Computer Oral History Collection, 1969-1973, 1977

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MERZBACH:

Why don't we start off by talking a little bit about your early career and how you got into the computer business. You started out as a…

ALT:

Quite by accident, quite by accident. I was in mathematics, and I was more specifically in mathematics and methods of business forecasting, or, I should say, statistical methods of business forecasting. That was just before World War II, and then I was drafted into the Army. And toward the end of the war, I was pulled out of the assignment that I had before, (because the Office of Strategic Services wanted to send me overseas, but things were happening so fast in Europe at that time, that, just before I was sent away, the request was cancelled); and, they had me sitting in Washington and didn't know what to do with me. So, just to be nice, they asked me: "Where would you like to go?" And, it happened that I had heard that Aberdeen Proving Grounds was one place that I'd heard mathematicians could be used, so I suggested Aberdeen Proving Grounds, and so they sent me there. And when I arrived at Aberdeen, people were very much surprised because their officers' contingent had just been greatly reduced, and they had lost a good many of their officers who had been sent overseas, and here a new one was being sent in and they didn't quite know what to do with me, and so they put me on something called a Computations Committee. We were then planning to introduce automatic computers, and they were trying to divorce the preparation for these computers from the routine operation of the computation laboratory. The committee consisted of four people and reported directly to Dr. Dederick, who was an associate director--one of the two or three associate directors of the laboratory. The other members of the committee were: Derrick Lehmer, Haskell Curry, the logician from Penn State, (Lehmer, of course, was the number theorist from Berkeley who was spending a year at Aberdeen on war work) and a younger man, an astronomer, Cunningham--Cunningham who later on went to Berkeley and I think is still there. He had been studying at Harvard at the Harvard Observatory and had come to Aberdeen from there--knew a little bit about computing on punch-card machines and was put on this committee. These three and myself made up the Computations Committee, and we were supposed to study the introduction of the new computers and how they would be integrated into the operation of the laboratories.

MERZBACH:

Now what year was that?

ALT:

That was the spring of 1945 that I arrived at Aberdeen, March or April, I think April, of 1945. The others weren't on board yet. Cunningham was there but was working in the computation laboratory, and he was soon to be transferred to this committee. Curry and Lehmer both arrived later that summer. In retrospect, it seems that one wouldn't start something so shortly before the end of the war; but, of course, we didn't know that the war was going to end. I was the first one and I was looking for something to do and I didn't get very many guidelines. ENIAC was away in Philadelphia and nothing to do with it. The Bell Laboratories were building a computer for Aberdeen but that was far away. The only thing that was there and in existence apart from the differential analyzer and standard punch-card machines were a pair of relay calculators built by IBM, quite small by today's concepts, but a little larger than most of the standard IBM machines at that time. And, so I studied those and they were…

MERZBACH:

These were the so-called pluggable…

ALT:

Yes, the name was Relay Calculator, I believe that was their full --the IBM Relay Calculators and they had just been delivered. They were not commercially available; IBM made only a few and we had gotten some of the earliest, and there was a problem about what one would do with them and I began to work on it. Up until then I hadn't even known anything about the use of ordinary punch-card machines in computing. I learned that rather quickly and ran one or two problems on standard machines for which I prepared the plug boards myself just to learn, and then started to devise some programs for the relay calculators. A program there would mean designing a plug board for it.

MERZBACH:

Let me go back a minute. You said that you had heard about Aberdeen--that there was some activity--did you know anyone who was involved with the activities there or do you recall what…

ALT:

Well, no. But, even before the war I knew that Aberdeen had a sort of mathematical establishment and later during the war I was stationed at Edgewood Arsenal for a while,

(which is only twelve miles from there) and we visited Aberdeen once in a while and I knew about its existence that way. I didn't know anything about computers in that connection, in fact, they hardly existed. But, before we had gotten much further the war was over. One of the last things I did while I was still in uniform was attend a conference at MIT in 1945--the dedication of one of the computers up there. This was in September of '48. I don't remember whether it was one of the big Aiken Relay Calculators that was being dedicated or possibly the second differential analyzer at MIT.

