the feeling, "Gee whiz! You really ought to stay two years. It takes one year to learn the ropes and the second year maybe you can do a much better job." I came it back to Duke because you see the results. And when you are in the classroom you are dealing with students; you're running the computing center; you are doing research. You see the results coming out. And when you work for NSF it's all on faith. You don't see the results of your work until years later. I guess that's the reason I left after a year. I couldn't stand to not have the feedback that you get when you're on the front lines, as it were. At NSF it is very difficult to tell with any certainty whether the grants you're making are good ones or not. So I did... before meeting with you I tried to think about, "Well, what grants did I make that I am really proud of?" And when I look back on things I have done in my life it's in other areas that I say, "Oh, I am really proud that I did this." I don't think I did much harm. [laugh] And \$6 million was not a lot for the United States to spend to help the university community move toward using the computer as a tool in education not a lot of money. I wish I could point to something, but let me say this, that that kind of work is very, very difficult. An example, an obvious thing to do is to use the computer in teaching calculus. Now, I made grants in that area in 1968, 1969. I don't remember what they were. What has happened has depended very much on the technology. The fact that we have pocket calculators now that will do the symbolic work that we used to drill students on the integral of the sine is the cosine and so on. And when you think of the man-hours of student work and instructional work that over the decades of this century are devoted to that and which is now done with a pocket calculator. My point is that it's

taken a long time that we had to get that technology, and it's going to take a lot longer before the mathematics community wakes up and starts using it, and whether the National Science Foundation can wake them up or not I don't know. So I can't point to a grant that I made that revolutionized that area. It's been a long, long, slow, slow process. The inertia in the educational system is incredible. At every other system we like to do things the way we did it when we were a boy. [laugh]

ASPRAY: You have alluded to a couple of grants that I think, but maybe incorrectly, were part of the Regional Computer Centers program.

GALLIE: I had been involved in that. The best regional computing program in the country in my own prejudiced view is one that I had a hand in starting, which we had started, I think, before I went to NSF, at that time called the North Carolina Computer Orientation Project. We offered free computing for one year to every post high school institution in the state of North Carolina, and very darn few of them passed it up. The NSF program, which I served as a consultant afterwards, and I visited some of those and reviewed proposals. It sort of followed in my unbiased view [laugh] I think that that program to some extent was inspired by the success that we had in North Carolina in getting many computers, many universities and non-universities to share computing facilities and share expertise, share programs, share curriculum materials and this sort of thing. And I think the NSF initiative in that regard of these regional computing centers to a large extent may have been inspired by what we did. And in my view it was not too successful, to be frank with you. My impression is that when NSF funding was withdrawn most of those regional centers collapsed. Ours did not. It's in operation today, although it's not really very significant anymore, because the technology has changed, and because of microcomputers. And that, a regional activity makes much less sense, although as I said, it's now a permanent part of the University of North Carolina system. As a symptom of the kind of thinking that happens in many of these cases I went on a site visit to an institution I will not name and they were setting up. They had proposed a state-wide network and they had representatives of the lesser institutions that were to hook into the central facility. And when it came lunch time the NSF visitors were taken and had lunch at the faculty club with the president of the institution. And the visitors from the other institutions were told where

McDonald's is. [laugh] "Go get something to eat and we will resume at 2:00. Now, you know, when the central institution has that attitude the thing won't fly. [laugh] No, I think a grant was not made in this case, but I have seen the statements from Carnegie Mellon that said that if the institutions that were working with them weren't bright enough to understand how they did computing at CMU, well, that was too bad. The facility was there and they could use it. I may be wrong about that. I don't have the document, and so on. But I think one could see that attitude in the places, and you absolutely cannot bring these institutions where the faculty are not well-prepared to use computers, who have inferiority complexes of one sort or another. You can't tie them into an MIT, let's say, without MIT really did a wonderful job in the 1950s before I got into it of bring other institutions in New England together. When I say the NSF program was inspired by the North Carolina thing I would have to say we were inspired by MIT, and MIT and UCLA were the grandfathers of that sort of thing. I think they did wonderful things in the early days of computing to get cooperation between different institutions. I think the NSF program maybe came too late in the day and our own centralized facility here, the Triangle University's Computation Center, has finally maybe 10 years too late has been put to sleep. It was a very significant thing in the 1960s because the cost of computing was so great you had to share it. Now the cost of computing is so incredibly inexpensive with the microprocessor. I have a computer here which is really much superior computing. Everything to the original multi-million dollar machine we started with out in the research triangle that three universities and 25 other institutions around the state were sharing. I got it here on my desk. I go away for weeks and leave it off and don't worry. So those are some thoughts about the NSF regional program. But I did follow that somewhat, and I think some good things happened. It's only just this instance it popped in my head. The reason that it wasn't more successful may well be that we were just too late. The technology was already moving ahead. The lesser institutions could afford to have their own computing facilities as we moved into the 1970s.

ASPRAY: Are there any topics we haven't talked about that you would like to see addressed?

GALLIE: Do I have any more diatribes? [laugh] I don't think of anything. I thought the Foundation was well run. When I was there they had a crisis at the computing facilities that were monitoring grants and this sort of thing where

the Foundation didn't know how much money had been awarded, and there was a crisis, an investigation, and that's an interesting story in itself. Kent Curtis was a wonderful fellow. I think he chaired the committee that looked into that. And I don't know whether you want to have anything about that in the history, but it's interesting. You see, basically, the Foundation found that the computing work that they farmed out to private industry got done well and efficiently. The stuff they did in-house did not. And why was that? Well, basically, that's the way the federal government works. They use the personnel policies of the federal government. You can't get computing done if using the job descriptions and things like that. Enough said. [laugh]

[INTERRUPTION]

GALLIE: It was only part of the Foundation where they said, "You must put your money here! It was mandated not by NSF really, but the Congress had great enthusiasm for that. And so they mainly were in the business of funding these training teachers. I was the recipient of a grant for training. I did a summer institute for college teachers. Duke was in there. Anyway, they were not in the curriculum development business. Oh, that's not true. The new math, which is so maligned. That's very controversial. My own view is that people tend to take very extreme positions on that, and I think there's much to be said for the new math, but it wasn't done right and it gave curriculum development a bad name. [laughter] That was done, I guess, out of the education section. NSF, it seemed to me, only sporadically went into the curriculum development. That's sort of what I did for a year, and it may have been useful. We were briefed by DARPA. They were just starting the ARPANet. They didn't talk about their relations with universities, and I think these big block grants at the universities tended to come after 1968, and I think they were maybe just starting. Well, I guess they have always been getting work with MIT, but they were picking up one university after another and putting these huge grants in. That was not discussed. The Office of Education had a lot of money. I mean, it really, really looked like a rathole to me. They were spending a lot of money and I couldn't see that anything was being accomplished. So I had a very negative feeling about the Office of Education, and I guess they went out of that business. Maybe they were doing comparable work. They picked out certain high schools some in Philadelphia, and so on where they put a lot of money in and gave them computing equipment, and some

good things got done there. One philosophical remark that I would like to make is when I look at the American educational system, particularly as you get higher up... the university in the U.S. is the best in the world. And I think it is so... I think that's indefensible. You can make an argument to support that view, and I think it's because of the diversity of our educational system. I have spent time in universities in Europe that's all government funded, and everything works in lock-step and so on. And, yes, there's great science done at Cambridge and at the ETH in Zurich and so on and so on. But there is no competition to government-supported education for private institutions, and I mean, it's very healthy here. And then we have our community colleges and this sort of thing. So a lot of different things get tried and some of them work and some don't. And I think the NSF has been in there playing a useful role and putting money in all of these different kinds of institutions - public, private, research universities, community colleges, high schools. We didn't do much. That may be the difference. So the stuff I was doing had nothing to do with research, but of course without an educational system we wouldn't have any research. If we don't straighten out our public elementary and junior high schools, everybody in the country, I think, knows that we absolutely have to do that for all kinds of reasons. If you don't pay attention to the kids when they're in first grade, let them have an influence on what they do in their Ph.D. programs.

[INTERRUPTION]

GALLIE: That is, that this business of diversity also applies to the different disciplines, that it's a good thing, that computing has not been limited to the university computing centers. It's spread out to the desks of the professor of classics and art and religion and biology and physics and math and so on. And it's also a good thing that the development of computing algorithms and curriculum development and so on has not been centralized. I founded the computer science department here. Computer science departments will probably work themselves into the same sort of narrow specialization and have the same degree of relevance or irrelevance that other departments have. Philosophy used to be everything. All of science was called natural philosophy, and now departments of philosophy split hairs of one sort or another, and I think computer science departments will tend to do the same. Now, the Office of Computing Activities was created by the National Science Foundation, I suppose (I wasn't consulted), because at

that period of time it looked as though computing needed a special emphasis, a special hole of its own. I suspect that if you look... You probably have already looked at what's going on at NSF you find support of computing activities is spread all through the Foundation. It isn't just located in one area. The physicists are tremendous users of computers. In the earliest days in the 1940s all the programmers in the U.S. practically... all the scientific programmers in the U.S. were guys that had a Ph.D. in physics. Well, it's still the case that physicists make tremendous use of computers, make contributions to have computers used and so on and so on. And I think this is a good thing. The NSF has reorganized and not treated computing as something apart from everything else, except there is now a well-defined domain of computer science and deserves to be funded on its own grounds, but without the notion that it's going to save the world for all of these other disciplines. And that's what I have always been interested in getting computing spread out to the masses and into other disciplines in math and computer science and electrical engineering. And that's what my section was up to, and it was probably a good thing at the time, and it's probably utterly inappropriate now, for it to have anything of that it would be insane to have anything of that sort funded by the Foundation now. The academic community has matured since that time. You bring back wonderful memories. Oh, it was so wonderful to be able to travel around the country and see this going on in all these institutions. And of course they treated us like royalty. We went to MIT and the whole EE department there did a show and tell, and they treated us like we were kings. It was easy to get your head turned. If you got money in your pocket you really get the royal welcome from these institutions. [laugh]

ASPRAY: Certainly.

GALLIE: And so I met all sorts of interesting and wonderful people working for the Foundation. It was a great experience. [laugh]

END OF INTERVIEW