MERZBACH:

Yes, I think that was the MIT Conference, because Mark II…

ALT:

All right, the conference was at MIT and we had one session at Harvard where we were being shown around. That's the correct designation, yes. And, I left Aberdeen before anything had really happened in computers. Perhaps the most significant thing for me was I met Lehmer there. Lehmer stayed another year; and it was during that year, that ENIAC was completed, and Lehmer put his first famous test problems on. But, meanwhile, I had become very much interested in computers; and going back to my old civilian occupation was mostly because that got me out of the Army fastest. But, I had a continuing desire to get back to computers; and so about a year later, I returned to the Aberdeen payroll.

MERZBACH:

Excuse me; this means you went back to the…

ALT:

I went back to New York for a year. From November '45 to October '46 I was there, and then returned to the Aberdeen staff. And, then for a few months, I was on detail service in New York at Bell Laboratories where the relay calculators were being completed just at that time. And I was there during the testing and in order to learn how to handle them--and that was a good assignment. I had nothing to do but work with these machines, and it was the first time that I became really intimate and familiar with the machines. A couple of girls from Aberdeen were transferred to New York and worked, under my supervision, on programming--and that one, can really be called programming; that was the first time that we really programmed the computer. We knew, meanwhile, about the ENIAC; and we knew about the early designs for the EDVAC. And I kept making comparisons between those and the programming for the Bell Laboratories' computers. We also programmed some…I wish I could show you something that we did at that time, if the line will be long enough?

MERZBACH:

Very long

ALT:

Here is a printout of something that we computed there. This is a table of the incomplete Beta function; also called the incomplete binomial summation. One of the statisticians at Bell Laboratories had suggested that as a test problem because he was interested in having these functions tabulated. I learned a lot in that, for example that one spends twice as much time planning the printing as planning the computing. It took no time at all to write the instructions for computing but then when we began to format the pages and figure out how long the columns should be and how many lines on a page (and this is a difficult table to format, because the different portions take different lengths of columns) most of our time went into that. The result was a very automatic production of a printed table. The whole book that you see could have been produced without human intervention if the computer had run long enough. Actually, at that time, it ran for a few hours at a time before a relay would get dirty and the machine would stop and somebody would have to start it up again. So, we had plenty of time to look at the sheets as they came off. But, I remember one horrible morning…It was our custom to leave the machine on in the evening when we went home because it was supposed to be running alone at night and had plenty of fire protection and safeguards against malfunctions and all sorts of things, and typically it would run for a few hours after we had left and then stop on something wrong. And, we would come in the morning and find out where it had stopped and go on from there. But, one morning we came in and the machine was stopped as usual but something seemed to have gone wrong, because there was paper all over the floor; there was a mountain of paper next to the machine and it took us a while to realize that night the machine had worked until about five in the morning and we hadn't expected--we hadn't planned on how much paper was produced in the process. We spent the rest of the morning cutting its pages.

MERZBACH:

There's one thing that interests me. You mentioned a while ago that while you were there you were aware of ENIAC but this was really disassociated from your…

ALT:

Yes, yes. All the machines were the responsibility of the Computations Committee but we quickly subdivided since there were four of us: Lehmer and Curry took principal interest in the ENIAC, and I worked first on the relay calculators and then on the Bell Laboratories' computers. (Cunningham was also more an IBM man because that was his earlier experience.) And then later on just because I was in New York, I worked with the Bell Relay Calculators. When I came back to Aberdeen in 1946, the Computations Committee didn't exist anymore; the others had left. But, I was assigned, because I

happened to be living in New York, I was assigned to Bell Laboratories. It seemed to be a good arrangement for all concerned, and I stayed at Bell Laboratories until about April or May of 1947 when the machines were moved to Aberdeen. They hadn't been moved earlier partly because they weren't finished and hadn't been released, and partly because the building in Aberdeen was not finished; they put up a new wing to the Laboratories building just to house the computers. ENIAC was being moved just before the relay computers. As it was, the computers were moved slightly prematurely. Bell Laboratory was not quite ready to release them; they were not operating as well as the laboratories had hoped, but on the other hand, Aberdeen was anxious to get everything down there, have it together. And we didn't have any great trouble after the machines were installed at Aberdeen. We had used the time in New York to train a couple of maintenance men whom I remember quite well still, and they did a very competent job keeping the machine going. So that once we were at Aberdeen we had relatively little trouble despite the reluctance of Bell Laboratories to release the machines so early. At Aberdeen the relay computers were in competition with ENIAC, and they didn't hold their own. They were much too slow by comparison. We ran a few interesting problems on them--they did have the advantage of reliability--they ran much better than ENIAC--much more reliably. But, after a few years people lost interest in them. They were really obsolete before they were finished. They had been built as an insurance against the possibility that electronic computing might not work. That was quite untried, and if ENIAC had not worked these would have been our principal computing equipment.

MERZBACH:

When they were designed, how much collaboration was there between you and the Aberdeen group and Bell Labs? Did Bell Labs take care of most of the…

ALT:

Oh, in the first place, I got into this quite late. When I went to Bell Labs here in New York, the machines were already put together, already built. The design was years before that, and the construction was before I came in. When I was at Aberdeen the first time in 1945, I don't remember exactly in what stage the machines were. I visited New York once. Bell Labs got a lot of information from Aberdeen, but all the work was actually done at Bell Labs; it was all their own contribution. They had all the history of Stibitz behind them. Sam Williams was the principal designer, also Ernest Andrews; those two were in charge--the machine was really their brainchild. We didn't contribute anything. The whole Aberdeen group didn't contribute to the design of the computers, we only furnished information.

MERZBACH:

Information concerning the type of problems?

ALT:

Yes, on the problems…The machines were to be used primarily for trajectories. We knew what the equations were, and we knew how much storage was needed and things like that. There was also a very good, close understanding, I believe, between Bell Labs and the Harvard group. While I was at Bell Labs in '46 and '47, Howard Aiken visited and we visited Harvard; and there was a good deal of frank discussion about principles of design, about components to be used. We learned about Aiken's plan for magnetic storage and things like that. Aiken used a lot of punched paper-tape techniques, and Bell Labs was leading in those. Now, when I finally got to Aberdeen the second time in 1947--when I physically moved to Aberdeen, meanwhile ENIAC had been installed there, and I began to be much more interested in that. And, just at that time the principal interest was in changing over ENIAC from plug board programming to punched-card.*

*ENIAC did not use punched cards, but used the machine's own function tables programming, and that made a great deal of difference in the use of the machine. ENIAC also would have been obsolete from the time it was built except for two things: One was that the other electronic computers, real stored-program computers, were still slower in coming--were not finished--and the other was that Von Neumann invented the method of programming ENIAC by means of punched cards.

ENIAC did not use punched cards, but used the machine's own function tables cards; and that gave it a new lease on life. The old way, where each new program was set up by plugging wires into panels (and there were I don't know how many hundreds of wires to be plugged for each program, the panels filled the whole room) it took days to change over from one problem to the next. It was quite like a differential analyzer, which also took several days to set up. And that was the only way of operation Aberdeen knew, and they didn't seem to resent that. But we began to see gradually that this did not take advantage of the speed of the machine. We would run one problem for a week or two and then change over to another problem. In one week one could do too much for--more than any one problem could stand-- we were mostly in the process of changing over and testing the new setup. Von Neumann invented a new system quite comparable to today's automatic programming. Instructions were punched into cards, the cards were read. The way the machine was designed, cards would be read only for input data in the course of a problem. But, here now, the machines read the cards, stored the numbers as numbers, and then interpreted these numbers as instructions. And the machine was permanently wired to interpret each number as an instruction. And that so-called "New Programming Method" was being designed--it was Von Neumann's idea, but it was Richard Clippinger who mainly implemented it, together with Bernard Dimsdale, those two--and it took probably a year or so before it was all tested out. Toward the end of that year, which might be in the spring of 1948, we began to set up real problems by this method.

MERZBACH:

Yes. One question, going back again, did your first--the original Computations Committee at your first stay--were you involved at all in problems concerning the differential analyzer?

ALT:

No, no. That was operational. That was way beyond us.

MERZBACH:

I see. The purpose of this committee was mainly to consider problems of the future computer.

ALT:

For the digital computers, for the future digital computers, yes. Yes, the analyzer was a section by itself. Dr. Joseph Levin was in charge of that and I knew him many years after that. He came to the Bureau of Standards with me and then went to Raytheon at Waltham (and that was the company that was later-the computing part of Raytheon was later merged with the computer part of Honeywell, and it's now the Honeywell Labs at Newton, I think.

MERZBACH:

How long was the-well, that section was entirely separated?

ALT:

The differential analyzer section was one section of the Computation Laboratory; another section was the punched-card section; another one was artillery trajectories; another one was bombing trajectories; another one was paper reduction, and so on.

MERZBACH:

Well, why don't we…

ALT:

Stop